## WASTE STREAM 8A06 Dewatered Sewage Sludge

| | |
|---|---|
| **SITE** | Capenhurst |
| **SITE OWNER** | Urenco |
| **WASTE CUSTODIAN** | URENCO |
| **WASTE TYPE** | LLW; SPD1 |
| Is the waste subject to Scottish Policy: | No |

**WASTE VOLUMES**

| | | Reported |
|---|---|---|
| Stocks: | At 1.4.2022..... | 20.0 m³ |
| Future arisings - | 1.4.2022 - 31.3.2023..... | 40.0 m³ |
| | 1.4.2023 - 31.3.2024..... | 20.0 m³ |
| | 1.4.2024 - 31.3.2025..... | 20.0 m³ |
| | 1.4.2025 - 31.3.2037..... | 240.0 m³ |
| Total future arisings: | | 320.0 m³ |
| Total waste volume: | | 340.0 m³ |

Comment on volumes: Improved characterisation techniques in addition to environmental improvement works are expected to result in the majority of this wastestream being characterised as Out of Scope. Following completion of desludging operations, it is expected that the quantities of sludge generated will reduce significantly. In addition, it is assumed that the improved characterisation techniques will result in more Out of Scope waste.

| Uncertainty factors on volumes: | | | | |
|---|---|---|---|---|
| | Stock (upper): | x 2.0 | Arisings (upper) | x 2.0 |
| | Stock (lower): | x 0.5 | Arisings (lower) | x 0.5 |

**WASTE SOURCE** Sewage Treatment Plant

**PHYSICAL CHARACTERISTICS**

| | |
|---|---|
| General description: | Dewatered sewage sludge mixed with absorbent granules loaded into 1m3 fabric IP-1 packages. The sludge is dewatered by processing out the liquor content. The liquor is returned to the sewage treatment plant. Absorbent granules are added to the pressed sludge. |
| Physical components (%wt): | Pressed sewage sludge to remove liquor content mixed with approx 5% volume of absorbent granules. |
| Sealed sources: | The waste does not contain sealed sources. |
| Bulk density (t/m³): | ~~1.5 |
| Comment on density: | Determined via weight and volume of mixed pressed sludge |

**CHEMICAL COMPOSITION**

| | |
|---|---|
| General description and components (%wt): | Contaminated with uranics from the enrichment buildings |
| Chemical state: | Neutral |
| Chemical form of radionuclides: | U: U3O8, UF4, UO2 |
| Metals and alloys (%wt): | - |

| | (%wt) | Type(s) / Grade(s) with proportions | % of total C14 activity |
|---|---|---|---|
| Stainless steel..... | | | |
| Other ferrous metals..... | | | |
| Iron..... | | | |
| Aluminium..... | | | |
| Beryllium..... | | | |
| Cobalt..... | | | |
| Copper..... | | | |

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Lead.....
Magnox/Magnesium.....
Nickel.....
Titanium.....
Uranium.....
Zinc.....
Zircaloy/Zirconium.....
Other metals.....

Organics (%wt): -

| | (%wt) | Type(s) and comment | % of total C14 activity |
|---|---|---|---|
| Total cellulosics..... | | | |
| Paper, cotton..... | | | |
| Wood..... | | | |
| Halogenated plastics ..... | | | |
| Total non-halogenated plastics..... | | | |
| Condensation polymers..... | | | |
| Others..... | | | |
| 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..... | ~95.0 | Pressed sewage sludge | |

Other materials (%wt): -

| | (%wt) | Type(s) and comment | % of total C14 activity |
|---|---|---|---|
| Inorganic ion exchange materials.. | | | |
| Inorganic sludges and flocs..... | | | |
| Soil..... | | | |
| Brick/Stone/Rubble..... | | | |
| Cementitious material..... | | | |
| Sand..... | | | |
| Glass/Ceramics..... | | | |
| Graphite..... | | | |
| Desiccants/Catalysts..... | | | |
| Asbestos..... | | | |

**WASTE STREAM 8A06 Dewatered Sewage Sludge**

| | | |
|---|---|---|
| Non/low friable..... | | |
| Moderately friable..... | | |
| Highly friable..... | | |
| Free aqueous liquids..... | | |
| Free non-aqueous liquids..... | | |
| Powder/Ash..... | ~5.0 | Absorbent granules (wood) and fabric IP1 bag |

