

| WASTE STREAM | 2D95.3 | Sludge Settling Tank |
|--------------|--------|----------------------|
|--------------|--------|----------------------|

**SITE** Sellafield

**SITE OWNER** Nuclear Decommissioning Authority

**WASTE CUSTODIAN** Sellafield Ltd

**WASTE TYPE** ILW

#### WASTE VOLUMES

|                        | Reported (m <sup>3</sup> ) | OR     | Conditioned (m <sup>3</sup> ) | Packaged (m <sup>3</sup> ) |
|------------------------|----------------------------|--------|-------------------------------|----------------------------|
| Stocks:                | At 1.4.2025                | = 28.3 |                               |                            |
| Future arisings:       |                            |        |                               |                            |
| Total future arisings: |                            | 0.0    |                               |                            |
| Total waste volume:    |                            | 28.3   |                               |                            |

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

Comment on arising rates: Remaining feeds into the Sludge Settling Tank (Effluent Distribution Tank) are effluent with negligible solids content. The facility is not open to the elements. No arisings are expected.

Additional information on quantities: Sludge volume estimates are derived from SONAR surveys undertaken in 2010.

Uncertainty factors on volumes: Stock (upper): x 1.30 Arisings (upper): x -  
Stock (lower): x 0.70 Arisings (lower): x -

**WASTE SOURCE** The waste originates as sludge from the corrosion of Magnox cladding.

#### PHYSICAL CHARACTERISTICS

General description: Magnesium hydroxide sludge, containing quantities of corroded uranium. No items require special handling.

Changes since waste generated: -

Bulk density (t/m<sup>3</sup>): = 1.5

Comment on density: The density has been estimated as: 1.5 t/m<sup>3</sup> wet, 2.5 t/m<sup>3</sup> dry solid.

#### CHEMICAL COMPOSITION

General description and components (%wt): Magnesium hydroxide with quantities of uranium.

Chemical state: Alkali

Sheet metal proportion / thickness: Metal only present as small particles.

Metals and alloys (%wt):

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

Organics (%wt):

|                                     | (%wt) | Type(s) and comment | % of total C14 activity |
|-------------------------------------|-------|---------------------|-------------------------|
| Total cellulose.....                | = 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):

|                                       | (%wt)   | Type(s) and comment | % of total C14 activity |
|---------------------------------------|---------|---------------------|-------------------------|
| Inorganic ion exchange materials..... | = 0     | -                   |                         |
| Inorganic sludges and flocs.....      | = 100.0 | -                   |                         |
| Soil.....                             | = 0     | -                   |                         |
| Brick/Stone/Rubble.....               | = 0     | -                   |                         |
| Cementitious material.....            | TR      | -                   |                         |
| Sand.....                             |         | -                   |                         |
| Glass/Ceramics.....                   |         | -                   |                         |
| Graphite.....                         | = 0     | -                   |                         |
| Desiccants/Catalysts.....             |         | -                   |                         |
| Asbestos.....                         | = 0     | -                   |                         |
| Non/low friable.....                  |         | -                   |                         |
| Moderately friable.....               |         | -                   |                         |
| Highly friable.....                   |         | -                   |                         |
| Free aqueous liquids.....             | NE      | -                   |                         |
| Free non-aqueous liquids.....         | = 0     | -                   |                         |
| Powder/Ash.....                       |         | -                   |                         |

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

Inorganic anions (%wt):

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

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.....                                  |       | -                   |
| 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.....                 | NE    | -                   |
| Soluble solids as bulk chemical compounds..... | NE    | -                   |

Hazardous substances / non hazardous pollutants:

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

Complexing agents (%wt):

| No                             |       |                         |
|--------------------------------|-------|-------------------------|
|                                | (%wt) | Type(s) and comment     |
| EDTA.....                      |       | -                       |
| DPTA.....                      |       | -                       |
| NTA.....                       |       | -                       |
| Polycarboxylic acids.....      |       | -                       |
| Other organic complexants..... |       | Unlikely to be present. |
| 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                                             | On-site            | = 100.0         |
| 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                               |                    |                 |
| None                                                       |                    |                 |

Comments on planned treatments:

Treatment method(s) yet to be decided.

