

| WASTE STREAM | 3K28 | Miscellaneous Activated Components - Tie Bar Ends & Nuts |
|--------------|------|----------------------------------------------------------|
|--------------|------|----------------------------------------------------------|

**SITE** Hartlepool

**SITE OWNER** EDF Energy Nuclear Generation Ltd (EDFE NGL)

**WASTE CUSTODIAN** EDF Energy Nuclear Generation Ltd (EDFE NGL)

**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                | = 2.1      |                               |                            |
| Future arisings:       | 1.4.2025 - 31.3.2027       | = 0.2      |                               |                            |
|                        | 1.4.2027 - 31.3.2030       | = 0.6      |                               |                            |
| Total future arisings: |                            | <b>0.8</b> |                               |                            |
| Total waste volume:    |                            | <b>2.9</b> |                               |                            |

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

Comment on arising rates: Stock volume estimated at 2.1 m3 based on previous estimates. Waste volumes will be variable depending on station operating conditions. Future arising estimated at 0.1 m3/yr during the rest of the operational period and 0.19 m3/yr during the period of defueling. Total future arising value increased compared to 2022 due to station lifetime extension and defueling period which will end in 2030

Additional information on quantities: -

Uncertainty factors on volumes: Stock (upper): x 1.25 Arisings (upper): x 1.75  
Stock (lower): x 0.75 Arisings (lower): x 0.25

**WASTE SOURCE** Metallic components resulting from the dismantling of fuel element stringers.

#### PHYSICAL CHARACTERISTICS

General description: Tie bar ends and nuts. Some other components may be present. No large items are expected.

Changes since waste generated: -

Bulk density (t/m<sup>3</sup>): ~ 0.50

Comment on density: -

#### CHEMICAL COMPOSITION

General description and components (%wt): Mainly stainless steel. Some nimonic alloy will also be present. Percentage breakdown not estimated.

Chemical state: Neutral

Sheet metal proportion / thickness: -

Metals and alloys (%wt):

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

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...                 | NE    | -                   |                         |

Other materials (%wt):

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

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

Inorganic anions (%wt):

|              | (%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   | -                   |
| Corrosive materials...                       | = 0   | -                   |
| Pyrophoric materials...                      | = 0   | -                   |
| Generating toxic gases...                    | = 0   | -                   |
| Reacting with water...                       | = 0   | -                   |
| Higher activity particles...                 | P     | -                   |
| Soluble solids as bulk chemical compounds... | = 0   | -                   |

Hazardous substances / non hazardous pollutants:

|                             | (%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.....      | NE    | -                   |
| Others.....                 | NE    | -                   |

Complexing agents (%wt):

| Not yet determined             |       |                                       |
|--------------------------------|-------|---------------------------------------|
|                                | (%wt) | Type(s) and comment                   |
| EDTA.....                      | NE    | -                                     |
| DPTA.....                      | NE    | -                                     |
| NTA.....                       | NE    | -                                     |
| Polycarboxylic acids.....      | NE    | -                                     |
| Other organic complexants..... | NE    | Expect only trace quantities, if any. |
| Total complexing agents.....   | NE    | -                                     |

Physical components:

|                                         | Number | Type(s) and comment |
|-----------------------------------------|--------|---------------------|
| Sources.....                            | = 0    | -                   |
| 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<br>Decay storage<br>Low force compaction<br>Supercompaction (HFC)<br>Incineration<br>Drying/dewatering/liquid separation<br>Tie down/fixatives/strippable coating/painting application<br>Decontamination<br>Metal treatment<br>Recycling / reuse<br>Thermal treatment, including vitrification<br>Encapsulation<br>Polymer encapsulation<br>Other physical treatment<br>Other chemical treatment<br>Containerisation<br>Treatment not yet determined<br>None | On-site            | = 100.0         |

Comments on planned treatments:

-

Conditioning method:

"The waste will be conditioned to satisfy the disposal requirements which are effective at the time of retrieval/conditioning. It is currently assumed that the waste will be placed in 'baskets' in the waste packages and will be encapsulated."

Conditioning plants:

| Plant Name                               | Location   |
|------------------------------------------|------------|
| Hartlepool Waste Management Centre (WMC) | Hartlepool |

Likely conditioning matrix:

-

Further information on the conditioning matrix:

Conditioning matrix will be BFS/OPC. Mix ratios are yet to be established

**Waste Packaging:**

|                        |                                     |                       |                    |              |                    |                                    |
|------------------------|-------------------------------------|-----------------------|--------------------|--------------|--------------------|------------------------------------|
| Likely container type: | Container                           | Waste packaged (vol%) | Waste loading (m³) | Payload (m³) | Number of packages | Estimated start date for packaging |
|                        | 4 m box (100 mm concrete shielding) | 100.0                 | 12.2               | 14.3         | 1                  | -                                  |

Range in container waste loading:

Other information on packaging and conditioning: Waste will be retained on site pending Final Site Clearance, to let nuclides such as Co-60 undergo considerable radioactive decay. Baskets of different Final Site Clearance ILW wastes may be in the same waste package.

