

**WASTE STREAM****7A29****Uranium Contaminated Operations ILW****SITE** AWE Aldermaston**SITE OWNER** Ministry of Defence**WASTE CUSTODIAN** AWE plc**WASTE TYPE** ILW**WASTE VOLUMES**

|                        |                           | Reported             |
|------------------------|---------------------------|----------------------|
| Stocks:                | At 1.4.2019.....          | 58.4 m <sup>3</sup>  |
| Future arisings -      | 1.4.2019 - 31.3.2022..... | 5.0 m <sup>3</sup>   |
|                        | 1.4.2022 - 31.3.2025..... | 0.8 m <sup>3</sup>   |
|                        | 1.4.2025 - 31.3.2029..... | 12.5 m <sup>3</sup>  |
|                        | 1.4.2029 - 31.3.2038..... | 0 m <sup>3</sup>     |
|                        | 1.4.2038 - 31.3.2061..... | 36.0 m <sup>3</sup>  |
|                        | 1.4.2061 - 31.3.2080..... | 0 m <sup>3</sup>     |
| Total future arisings: |                           | 54.3 m <sup>3</sup>  |
| Total waste volume:    |                           | 112.7 m <sup>3</sup> |

Comment on volumes: The waste arising has increased, this is based on the waste arisings of a single facility during POCO and predictions for the same facility during decommissioning. Stock volumes are different to the 2016 values, but are considered to be accurate. Predicted volumes could vary depending on how much waste is produced prior to decommissioning.

Uncertainty factors on volumes: Stock (upper): x 1.0 Arisings (upper) x 5.0  
 Stock (lower): x 1.0 Arisings (lower) x 0.5

**WASTE SOURCE** Organic and inorganic solids arising from operations with highly enriched uranium and some wastes containing very large quantities of DU.

**PHYSICAL CHARACTERISTICS**

General description: The waste consists of solids arising from operations with highly enriched uranium and some historical wastes containing very large quantities of DU. These wastes include tools, filters, box gloves, discarded equipment.

Physical components (%wt): Halogenated plastics (27.5%), non halogenated plastics (14.5%), rubber (2%), cellulose (40%), stainless steel (2%), other ferrous metals (4%), aluminium (2%), copper (4%), lead (1%), glass (1%), graphite (1%) and asbestos (1%). The composition is based on the 2010 UKRWI, as there is no significant change in the physical composition.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m<sup>3</sup>): 0.2

Comment on density: Reviewed in 2019, based on data in database, and identical to the 2016 RWI value.

**CHEMICAL COMPOSITION**

General description and components (%wt): Halogenated plastics (27.5%), non halogenated plastics (14.5%), rubber (2%), cellulose (40%), stainless steel (2%), other ferrous metals (4%), aluminium (2%), copper (4%), lead (1%), glass (1%), graphite (1%) and asbestos (1%).

Chemical state: Neutral

Chemical form of radionuclides: U: Oxide form.

Metals and alloys (%wt): Steel in the form of box fittings, tools and fixtures. Lead in the form of shielding panels.

|                           |     |
|---------------------------|-----|
| Stainless steel.....      | 2.0 |
| Other ferrous metals..... | 4.0 |
| Iron.....                 |     |
| Aluminium.....            | 2.0 |
| Beryllium.....            |     |
| Cobalt.....               |     |
| Copper.....               | 4.0 |

