

**WASTE STREAM****3K117****Care and Maintenance Preparations: Gas Circulator LLW****SITE** Hartlepool**SITE OWNER** EDFE NGL**WASTE CUSTODIAN** EDFE NGL**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 - 31.3.2027..... | 0 m <sup>3</sup>     |
|                        | 1.4.2027 - 31.3.2028..... | 398.0 m <sup>3</sup> |
|                        | 1.4.2028 - 31.3.2029..... | 138.0 m <sup>3</sup> |
|                        | 1.4.2029 - 31.3.2030..... | 322.0 m <sup>3</sup> |
| Total future arisings: |                           | 858.0 m <sup>3</sup> |
| Total waste volume:    |                           | 858.0 m <sup>3</sup> |

Comment on volumes: Waste volumes will be variable depending on station operating conditions. Volumes based on Back to Bio Shield strategy. Work is ongoing looking at optimising the strategy which could lead to a change in volume and timings of arisings across Pre C&M wastes (100s) and Final Site Clearance wastes (300s), in future submissions.

Uncertainty factors on volumes: Stock (upper): x Arisings (upper) x 1.5  
 Stock (lower): x Arisings (lower) x 0.5

**WASTE SOURCE** General solid decommissioning LLW arisings from the Dry Fuel Route. Waste arising from plant dismantling and associated contamination control procedures.

**PHYSICAL CHARACTERISTICS**

General description: A variety of mixed decommissioning materials, including metals, organics and other mixed materials.

Physical components (%wt): A variety of mixed decommissioning materials, including metals, organics and other mixed materials.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m<sup>3</sup>): ~1.1

Comment on density: Density based on raw volume and weight.

**CHEMICAL COMPOSITION**

General description and components (%wt): A variety of mixed decommissioning materials, including metals, organics and other mixed materials.

Chemical state: Neutral

Chemical form of radionuclides: H-3: To be Determined  
 C-14: To be Determined  
 Cl-36: To be Determined  
 Se-79: To be Determined  
 Tc-99: To be Determined  
 I-129: To be Determined  
 Ra: To be Determined  
 Th: To be Determined  
 U: To be Determined  
 Np: To be Determined  
 Pu: To be Determined

Metals and alloys (%wt): Not Estimated

|                     |              |  |
|---------------------|--------------|--|
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|                                     | (%wt)            | Type(s) / Grade(s) with proportions | % of total C14 activity |
|-------------------------------------|------------------|-------------------------------------|-------------------------|
| Stainless steel.....                | ~2.0             |                                     |                         |
| Other ferrous metals.....           | ~14.0            | Mild steel                          |                         |
| Iron.....                           | NE               |                                     |                         |
| Aluminium.....                      | NE               |                                     |                         |
| Beryllium.....                      | NE               |                                     |                         |
| Cobalt.....                         | NE               |                                     |                         |
| Copper.....                         | NE               |                                     |                         |
| Lead.....                           | NE               |                                     |                         |
| Magnox/Magnesium.....               | NE               |                                     |                         |
| Nickel.....                         | NE               |                                     |                         |
| Titanium.....                       | NE               |                                     |                         |
| Uranium.....                        | NE               |                                     |                         |
| Zinc.....                           | NE               |                                     |                         |
| Zircaloy/Zirconium.....             | NE               |                                     |                         |
| Other metals.....                   | NE               |                                     |                         |
| Organics (%wt):                     | Organics ~28.54% |                                     |                         |
|                                     | (%wt)            | Type(s) and comment                 | % of total C14 activity |
| Total cellulose.....                | ~46.0            |                                     |                         |
| Paper, cotton.....                  | ~45.0            |                                     |                         |
| Wood.....                           | ~0.19            |                                     |                         |
| Halogenated plastics .....          | ~12.0            |                                     |                         |
| Total non-halogenated plastics..... | ~12.0            |                                     |                         |
| Condensation polymers.....          | 0                |                                     |                         |
| Others.....                         |                  |                                     |                         |
| Organic ion exchange materials....  | 0                |                                     |                         |
| Total rubber.....                   | ~12.0            |                                     |                         |
| Halogenated rubber .....            | ~6.0             |                                     |                         |
| Non-halogenated rubber.....         | ~6.0             |                                     |                         |
| Hydrocarbons.....                   | NE               |                                     |                         |
| Oil or grease .....                 | 0                |                                     |                         |
| Fuel.....                           | 0                |                                     |                         |
| Asphalt/Tarmac (cont.coal tar)...   | 0                |                                     |                         |
| Asphalt/Tarmac (no coal tar)....    | 0                |                                     |                         |
| Bitumen.....                        | 0                |                                     |                         |
| Others.....                         | 0                |                                     |                         |
| Other organics.....                 | NE               |                                     |                         |
| Other materials (%wt):              | -                |                                     |                         |

