## WASTE STREAM 8A03 UUK Operational waste

**SITE** Capenhurst

**SITE OWNER** Urenco

**WASTE CUSTODIAN** URENCO

**WASTE TYPE** VLLW

Is the waste subject to Scottish Policy: No

**WASTE VOLUMES**

| | | Reported |
|---|---|---|
| Stocks: | At 1.4.2022..... | 130.0 m³ |
| Future arisings - | 1.4.2022 - 31.3.2023..... | 52.0 m³ |
| | 1.4.2023 - 31.3.2024..... | 52.0 m³ |
| | 1.4.2024 - 31.3.2025..... | 52.0 m³ |
| | 1.4.2025 - 31.3.2040..... | 780.0 m³ |
| Total future arisings: | | 936.0 m³ |
| Total waste volume: | | 1066.0 m³ |

Comment on volumes: Arisings have been determined via known generation rates. Reduction in arisings is due to improved characterisation techniques resulting in more waste being classified as Out of Scope. Volumes based on current rate of arising.

Uncertainty factors on volumes:

| | | | |
|---|---|---|---|
| Stock (upper): | x 1.05 | Arisings (upper) | x 2.0 |
| Stock (lower): | x 0.95 | Arisings (lower) | x 0.5 |

**WASTE SOURCE** The waste arises from centrifuge plant operations and maintenance, auxiliary activities such as chemistry laboratories and a small fraction from clean-up and decommissioning activities. The waste consists of PPE, Cardboard, Wipes, Filters, WEEE and other compactable/non-compactable wastes.

**PHYSICAL CHARACTERISTICS**

General description: Operational wastes including PPE, Wipes, Filters, WEEE, etc. None.

Physical components (%wt): 50% cloths, wipes and cellulosic based PPE etc, 15% sheeting and other plastic, 15% electrical items, 10% gaskets and other rubber, 10% assorted other organic solids.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): ~0.2

Comment on density: Assumes average of 40 kg of waste per ca. 200 litre drum

**CHEMICAL COMPOSITION**

General description and components (%wt): 50% cellulose, 15% plastic, 15% metal, 10% rubber, 10% PFTE / polyester

Chemical state: Neutral

Chemical form of radionuclides: Tc-99: Trace quantities present as Tc(IV) as TcO2 and Tc(VII) as pertechnate.
U: Uranyl fluoride (70%), uranium tetrafluoride (30%).
Np: Trace quantities present as the NpO2 ++ ion.

Metals and alloys (%wt): None

| | (%wt) | Type(s) / Grade(s) with proportions | % of total C14 activity |
|---|---|---|---|
| Stainless steel..... | ~5.0 | | |
| Other ferrous metals..... | ~5.0 | | |
| Iron..... | | | |
| Aluminium..... | ~5.0 | | |
| 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..... | ~50.0 | | |
| Paper, cotton..... | | | |
| Wood..... | | | |
| Halogenated plastics ..... | ~10.0 | | |
| Total non-halogenated plastics..... | ~15.0 | | |
| Condensation polymers..... | | | |
| Others..... | | | |
| Organic ion exchange materials.... | | | |
| Total rubber..... | ~10.0 | Breakdown not known | |
| 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): -

| | (%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..... | | | |

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Non/low friable.....

Moderately friable.....

Highly friable.....

Free aqueous liquids.....

Free non-aqueous liquids.....

Powder/Ash.....

Inorganic anions (%wt): Present as fluorides of uranium

| | (%wt) | Type(s) and comment |
|---|---|---|
| Fluoride..... | ~0.30 | |
| 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..... | | |
| 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: Waste Electrical Equipment

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

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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..... ~20.0

EEE Type 2..... ~50.0

EEE Type 3..... ~30.0

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 8A03 UUK Operational waste

**TREATMENT, PACKAGING AND DISPOSAL**

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

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

Comment on planned treatments: #Name?

**Disposal Routes:**

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

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

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

**Opportunities for alternative disposal routing:** #Name?

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

**Waste Packaging for Disposal:** #Name?

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

Other information: #Name?

**Waste Planned for Disposal at the LLW Repository:** #Name?

Container voidage: #Name?

Waste Characterisation Form (WCH): #Name?

Waste consigned for disposal to LLWR in year of generation: #Name?

**Non-Containerised Waste for In-Vault Grouting:** #Name?

Stream volume (%): #Name?

Waste stream variation: #Name?

Bounding cuboidal volume: #Name?

Inaccessible voidage: #Name?

Other information: #Name?

### RADIOACTIVITY

Source: Uranium enrichment and recovery operations.

Uncertainty: Variations in activity will occur due to changes in uranium concentration and enrichment.

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: Intrusive sampling and non-destructive HRGS Assay

Other information: Uranium daughter products are considered to be in equilibrium with the parent.

## WASTE STREAM 8A03 UUK Operational waste

| Nuclide | Mean radioactivity, TBq/m³ Waste at 1.4.2022 | Bands and Code | Future arisings | Bands and Code | Nuclide | Mean radioactivity, TBq/m³ Waste at 1.4.2022 | 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 | | | | |
| 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 | ~5.94E-08 | A A 2 | ~5.94E-08 | A A 2 | U 232 | | | | |
| Ru 106 | | | | | U 233 | | | | |
| Pd 107 | | | | | U 234 | ~2.37E-06 | A A 2 | ~2.37E-06 | A A 2 |
| Ag 108m | | | | | U 235 | ~9.36E-08 | A A 2 | ~9.36E-08 | A A 2 |
| Ag 110m | | | | | U 236 | | | | |
| Cd 109 | | | | | U 238 | ~2.75E-07 | A A 2 | ~2.75E-07 | A A 2 |
| Cd 113m | | | | | Np 237 | ~1.52E-08 | A A 2 | ~1.52E-08 | A A 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** | **~2.76E-06** | **A A 2** | **~2.76E-06** | **A A 2** |
| Eu 155 | | | | | **Total b/g** | **~5.94E-08** | **A A 2** | **~5.94E-08** | **A A 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