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|                        |                                     |      |     |
|------------------------|-------------------------------------|------|-----|
|                        | Lead.....                           | 1.0  |     |
|                        | Magnox/Magnesium.....               |      |     |
|                        | Nickel.....                         |      |     |
|                        | Titanium.....                       |      |     |
|                        | Uranium.....                        |      |     |
|                        | Zinc.....                           |      |     |
|                        | Zircaloy/Zirconium.....             |      |     |
|                        | Other metals.....                   |      |     |
| Organics (%wt):        | PVC and perspex (1%).               |      |     |
|                        | Total cellulosics.....              | 40.0 |     |
|                        | Paper, cotton.....                  | 32.5 |     |
|                        | Wood.....                           | 7.5  |     |
|                        | Halogenated plastics .....          | 27.5 | PVC |
|                        | Total non-halogenated plastics..... | 14.5 |     |
|                        | Condensation polymers.....          |      |     |
|                        | Others.....                         | 14.5 |     |
|                        | Organic ion exchange materials....  |      |     |
|                        | Total rubber.....                   | 2.0  |     |
|                        | Halogenated rubber .....            | 1.0  |     |
|                        | Non-halogenated rubber.....         | 1.0  |     |
|                        | Hydrocarbons.....                   |      |     |
|                        | Oil or grease .....                 |      |     |
|                        | Fuel.....                           |      |     |
|                        | Asphalt/Tarmac (cont.coal tar)...   |      |     |
|                        | Asphalt/Tarmac (no coal tar)....    |      |     |
|                        | Bitumen.....                        |      |     |
|                        | Others.....                         |      |     |
|                        | Other organics.....                 |      |     |
| Other materials (%wt): | -                                   |      |     |
|                        | Inorganic ion exchange materials.   |      |     |
|                        | Inorganic sludges and flocs.....    |      |     |
|                        | Soil.....                           |      |     |
|                        | Brick/Stone/Rubble.....             |      |     |
|                        | Cementitious material.....          |      |     |
|                        | Sand.....                           |      |     |
|                        | Glass/Ceramics.....                 | 1.0  |     |
|                        | Graphite.....                       | 1.0  |     |
|                        | Desiccants/Catalysts.....           |      |     |
|                        | Asbestos.....                       | 1.0  |     |
|                        | Non/low friable.....                | 1.0  |     |
|                        | Moderately friable.....             |      |     |
|                        | Highly friable.....                 |      |     |
|                        | Free aqueous liquids.....           |      |     |

Inorganic anions (%wt):

- Free non-aqueous liquids.....
- Powder/Ash.....
- 
- Fluoride.....
- Chloride.....
- Iodide.....
- Cyanide.....
- Carbonate.....
- Nitrate.....
- Nitrite.....
- Phosphate.....
- Sulphate.....
- Sulphide.....

Materials of interest for waste acceptance criteria:

- 
- Combustible metals..... 0
- Low flash point liquids..... 0
- Explosive materials..... 0
- Phosphorus..... 0
- Hydrides..... 0
- Biological etc. materials..... 0
- Biodegradable materials..... P
- Putrescible wastes..... 0
- Non-putrescible wastes..... P
- Corrosive materials..... 0
- Pyrophoric materials..... 0
- Generating toxic gases..... 0
- Reacting with water..... 0
- Active particles..... 0
- Soluble solids as bulk chemical compounds..... 0
- Lead (1%wt) and asbestos (1%wt).

Hazardous substances / non hazardous pollutants:

- Acrylamide..... 0
- Benzene..... 0
- Chlorinated solvents..... 0
- Formaldehyde..... 0
- Organometallics..... 0
- Phenol..... 0
- Styrene..... 0
- Tri-butyl phosphate..... 0
- Other organophosphates..... 0

Paper, cotton and wood are present.

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|                                       |    |              |
|---------------------------------------|----|--------------|
| Vinyl chloride.....                   | NE | PVC present. |
| Arsenic.....                          | 0  |              |
| Barium.....                           | 0  |              |
| Boron.....                            | 0  |              |
| Cadmium.....                          | 0  |              |
| Caesium.....                          | 0  |              |
| Selenium.....                         | 0  |              |
| Chromium.....                         | 0  |              |
| Molybdenum.....                       | 0  |              |
| Thallium.....                         | 0  |              |
| Tin.....                              | 0  |              |
| Vanadium.....                         | 0  |              |
| Mercury compounds.....                | 0  |              |
| 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.....          |    |              |

**PACKAGING AND CONDITIONING**

|  |   |
|--|---|
| Conditioning method:   | A conditioning and packaging regime has yet to be determined, development work continues. It is proposed that 200 litre drums will be supercompacted. The pucks will be loaded into a 500 litre drum and grouted with cement. |
| Plant Name:  | -   |
| Location:  | Sellafield, Seascale, Cumbria   |
| Plant startup date:  | Unknown   |
| Total capacity (m <sup>3</sup> /y incoming waste):             | -   |
| Target start date for packaging this stream:                   | -   |
| Throughput for this stream (m <sup>3</sup> /y incoming waste): | -   |
| Other information:   | -   |

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|                        |            |                       |                                 |                           |                    |
|------------------------|------------|-----------------------|---------------------------------|---------------------------|--------------------|
| Likely container type: | Container  | Waste packaged (%vol) | Waste loading (m <sup>3</sup> ) | Payload (m <sup>3</sup> ) | Number of packages |
|                        | 500 l drum | 100.0                 | ~1                              | ~0.5                      | 113                |

Likely container type comment:

The loading is an estimate based on experience with similar waste at Sellafield.