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|                                    | (%wt) | Type(s) and comment | % of total C14 activity |
|------------------------------------|-------|---------------------|-------------------------|
| Inorganic ion exchange materials.. | NE    |                     |                         |
| Inorganic sludges and flocs.....   | ~1.0  |                     |                         |
| Soil.....                          | NE    |                     |                         |
| Brick/Stone/Rubble.....            | ~1.0  |                     |                         |
| Cementitious material.....         | NE    |                     |                         |
| Sand.....                          | NE    |                     |                         |
| Glass/Ceramics.....                | NE    |                     |                         |
| Graphite.....                      | NE    |                     |                         |
| Desiccants/Catalysts.....          | NE    |                     |                         |
| Asbestos.....                      | NE    |                     |                         |
| Non/low friable.....               | NE    |                     |                         |
| Moderately friable.....            | NE    |                     |                         |
| Highly friable.....                | NE    |                     |                         |
| Free aqueous liquids.....          | NE    |                     |                         |
| Free non-aqueous liquids.....      | NE    |                     |                         |
| Powder/Ash.....                    | NE    |                     |                         |

Inorganic anions (%wt):      Not estimated.

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

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.....                  | 0     |                     |
| Biological etc. materials..... | 0     |                     |
| Biodegradable materials.....   | 0     |                     |
| Putrescible wastes.....        | 0     |                     |
| Non-putrescible wastes.....    | 0     |                     |

|                     |              |  |
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|  |   |              |
|--|---|--------------|
| Corrosive materials.....                       | 0 |              |
| Pyrophoric materials.....                      | 0 |              |
| Generating toxic gases.....                    | 0 |              |
| Reacting with water.....                       | 0 |              |
| Higher activity particles.....                 | 0 | Not expected |
| Soluble solids as bulk chemical compounds..... | 0 |              |

Hazardous substances / non hazardous pollutants:      Listed substances are not expected in significant quantity.

|                                       | (%wt) | Type(s) and comment |
|---------------------------------------|-------|---------------------|
| Acrylamide.....                       | NE    |                     |
| Benzene.....                          | NE    |                     |
| Chlorinated solvents.....             | NE    |                     |
| Formaldehyde.....                     | NE    |                     |
| Organometallics.....                  | NE    |                     |
| Phenol.....                           | NE    |                     |
| Styrene.....                          | NE    |                     |
| Tri-butyl phosphate.....              | NE    |                     |
| Other organophosphates.....           | NE    |                     |
| Vinyl chloride.....                   | NE    |                     |
| Arsenic.....                          | NE    |                     |
| Barium.....                           | NE    |                     |
| Boron.....                            | NE    |                     |
| Boron (in Boral).....                 | NE    |                     |
| Boron (non-Boral).....                | NE    |                     |
| Cadmium.....                          | NE    |                     |
| Caesium.....                          | NE    |                     |
| Selenium.....                         | NE    |                     |
| Chromium.....                         | NE    |                     |
| Molybdenum.....                       | NE    |                     |
| Thallium.....                         | NE    |                     |
| Tin.....                              | NE    |                     |
| Vanadium.....                         | NE    |                     |
| Mercury compounds.....                | TR    |                     |
| Others.....                           | NE    |                     |
| Electronic Electrical Equipment (EEE) |       |                     |
| EEE Type 1.....                       | NE    |                     |
| EEE Type 2.....                       | NE    |                     |
| EEE Type 3.....                       | NE    |                     |
| EEE Type 4.....                       | NE    |                     |
| EEE Type 5.....                       | NE    |                     |

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Complexing agents (%wt): Not yet determined

|                                | (%wt) | Type(s) and comment |
|--------------------------------|-------|---------------------|
| EDTA.....                      | NE    |                     |
| DPTA.....                      | NE    |                     |
| NTA.....                       | NE    |                     |
| Polycarboxylic acids.....      | NE    |                     |
| Other organic complexants..... | NE    |                     |
| Total complexing agents.....   | NE    |                     |

Potential for the waste to contain discrete items: Yes.

