

**WASTE STREAM****3L28****WET (POND) CARBONACEOUS DEBRIS****SITE** Heysham 1**SITE OWNER** EDFE NGL**WASTE CUSTODIAN** EDFE NGL**WASTE TYPE** ILW; SPD1

Is the waste subject to Scottish Policy: No

**WASTE VOLUMES**

|                                 |   | Reported                |
|---------------------------------|---|-------------------------|
| Stocks:                         | At 1.4.2022.....  | ~0.6 m <sup>3</sup>     |
| Future arisings -               | 1.4.2022 - 31.3.2024.....   | ~0.2 m <sup>3</sup>     |
|                                 | 1.4.2024 - 31.3.2028.....   | ~0.4 m <sup>3</sup>     |
| Total future arisings:          |   | 0.6 m <sup>3</sup>      |
| Total waste volume:             |   | 1.2 m <sup>3</sup>      |
| Comment on volumes:             | Arising rate of 0.1m <sup>3</sup> /year conservatively assumed for operational period plus four years of defueling. |                         |
| Uncertainty factors on volumes: | Stock (upper): x 1.75   | Arisings (upper) x 1.75 |
|                                 | Stock (lower): x 0.25   | Arisings (lower) x 0.25 |

**WASTE SOURCE** Two main sources: (1) Carbon deposition onto internal reactor surfaces; and (2) Superficial damage to graphite fuel sleeves.**PHYSICAL CHARACTERISTICS**

General description: Two sources give rise to two different waste populations: (1) Finer dust-like debris expected to have arisen from fuel assembly carbon deposition that has subsequently been washed into the ponds; and (2) Larger graphite fragments understood to have fragmented from graphite fuel sleeves during the discharge of irradiated fuel elements into the ponds.

Physical components (%vol): Not yet determined

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m<sup>3</sup>): NEComment on density: Bulk density not yet determined. Bulk density of 1t/m<sup>3</sup> assumed to convert specific activities (measured in units Bq/g by radiochemical analysis) to units TBq/m<sup>3</sup>.**CHEMICAL COMPOSITION**

General description and components (%wt): Not yet determined

Chemical state: -

Chemical form of radionuclides: H-3: Not yet determined  
C-14: Not yet determined  
Cl-36: Not yet determined  
Se-79: Not yet determined  
Tc-99: Not yet determined  
I-129: Not yet determined  
Ra: Not yet determined  
Th: Not yet determined  
U: Not yet determined  
Np: Not yet determined  
Pu: Not yet determined

Metals and alloys (%wt): Not yet determined

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

**WASTE STREAM**

**3L28**

**WET (POND) CARBONACEOUS DEBRIS**

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

Organics (%wt):                      Not yet determined

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

Other materials (%wt):                      Not yet determined

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

**WASTE STREAM****3L28****WET (POND) CARBONACEOUS DEBRIS**

Graphite.....  
 Desiccants/Catalysts.....  
 Asbestos.....  
     Non/low friable.....  
     Moderately friable.....  
     Highly friable.....  
 Free aqueous liquids.....  
 Free non-aqueous liquids.....  
 Powder/Ash.....

Inorganic anions (%wt):           Not yet determined

(%wt)    Type(s) and comment

Fluoride.....  
 Chloride.....  
 Iodide.....  
 Cyanide.....  
 Carbonate.....  
 Nitrate.....  
 Nitrite.....  
 Phosphate.....  
 Sulphate.....  
 Sulphide.....

Materials of interest for           Not yet determined  
 waste acceptance criteria:

(%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.....

**WASTE STREAM****3L28****WET (POND) CARBONACEOUS DEBRIS**

Hazardous substances /  
non hazardous pollutants:      Not yet determined

|                                       | (%wt) | Type(s) and comment |
|---------------------------------------|-------|---------------------|
| Acrylamide.....                       |       |                     |
| Benzene.....                          |       |                     |
| 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):      Not yet determined

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

**WASTE STREAM****3L28****WET (POND) CARBONACEOUS DEBRIS**

Potential for the waste to contain discrete items: Not yet determined.

**PACKAGING AND CONDITIONING**

Conditioning method: Not yet determined  
 Plant Name: -  
 Location: Heysham 1 Power Station  
 Plant startup date: Not yet determined  
 Total capacity (m<sup>3</sup>/y incoming waste): NE  
 Target start date for packaging this stream: -  
 Throughput for this stream (m<sup>3</sup>/y incoming waste): NE  
 Other information: -

| Likely container type: | Container               | Waste packaged (%vol) | Waste loading (m <sup>3</sup> ) | Payload (m <sup>3</sup> ) | Number of packages |
|------------------------|-------------------------|-----------------------|---------------------------------|---------------------------|--------------------|
|                        | Other(To be determined) | NE                    | NE                              | NE                        |                    |

Likely container type comment: To be determined

Range in container waste volume: To be determined

Other information on containers: -

Likely conditioning matrix: Other  
 Other information: To be determined

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

Conditioned density comment: -

Other information on conditioning: -

Opportunities for alternative disposal routing: Not yet determined

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

**RADIOACTIVITY**

Source: Metal activation and nuclear fission products.

Uncertainty: Specific activity data was available for a total of five samples from three different areas of the cooling ponds. The average specific activity of these five samples was determined by weighting the volume of waste present in each area of the cooling ponds. There is high uncertainty in specific activity data due to the small number of samples that have been retrieved to date and the range of specific activities presented by them.

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'.

**WASTE STREAM**

**3L28**

**WET (POND) CARBONACEOUS DEBRIS**

Measurement of  
radioactivities:

Measured by radiochemical analysis.