Conditioned density (t/m³): ~ 2.5  
 Conditioned density comment: The density of the encapsulated waste is expected to be approximately 2.5 t/m³.

**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) | = 100.0         |                  |            |
| 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                                                           |                 |                  |            |

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

Opportunities for alternative disposal routing: No

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

**RADIOACTIVITY**

Source: Activation of nuclides within the steel will be the main sources of activity.

Uncertainty: Specific activity is a function of station operating history. The values quoted are indicative of the activities that might be expected.

Measurement of radioactivities: Estimates have been based on theoretical assessments. Other beta/gamma nuclides (in TBq/m³) in arisings and stocks include: - S35 (6E-1, 8E-3); Ca45 (1E+0, 3E-2); Cr51 (2E+4, 1E+1); Co58 (1E+3, 9E+0); Zr95 (6E-1, 5E-3); Nb95 (1E+1, 1E-2); Sc46 (1E-1, 1E-3) and Fe59 (2E+2, 7E-1).

Chemical form of radionuclides:

- H-3: -
- C-14: -
- Cl-36: -
- Se-79: -
- Tc-99: -
- I-129: -
- Ra: -
- Th: -
- U: -
- Np: -
- Pu: -

| WASTE STREAM |                            | 3K28              |                 | Miscellaneous Activated Components - Tie Bar Ends & Nuts |           |                            |                   |                 |                   |
|--------------|----------------------------|-------------------|-----------------|----------------------------------------------------------|-----------|----------------------------|-------------------|-----------------|-------------------|
| Nuclide      | Mean radioactivity, TBq/m³ |                   |                 |                                                          | Nuclide   | Mean radioactivity, TBq/m³ |                   |                 |                   |
|              | Waste at<br>1.4.2025       | Bands and<br>Code | Future Arisings | Bands and<br>Code                                        |           | Waste at<br>1.4.2025       | Bands and<br>Code | Future Arisings | Bands and<br>Code |
| H 3          | 1.00E-06                   | C C 2             | 2.00E-06        | C C 2                                                    | Gd 153    |                            |                   |                 |                   |
| Be 10        | 1.00E-09                   | C C 2             | 1.00E-09        | C C 2                                                    | Ho 163    |                            |                   |                 |                   |
| C 14         | 3.00E-06                   | C C 2             | 3.00E-06        | C C 2                                                    | Ho 166m   |                            |                   |                 |                   |
| Na 22        |                            | 4                 |                 | 4                                                        | Tm 170    |                            |                   |                 |                   |
| Al 26        |                            | 4                 |                 | 4                                                        | Tm 171    |                            |                   |                 |                   |
| Cl 36        | 7.00E-05                   | C C 2             | 7.00E-05        | C C 2                                                    | Lu 174    |                            |                   |                 |                   |
| Ar 39        |                            |                   |                 |                                                          | Lu 176    |                            |                   |                 |                   |
| Ar 42        |                            |                   |                 |                                                          | Hf 178n   |                            |                   |                 |                   |
| K 40         |                            |                   |                 |                                                          | Hf 182    |                            |                   |                 |                   |
| Ca 41        | 7.00E-04                   | C C 2             | 7.00E-04        | C C 2                                                    | Pt 193    |                            |                   |                 |                   |
| Mn 53        |                            |                   |                 |                                                          | Tl 204    |                            |                   |                 |                   |
| Mn 54        | 6.00E+00                   | C C 2             | 1.00E+02        | C C 2                                                    | Pb 205    |                            |                   |                 |                   |
| Fe 55        | 1.00E+03                   | C C 2             | 6.00E+03        | C C 2                                                    | Pb 210    | 8                          |                   |                 | 8                 |
| Co 60        | 2.00E+03                   | C C 2             | 3.00E+03        | C C 2                                                    | Bi 208    |                            |                   |                 |                   |
| Ni 59        | 8.00E+00                   | C C 2             | 8.00E+00        | C C 2                                                    | Bi 210m   |                            |                   |                 |                   |
| Ni 63        | 9.00E+02                   | C C 2             | 1.00E+03        | C C 2                                                    | Po 210    | 8                          |                   |                 | 8                 |
| Zn 65        | 2.00E-04                   | C C 2             | 5.00E-03        | C C 2                                                    | Ra 223    |                            |                   |                 |                   |
| Se 79        |                            | 8                 |                 | 8                                                        | Ra 225    |                            |                   |                 |                   |
| Kr 81        |                            |                   |                 |                                                          | Ra 226    | 8                          |                   |                 | 8                 |
| Kr 85        |                            |                   |                 |                                                          | Ra 228    |                            |                   |                 |                   |
| Rb 87        |                            |                   |                 |                                                          | Ac 227    |                            |                   |                 |                   |
| Sr 90        |                            | 8                 |                 | 8                                                        | Th 227    |                            |                   |                 |                   |
| Zr 93        | 5.00E-06                   | C C 2             | 5.00E-06        | C C 2                                                    | Th 228    |                            |                   |                 |                   |
| Nb 91        |                            |                   |                 |                                                          | Th 229    | 8                          |                   |                 | 8                 |
| Nb 92        |                            |                   |                 |                                                          | Th 230    | 8                          |                   |                 | 8                 |