**TREATMENT, PACKAGING AND DISPOSAL**

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

| Treatment             | On-site / Off site | Stream volume % |
|-----------------------|--------------------|-----------------|
| Low force compaction  |                    |                 |
| Supercompaction (HFC) | Off-site           | ~11.0           |
| Incineration          | Off-site           | ~65.0           |
| Solidification        |                    |                 |
| Decontamination       |                    |                 |
| Metal treatment       | Off-Site           | ~10.0           |
| Size reduction        |                    |                 |
| Decay storage         |                    |                 |
| Recycling / reuse     |                    |                 |
| Other / various       |                    |                 |
| None                  | Off-site           | ~14.0           |

Comment on planned treatments:

In line with the waste hierarchy, wastes will be treated preferentially by incineration, metal decontamination/melting, supercompaction, optimal packaging in HHISOs or immobilisation by encapsulation where necessary, prior to ultimate disposal at the LLW Repository. These treatments will be carried out off-site under contract with companies such as LLWR Ltd, Cyclife, Tradebe Inutec. The percentages are based on the history of consignments across the fleet of EDF Energy Nuclear Generation stations.

**Disposal Routes:**

| Disposal Route   | Stream volume % | Disposal density t/m3 |
|--|-----------------|-----------------------|
| Expected to be consigned to the LLW Repository           | ~25.0           |                       |
| 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     | ~65.0           |                       |
| Expected to be consigned to a Metal Treatment Facility   | ~10.0           |                       |
| 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: -

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

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| 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:**

| 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 | ~25.0           | ~15.46                       | 14                 |
| 2m box (no shielding)                  |                 |                              |                    |
| 4m box (no shielding)                  |                 |                              |                    |
| Other                                  |                 |                              |                    |

Other information: Waste loading is representative of the raw waste following further planned treatments. Supercompaction assumed to reduce volume to 20% of original. Solidification assumed to increase volume to 300% of original. No treatment results in the same volume.

**Waste Planned for Disposal at the LLW Repository:**

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.

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

Stream volume (%): -

Waste stream variation: -

Bounding cuboidal volume:

Inaccessible voidage: -

Other information: -

**RADIOACTIVITY**

Source: Activation and/or contamination of mixed materials from facility area.

Uncertainty: Approximate estimates have been made of the total specific activities.

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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 beta/gamma emitting radionuclides plus 'other beta/gamma' not listed on the datasheet.

Measurement of radioactivities:

Calculations based on operational wastestreams. More detailed characterisation work will be undertaken as the arising of the waste gets closer.