Other information:

-

**WASTE STREAM**

**3L28**

**WET (POND) CARBONACEOUS DEBRIS**

| 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     | 8.63E-01                               | CC 2           | 8.63E-01        | CC 2           | Gd 153           |  |                |                 |                |
| Be 10   |  |                |                 |                | Ho 163           |  |                |                 |                |
| C 14    | 4.15E-02                               | CC 2           | 4.15E-02        | CC 2           | Ho 166m          |  |                |                 |                |
| Na 22   |  |                |                 |                | Tm 170           |  |                |                 |                |
| Al 26   |  |                |                 |                | Tm 171           |  |                |                 |                |
| Cl 36   | 6.00E-06                               | CC 2           | 6.00E-06        | 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   | 1.46E-01                               | CC 2           | 1.46E-01        | CC 2           | Pb 205           |  |                |                 |                |
| Fe 55   | 1.89E+00                               | CC 2           | 1.89E+00        | CC 2           | Pb 210           |  |                |                 |                |
| Co 60   | 1.66E-01                               | CC 2           | 1.66E-01        | CC 2           | Bi 208           |  |                |                 |                |
| Ni 59   |  |                |                 |                | Bi 210m          |  |                |                 |                |
| Ni 63   | 1.16E-01                               | CC 2           | 1.16E-01        | CC 2           | Po 210           |  |                |                 |                |
| Zn 65   | 1.28E-03                               | CC 2           | 1.28E-03        | CC 2           | Ra 223           |  |                |                 |                |
| Se 79   |  |                |                 |                | Ra 225           |  |                |                 |                |
| Kr 81   |  |                |                 |                | Ra 226           |  |                |                 |                |
| Kr 85   |  |                |                 |                | Ra 228           |  |                |                 |                |
| Rb 87   |  |                |                 |                | Ac 227           |  |                |                 |                |
| Sr 90   | 1.39E-04                               | CC 2           | 1.39E-04        | CC 2           | 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   |  |                |                 |                | U 232            |  |                |                 |                |
| Ru 106  |  |                |                 |                | U 233            |  |                |                 |                |
| Pd 107  |  |                |                 |                | U 234            |  |                |                 |                |
| Ag 108m |  |                |                 |                | U 235            |  |                |                 |                |
| Ag 110m |  |                |                 |                | U 236            |  |                |                 |                |
| Cd 109  |  |                |                 |                | U 238            |  |                |                 |                |
| Cd 113m |  |                |                 |                | Np 237           |  |                |                 |                |
| Sn 119m |  |                |                 |                | Pu 236           |  |                |                 |                |
| Sn 121m |  |                |                 |                | Pu 238           | 1.77E-04                               | CC 2           | 1.77E-04        | CC 2           |
| Sn 123  |  |                |                 |                | Pu 239           | 3.42E-04                               | CC 2           | 3.42E-04        | CC 2           |
| Sn 126  |  |                |                 |                | Pu 240           | 3.42E-04                               | CC 2           | 3.42E-04        | CC 2           |
| Sb 125  |  |                |                 |                | Pu 241           | 1.03E-02                               | CC 2           | 1.03E-02        | CC 2           |
| Sb 126  |  |                |                 |                | Pu 242           |  |                |                 |                |
| Te 125m |  |                |                 |                | Am 241           | 9.19E-04                               | CC 2           | 9.19E-04        | CC 2           |
| Te 127m |  |                |                 |                | Am 242m          |  |                |                 |                |
| I 129   |  |                |                 |                | Am 243           |  |                |                 |                |
| Cs 134  | 2.56E-04                               | CC 2           | 2.56E-04        | CC 2           | Cm 242           | 6.05E-06                               | CC 2           | 6.05E-06        | CC 2           |
| Cs 135  |  |                |                 |                | Cm 243           | 2.80E-05                               | CC 2           | 2.80E-05        | CC 2           |
| Cs 137  | 4.55E-03                               | CC 2           | 4.55E-03        | CC 2           | Cm 244           | 2.80E-05                               | CC 2           | 2.80E-05        | CC 2           |
| Ba 133  | 1.11E-04                               | CC 2           | 1.11E-04        | CC 2           | Cm 245           |  |                |                 |                |
| La 137  |  |                |                 |                | Cm 246           |  |                |                 |                |
| La 138  |  |                |                 |                | Cm 248           |  |                |                 |                |
| Ce 144  |  |                |                 |                | Cf 249           |  |                |                 |                |
| Pm 145  |  |                |                 |                | Cf 250           |  |                |                 |                |
| Pm 147  | 1.27E-04                               | CC 2           | 1.27E-04        | CC 2           | Cf 251           |  |                |                 |                |
| Sm 147  |  |                |                 |                | Cf 252           |  |                |                 |                |
| Sm 151  | 7.09E-05                               | CC 2           | 7.09E-05        | CC 2           | Other a          |  | 8              |                 | 8              |
| Eu 152  |  |                |                 |                | Other b/g        | 6.00E-04                               | CC 2           | 6.00E-04        | CC 2           |
| Eu 154  | 2.40E-04                               | CC 2           | 2.40E-04        | CC 2           | <b>Total a</b>   | <b>1.84E-03</b>                        | <b>CC 2</b>    | <b>1.84E-03</b> | <b>CC 2</b>    |
| Eu 155  | 2.55E-04                               | CC 2           | 2.55E-04        | CC 2           | <b>Total b/g</b> | <b>3.24E+00</b>                        | <b>CC 2</b>    | <b>3.24E+00</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