| Nb 93m       | 4.00E-03                   | C C 2             | 5.00E-03        | C C 2                                                    | Th 232    | 8                          |                   |                 | 8                 |
| Nb 94        | 2.00E-02                   | C C 2             | 2.00E-02        | C C 2                                                    | Th 234    |                            |                   |                 |                   |
| Mo 93        | 6.00E-02                   | C C 2             | 6.00E-02        | C C 2                                                    | Pa 231    | 8                          |                   |                 | 8                 |
| Tc 97        |                            |                   |                 |                                                          | Pa 233    |                            |                   |                 |                   |
| Tc 99        |                            | 8                 |                 | 8                                                        | U 232     |                            |                   |                 |                   |
| Ru 106       |                            | 8                 |                 | 8                                                        | U 233     | 8                          |                   |                 | 8                 |
| Pd 107       |                            | 8                 |                 | 8                                                        | U 234     | 8                          |                   |                 | 8                 |
| Ag 108m      | 9.00E-03                   | C C 2             | 9.00E-03        | C C 2                                                    | U 235     | 8                          |                   |                 | 8                 |
| Ag 110m      | 1.00E-01                   | C C 2             | 3.00E+00        | C C 2                                                    | U 236     | 8                          |                   |                 | 8                 |
| Cd 109       | 9.00E-03                   | C C 2             | 1.00E-01        | C C 2                                                    | U 238     | 8                          |                   |                 | 8                 |
| Cd 113m      | 6.00E-07                   | C C 2             | 8.00E-07        | C C 2                                                    | Np 237    | 8                          |                   |                 | 8                 |
| Sn 119m      |                            |                   |                 |                                                          | Pu 236    |                            |                   |                 |                   |
| Sn 121m      |                            | 8                 |                 | 8                                                        | Pu 238    | 8                          |                   |                 | 8                 |
| Sn 123       |                            |                   |                 |                                                          | Pu 239    | 8                          |                   |                 | 8                 |
| Sn 126       |                            | 8                 |                 | 8                                                        | Pu 240    | 8                          |                   |                 | 8                 |
| Sb 125       |                            |                   |                 |                                                          | Pu 241    | 8                          |                   |                 | 8                 |
| Sb 126       |                            |                   |                 |                                                          | Pu 242    | 8                          |                   |                 | 8                 |
| Te 125m      |                            |                   |                 |                                                          | Am 241    | 8                          |                   |                 | 8                 |
| Te 127m      |                            |                   |                 |                                                          | Am 242m   | 8                          |                   |                 | 8                 |
| I 129        |                            | 8                 |                 | 8                                                        | Am 243    | 8                          |                   |                 | 8                 |
| Cs 134       |                            | 8                 |                 | 8                                                        | Cm 242    | 8                          |                   |                 | 8                 |
| Cs 135       |                            | 8                 |                 | 8                                                        | Cm 243    | 8                          |                   |                 | 8                 |
| Cs 137       |                            | 8                 |                 | 8                                                        | Cm 244    | 8                          |                   |                 | 8                 |
| Ba 133       |                            |                   |                 |                                                          | Cm 245    | 8                          |                   |                 | 8                 |
| La 137       |                            |                   |                 |                                                          | Cm 246    | 8                          |                   |                 | 8                 |
| La 138       |                            |                   |                 |                                                          | Cm 248    |                            |                   |                 |                   |
| Ce 144       |                            | 8                 |                 | 8                                                        | Cf 249    |                            |                   |                 |                   |
| Pm 145       |                            |                   |                 |                                                          | Cf 250    |                            |                   |                 |                   |
| Pm 147       |                            | 8                 |                 | 8                                                        | Cf 251    |                            |                   |                 |                   |
| Sm 147       |                            |                   |                 |                                                          | Cf 252    |                            |                   |                 |                   |
| Sm 151       |                            | 8                 |                 | 8                                                        | Unsp a    | 8                          |                   |                 | 8                 |
| Eu 152       |                            | 8                 |                 | 8                                                        | Unsp b/g  | 2.00E+01 C C 2             | 2.00E+04 C C 2    |                 | 2                 |
| Eu 154       |                            | 8                 |                 | 8                                                        | Total a   | 0                          | *                 | 0               | *                 |
| Eu 155       |                            | 8                 |                 | 8                                                        | Total b/g | 3.93E+03                   | *                 | 3.01E+04        | *                 |

#### 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