Conditioning method:

Conditioning method(s) yet to be decided.

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 |
|                        | Not yet determined | 100.0                 | -                  | -            | -                  | -                                  |

Range in container waste loading:

Other information on packaging and conditioning: -

Conditioned density (t/m³): NE  
Conditioned density comment: -**Management Routes:**

| Disposal Route                                                                     | Stream volume % | Raw density t/m³ | 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                       |                 |                  |            |
| 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                                                           | = 100.0         |                  |            |

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

**Opportunities for alternative disposal routing:** Not yet determined

| Baseline Management Route | Opportunity Management Route | Stream volume (%) | Opportunity Confidence | Comment |
|---------------------------|------------------------------|-------------------|------------------------|---------|
| -                         | -                            | -                 | -                      | -       |

**RADIOACTIVITY**

Source: The main source of activity is mixed fission products, uranium and plutonium.

Uncertainty: From the best available data an overall average has been derived.

Measurement of radioactivities: -

Chemical form of radionuclides:

H-3: -  
C-14: -  
Cl-36: -  
Se-79: -  
Tc-99: -  
I-129: -  
Ra: Present in less than trace amounts in fuel.  
Th: -  
U: Present in metallic and reacted forms (oxides and possibly hydride).  
Np: -  
Pu: Present in metallic and mixed oxide forms.