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     |  |                | 1.30E-05        | CC 2           | Gd 153           |  |                 |                 |                |
| Be 10   |  |                |                 |                | Ho 163           |  |                 |                 |                |
| C 14    |  |                | 1.32E-06        | CC 2           | Ho 166m          |  |                 |                 |                |
| Na 22   |  |                |                 |                | Tm 170           |  |                 |                 |                |
| Al 26   |  |                |                 |                | Tm 171           |  |                 |                 |                |
| Cl 36   |  |                | 2.39E-05        | CC 2           | Lu 174           |  |                 |                 |                |
| Ar 39   |  |                |                 |                | Lu 176           |  |                 |                 |                |
| Ar 42   |  |                |                 |                | Hf 178n          |  |                 |                 |                |
| K 40    |  |                |                 |                | Hf 182           |  |                 |                 |                |
| Ca 41   |  |                |                 |                | Pt 193           |  |                 |                 |                |
| Mn 53   |  |                |                 |                | Tl 204           |  |                 |                 |                |
| Mn 54   |  |                | 3.89E-06        | CC 2           | Pb 205           |  |                 |                 |                |
| Fe 55   |  |                | 1.3E-04         | CC 2           | Pb 210           |  |                 |                 |                |
| Co 60   |  |                | 1.46E-05        | CC 2           | Bi 208           |  |                 |                 |                |
| Ni 59   |  |                |                 |                | Bi 210m          |  |                 |                 |                |
| Ni 63   |  |                | 8.82E-06        | CC 2           | Po 210           |  |                 |                 |                |
| Zn 65   |  |                | 1.14E-07        | CC 2           | Ra 223           |  |                 |                 |                |
| Se 79   |  |                |                 |                | Ra 225           |  |                 |                 |                |
| Kr 81   |  |                |                 |                | Ra 226           |  |                 |                 |                |
| Kr 85   |  |                |                 |                | Ra 228           |  |                 |                 |                |
| Rb 87   |  |                |                 |                | Ac 227           |  |                 |                 |                |
| Sr 90   |  |                | 1.12E-07        | CC 2           | Th 227           |  |                 |                 |                |
| Zr 93   |  |                |                 |                | Th 228           |  |                 |                 |                |
| Nb 91   |  |                |                 |                | Th 229           |  |                 |                 |                |
| Nb 92   |  |                |                 |                | Th 230           |  |                 |                 |                |
| Nb 93m  |  |                |                 |                | Th 232           |  |                 |                 |                |
| Nb 94   |  |                | 6.48E-08        | CC 2           | Th 234           |  |                 |                 |                |
| Mo 93   |  |                |                 |                | Pa 231           |  |                 |                 |                |
| Tc 97   |  |                |                 |                | Pa 233           |  |                 |                 |                |
| Tc 99   |  |                |                 |                | U 232            |  |                 |                 |                |
| Ru 106  |  |                | 1.26E-06        | CC 2           | U 233            |  |                 |                 |                |
| Pd 107  |  |                |                 |                | U 234            |  |                 |                 |                |
| Ag 108m |  |                | 1.18E-07        | CC 2           | U 235            |  |                 |                 |                |
| Ag 110m |  |                | 2.69E-07        | CC 2           | U 236            |  |                 |                 |                |
| Cd 109  |  |                |                 |                | U 238            |  |                 |                 |                |
| Cd 113m |  |                |                 |                | Np 237           |  |                 |                 |                |
| Sn 119m |  |                |                 |                | Pu 236           |  |                 |                 |                |
| Sn 121m |  |                |                 |                | Pu 238           |  | 6E-10           | CC 2            |                |
| Sn 123  |  |                |                 |                | Pu 239           |  | 3.2E-10         | CC 2            |                |
| Sn 126  |  |                |                 |                | Pu 240           |  | 7.2E-10         | CC 2            |                |
| Sb 125  |  |                | 3.00E-07        | CC 2           | Pu 241           |  | 1.17E-07        | CC 2            |                |
| Sb 126  |  |                |                 |                | Pu 242           |  |                 |                 |                |
| Te 125m |  |                |                 |                | Am 241           |  | 1.68E-08        | CC 2            |                |
| Te 127m |  |                |                 |                | Am 242m          |  |                 |                 |                |
| I 129   |  |                |                 |                | Am 243           |  |                 |                 |                |
| Cs 134  |  |                | 2.27E-07        | CC 2           | Cm 242           |  | 1.13E-08        | CC 2            |                |
| Cs 135  |  |                |                 |                | Cm 243           |  | 4E-11           | CC 2            |                |
| Cs 137  |  |                | 6.42E-06        | CC 2           | Cm 244           |  | 2.08E-09        | CC 2            |                |
| Ba 133  |  |                | 7.48E-09        | CC 2           | Cm 245           |  |                 |                 |                |
| La 137  |  |                |                 |                | Cm 246           |  |                 |                 |                |
| La 138  |  |                |                 |                | Cm 248           |  |                 |                 |                |
| Ce 144  |  |                | 5.56E-07        | CC 2           | Cf 249           |  |                 |                 |                |
| Pm 145  |  |                |                 |                | Cf 250           |  |                 |                 |                |
| Pm 147  |  |                | 8.73E-08        | CC 2           | Cf 251           |  |                 |                 |                |
| Sm 147  |  |                |                 |                | Cf 252           |  |                 |                 |                |
| Sm 151  |  |                |                 |                | Other a          |  |                 |                 |                |
| Eu 152  |  |                | 8.08E-09        | CC 2           | Other b/g        |  | 1.32E-06        | CC 2            |                |
| Eu 154  |  |                | 9.68E-09        | CC 2           | <b>Total a</b>   | <b>0</b>                               | <b>3.18E-08</b> | <b>CC 2</b>     |                |
| Eu 155  |  |                | 1.53E-08        | CC 2           | <b>Total b/g</b> | <b>0</b>                               | <b>2.06E-04</b> | <b>CC 2</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