Range in container waste volume:

The proposed supercompaction at Sellafield will allow 5 pucks to be packed into a 500 litre drum.

Other information on containers:

Not specified.

Likely conditioning matrix:

Not specified

Other information:

-

Conditioned density (t/m<sup>3</sup>):

~2.0

Conditioned density comment:

The conditioned density is an estimate which is subject to change.

Other information on conditioning:

There are no firm conditioning plans until repository disposal criteria have been defined.

Opportunities for alternative disposal routing:

No

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

**RADIOACTIVITY**

Source:

Uranium.

Uncertainty:

The radionuclide data for stored wastes taken from database, alpha and beta activities are accurate, radionuclide specific values have been estimated.

Definition of total alpha and total beta/gamma:

It is not possible to provide radionuclide values for future arisings because the fingerprint would be classified.

Measurement of radioactivities:

Fingerprints used with non-destructive assay techniques i.e. low resolution gamma spectrometry. Decay nuclides with a half life of less than 3 months have been omitted.

Other information:

-

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| Nuclide | Mean radioactivity, TBq/m <sup>3</sup> |                |                 |                | Nuclide          | Mean radioactivity, TBq/m <sup>3</sup> |                |                 |                |
|---------|--|----------------|-----------------|----------------|------------------|--|----------------|-----------------|----------------|
|         | Waste at 1.4.2019                      | Bands and Code | Future arisings | Bands and Code |                  | Waste at 1.4.2019                      | Bands and Code | Future arisings | Bands and Code |
| H 3     |  |                |                 |                | Gd 153           |  |                |                 |                |
| Be 10   |  |                |                 |                | Ho 163           |  |                |                 |                |
| C 14    |  |                |                 |                | 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   |  |                |                 |                | Pb 210           |  | 6              |                 |                |
| Co 60   |  |                |                 |                | Bi 208           |  |                |                 |                |
| Ni 59   |  |                |                 |                | Bi 210m          |  |                |                 |                |
| Ni 63   |  |                |                 |                | Po 210           |  | 6              |                 |                |
| Zn 65   |  |                |                 |                | Ra 223           |  | 6              |                 |                |
| Se 79   |  |                |                 |                | Ra 225           |  |                |                 |                |
| Kr 81   |  |                |                 |                | Ra 226           |  | 6              |                 |                |
| Kr 85   |  |                |                 |                | Ra 228           |  | 6              |                 |                |
| Rb 87   |  |                |                 |                | Ac 227           |  | 6              |                 |                |
| Sr 90   |  |                |                 |                | Th 227           |  | 6              |                 |                |
| Zr 93   |  |                |                 |                | Th 228           |  | 6              |                 |                |
| Nb 91   |  |                |                 |                | Th 229           |  |                |                 |                |
| Nb 92   |  |                |                 |                | Th 230           |  | 6              |                 |                |
| Nb 93m  |  |                |                 |                | Th 232           |  | 6              |                 |                |
| Nb 94   |  |                |                 |                | Th 234           |  | 6              |                 |                |
| Mo 93   |  |                |                 |                | Pa 231           |  | 6              |                 |                |
| Tc 97   |  |                |                 |                | Pa 233           |  |                |                 |                |
| Tc 99   |  |                |                 |                | U 232            |  |                |                 |                |
| Ru 106  |  |                |                 |                | U 233            |  | 6              |                 | 6              |
| Pd 107  |  |                |                 |                | U 234            | 9.04E-04                               | BB 2           |                 | 7              |
| Ag 108m |  |                |                 |                | U 235            | 2.89E-05                               | BB 2           |                 | 7              |
| Ag 110m |  |                |                 |                | U 236            | 3.71E-06                               | BB 2           |                 | 7              |
| Cd 109  |  |                |                 |                | U 238            | 1.52E-05                               | BB 2           |                 | 7              |
| 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  |  |                |                 |                | Other a          |  |                |                 |                |
| Eu 152  |  |                |                 |                | Other b/g        |  |                |                 |                |
| Eu 154  |  |                |                 |                | <b>Total a</b>   | <b>9.51E-04</b>                        | <b>BB 2</b>    |                 | <b>NE</b>      |
| Eu 155  |  |                |                 |                | <b>Total b/g</b> | <b>0</b>                               |                |                 | <b>0</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