| WASTE STREAM 2D95.3 Sludge Settling Tank |                            |                |                 |                |                  |                            |                |                 |                |
|------------------------------------------|----------------------------|----------------|-----------------|----------------|------------------|----------------------------|----------------|-----------------|----------------|
| Nuclide                                  | Mean radioactivity, TBq/m³ |                |                 |                | Nuclide          | Mean radioactivity, TBq/m³ |                |                 |                |
|                                          | Waste at 1.4.2025          | Bands and Code | Future Arisings | Bands and Code |                  | Waste at 1.4.2025          | 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                                    | 1.04E-04                   | B B 2          |                 |                | Lu 174           |                            |                |                 |                |
| Ar 39                                    |                            |                |                 |                | Lu 176           |                            |                |                 |                |
| Ar 42                                    |                            |                |                 |                | Hf 178n          |                            |                |                 |                |
| K 40                                     |                            |                |                 |                | Hf 182           |                            |                |                 |                |
| Ca 41                                    |                            |                |                 |                | Pt 193           |                            |                |                 |                |
| Mn 53                                    |                            |                |                 |                | Ti 204           |                            |                |                 |                |
| Mn 54                                    |                            |                |                 |                | Pb 205           |                            |                |                 |                |
| Fe 55                                    |                            |                |                 |                | Pb 210           | 2.14E-10                   | B B 2          |                 |                |
| Co 60                                    | 1.97E-04                   | A 3            |                 |                | Bi 208           |                            |                |                 |                |
| Ni 59                                    |                            |                |                 |                | Bi 210m          |                            |                |                 |                |
| Ni 63                                    |                            |                |                 |                | Po 210           | 2.00E-10                   | B B 2          |                 |                |
| Zn 65                                    |                            |                |                 |                | Ra 223           | 3.94E-09                   | B B 2          |                 |                |
| Se 79                                    | 1.72E-05                   | B B 2          |                 |                | Ra 225           | 5.30E-13                   | B B 2          |                 |                |
| Kr 81                                    |                            |                |                 |                | Ra 226           | 1.04E-09                   | B B 2          |                 |                |
| Kr 85                                    |                            |                |                 |                | Ra 228           | 6.68E-17                   |                |                 |                |
| Rb 87                                    |                            |                |                 |                | Ac 227           | 3.97E-09                   | B B            |                 |                |
| Sr 90                                    | 9.49E+00                   | B B 2          |                 |                | Th 227           | 3.90E-09                   | B B 2          |                 |                |
| Zr 93                                    | 8.00E-04                   | B B 2          |                 |                | Th 228           | 2.62E-17                   |                |                 |                |
| Nb 91                                    |                            |                |                 |                | Th 229           | 5.34E-13                   | B B 2          |                 |                |
| Nb 92                                    |                            |                |                 |                | Th 230           | 2.01E-07                   | B B 2          |                 |                |
| Nb 93m                                   | 5.05E-04                   | B B 2          |                 |                | Th 232           | 2.48E-16                   | B B 2          |                 |                |
| Nb 94                                    | 5.00E-07                   | B B 2          |                 |                | Th 234           | 1.00E-03                   | B B 2          |                 |                |
| Mo 93                                    |                            |                |                 |                | Pa 231           | 1.32E-08                   | B B 2          |                 |                |
| Tc 97                                    |                            |                |                 |                | Pa 233           | 1.44E-05                   | B B 2          |                 |                |
| Tc 99                                    | 1.30E-02                   | A 3            |                 |                | U 232            |                            |                |                 |                |
| Ru 106                                   | 7.43E-11                   | A 3            |                 |                | U 233            | 7.24E-10                   | B B 2          |                 |                |
| Pd 107                                   |                            |                |                 |                | U 234            | 9.23E-04                   | B B 2          |                 |                |
| Ag 108m                                  |                            |                |                 |                | U 235            | 2.60E-05                   | B B 2          |                 |                |
| Ag 110m                                  |                            |                |                 |                | U 236            | 4.19E-07                   | B B 2          |                 |                |
| Cd 109                                   |                            |                |                 |                | U 238            | 1.00E-03                   | B B 2          |                 |                |
| Cd 113m                                  |                            |                |                 |                | Np 237           | 1.44E-05                   | B B 2          |                 |                |
| Sn 119m                                  |                            |                |                 |                | Pu 236           |                            |                |                 |                |
| Sn 121m                                  |                            |                |                 |                | Pu 238           | 3.04E-01                   | B B 2          |                 |                |
| Sn 123                                   |                            |                |                 |                | Pu 239           | 4.70E-01                   | B B 2          |                 |                |
| Sn 126                                   | 1.30E-04                   | B B 2          |                 |                | Pu 240           | 5.89E-01                   | B B 2          |                 |                |
| Sb 125                                   |                            |                |                 |                | Pu 241           | 5.76E+00                   | B B 2          |                 |                |
| Sb 126                                   | 1.83E-05                   | B B 2          |                 |                | Pu 242           |                            |                |                 |                |
| Te 125m                                  |                            |                |                 |                | Am 241           | 1.99E+00                   | B B 2          |                 |                |
| Te 127m                                  |                            |                |                 |                | Am 242m          |                            |                |                 |                |
| I 129                                    | 1.00E-05                   | B B 2          |                 |                | Am 243           |                            |                |                 |                |
| Cs 134                                   | 7.15E-07                   | B B 2          |                 |                | Cm 242           |                            |                |                 |                |
| Cs 135                                   | 7.00E-05                   | B B 2          |                 |                | Cm 243           |                            |                |                 |                |
| Cs 137                                   | 2.68E+00                   | B B 2          |                 |                | Cm 244           |                            |                |                 |                |
| Ba 133                                   |                            |                |                 |                | Cm 245           |                            |                |                 |                |
| La 137                                   |                            |                |                 |                | Cm 246           |                            |                |                 |                |
| La 138                                   |                            |                |                 |                | Cm 248           |                            |                |                 |                |
| Ce 144                                   | 8.47E-14                   | A 3            |                 |                | Cf 249           |                            |                |                 |                |
| Pm 145                                   |                            |                |                 |                | Cf 250           |                            |                |                 |                |
| Pm 147                                   |                            |                |                 |                | Cf 251           |                            |                |                 |                |
| Sm 147                                   |                            |                |                 |                | Cf 252           |                            |                |                 |                |
| Sm 151                                   |                            |                |                 |                | Unsp a           | 1.20E-01                   | B B 2          |                 |                |
| Eu 152                                   | 5.33E-03                   | A 3            |                 |                | Unsp b/g         | 2.06E-19                   | B B 2          |                 |                |
| Eu 154                                   | 2.18E-02                   | A 3            |                 |                | <b>Total a</b>   | <b>3.47E+00</b>            | *              | <b>0</b>        | *              |
| Eu 155                                   | 1.84E-03                   | A 3            |                 |                | <b>Total b/g</b> | <b>1.80E+01</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 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