Inorganic anions (%wt): To be characterised

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

Materials of interest for waste acceptance criteria: N/A

| | (%wt) | Type(s) and comment |
|---|---|---|
| Combustible metals..... | | |
| Low flash point liquids..... | | |
| Explosive materials..... | | |
| Phosphorus..... | | |
| Hydrides..... | | |
| Biological etc. materials..... | | |
| Biodegradable materials..... | | |
| Putrescible wastes..... | P | Pressed sewage sludge |
| Non-putrescible wastes..... | | |
| Corrosive materials..... | | |
| Pyrophoric materials..... | | |
| Generating toxic gases..... | | |
| Reacting with water..... | | |
| Higher activity particles..... | | |
| Soluble solids as bulk chemical compounds..... | | |

Hazardous substances / non hazardous pollutants: N/A

| | (%wt) | Type(s) and comment |
|---|---|---|
| Acrylamide..... | | |
| Benzene..... | | |

**WASTE STREAM 8A06 Dewatered Sewage Sludge**

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.....

Complexing agents (%wt): No

| | (%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.

## WASTE STREAM 8A06 Dewatered Sewage Sludge

**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 | On-site | 100.0 |
| None | | |

Comment on planned treatments: Pressed sludge to remove liquor content and absorbent granules added.

**Disposal Routes:**

| Disposal Route | Stream volume % | Disposal density t/m3 |
|---|---|---|
| Expected to be consigned to the LLW Repository | | |
| Expected to be consigned to a Landfill Facility | 100.0 | ~~1.5 |
| Expected to be consigned to an On-Site Disposal Facility | | |
| Expected to be consigned to an Incineration Facility | | |
| Expected to be consigned to a Metal Treatment Facility | | |
| Expected to be consigned as Out of Scope | | |
| Expected to be recycled / reused | | |
| Disposal route not known | | |

Classification codes for waste expected to be consigned to a landfill facility: Non-hazardous. EWC Code - 19 08 05

**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 | | | |
| Expected to be consigned to a Landfill Facility | | | |
| Expected to be consigned to an On-Site Disposal Facility | | | |
| Expected to be consigned to an Incineration Facility | | | |
| Expected to be consigned to a Metal Treatment Facility | | | |
| Expected to be consigned as Out of Scope | | | |
| Expected to be recycled / reused | | | |
| Disposal route not known | | | |

**Opportunities for alternative disposal routing:** -

| 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)

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| Container | Stream volume % | Waste loading m³ | 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: All pressed sludge to be loaded into IP-1 bags or 210 litre IP-2 Drums for disposal.

**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: -

**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

Source: Uranium enrichment and recovery operations.

Uncertainty: Batches are sampled every quarter to confirm radioactive content. Pessimistic sample analysis data is used for disposal as the wastestream is heterogeneous.

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: Estimated total activity content from existing sampling. Multiplied by total volume, divided by total weight (estimated).

Other information: -

## WASTE STREAM 8A06 Dewatered Sewage Sludge

| Nuclide | Mean radioactivity, TBq/m³ | | | | Nuclide | Mean radioactivity, TBq/m³ | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 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 | | | | | Gd 153 | | | | |
| Be 10 | | | | | Ho 163 | | | | |
| C 14 | ~8.86E-08 | C C 2 | ~8.86E-08 | C C 2 | 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 | | | | |
| Co 60 | | | | | Bi 208 | | | | |
| Ni 59 | | | | | Bi 210m | | | | |
| Ni 63 | | | | | 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 | ~7.09E-06 | C C 2 | ~8.3E-04 | C C 2 | U 232 | ~2.6E-08 | C C 2 | ~2.6E-08 | C C 2 |
| Ru 106 | | | | | U 233 | | | | |
| Pd 107 | | | | | U 234 | ~8.3E-06 | C C | ~8.3E-06 | C C 2 |
| Ag 108m | | | | | U 235 | ~3.33E-07 | C C | ~3.33E-07 | C C 2 |
| Ag 110m | | | | | U 236 | | | | |
| Cd 109 | | | | | U 238 | ~3.09E-06 | C C | ~3.09E-06 | C C 2 |
| Cd 113m | | | | | Np 237 | ~2.75E-07 | C C | ~2.75E-07 | C C 2 |
| 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 | | | | | **Total a** | **1.20E-05** | | **1.20E-05** | **C C 2** |
| Eu 155 | | | | | **Total b/g** | **7.18E-06** | | **8.30E-04** | **C C 2** |

**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