

| WASTE STREAM | 2C15 | Rotary Pump Oil |
|--------------|------|-----------------|
|--------------|------|-----------------|

**SITE** Chapelcross

**SITE OWNER** Nuclear Decommissioning Authority

**WASTE CUSTODIAN** Nuclear Restoration Services Ltd (NRS)

**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                | = 0.3 |                               |                            |
| Future arisings:       |                            |       |                               |                            |
| Total future arisings: |                            | 0.0   |                               |                            |
| Total waste volume:    |                            | 0.3   |                               |                            |

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

Comment on arising rates: No further arisings are expected.

Additional information on quantities: There are 47 bottles of oil (a majority of which also include absorbent material), with a further one bottle expected to be produced when the remaining oil within the plant is drained. The volume of the bottles are known so there is relatively little uncertainty.

Uncertainty factors on volumes:

|                |        |                   |     |
|----------------|--------|-------------------|-----|
| Stock (upper): | x 1.10 | Arisings (upper): | x - |
| Stock (lower): | x 0.90 | Arisings (lower): | x - |

**WASTE SOURCE** Rotary pump lubricant from Chapelcross Process Plant operations.

#### PHYSICAL CHARACTERISTICS

General description: Lubricant absorbed into vermiculite in '304 type' stainless steel bottles. There are no large items which require special treatment.

Changes since waste generated: -

Bulk density (t/m<sup>3</sup>): = 1.3

Comment on density: The density of the waste as stored based on mass and volume.

#### CHEMICAL COMPOSITION

General description and components (%wt): Oil (38.5%), vermiculite (5.3%) SS can (56.1%). Molybdenum may be present as an additive to the oil.

Chemical state: Neutral

Sheet metal proportion / thickness: -

Metals and alloys (%wt):

|                           | (%wt)  | Type(s) / Grades(s) with proportions | % of total C14 activity |
|---------------------------|--------|--------------------------------------|-------------------------|
| Stainless steel.....      | ~ 56.1 | -                                    |                         |
| Other ferrous metals..... | = 0    | -                                    |                         |
| Iron.....                 |        | -                                    |                         |
| Aluminium.....            | = 0    | -                                    |                         |
| Beryllium.....            | 0      | -                                    |                         |
| Cobalt.....               |        | -                                    |                         |
| Copper.....               | = 0    | -                                    |                         |
| Lead.....                 | = 0    | -                                    |                         |
| Magnox/Magnesium.....     | = 0    | -                                    |                         |
| Nickel.....               |        | -                                    |                         |
| Titanium.....             |        | -                                    |                         |
| 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.....                  | = 38.5 | -                   |                         |
| 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..... | = 0   | -                   |                         |
| Inorganic sludges and flocs.....      | = 0   | -                   |                         |
| Soil.....                             | = 0   | -                   |                         |
| Brick/Stone/Rubble.....               | = 0   | -                   |                         |
| Cementitious material.....            | = 0   | -                   |                         |
| Sand.....                             |       | -                   |                         |
| Glass/Ceramics.....                   | = 0   | -                   |                         |
| Graphite.....                         | = 0   | -                   |                         |
| Desiccants/Catalysts.....             |       | -                   |                         |
| Asbestos.....                         | = 0   | -                   |                         |
| Non/low friable.....                  |       | -                   |                         |
| Moderately friable.....               |       | -                   |                         |
| Highly friable.....                   |       | -                   |                         |
| Free aqueous liquids.....             | = 0   | -                   |                         |
| Free non-aqueous liquids.....         |       | -                   |                         |
| Powder/Ash.....                       | = 0   | -                   |                         |

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

Inorganic anions (%wt):

|                | (%wt) | Type(s) and comment |
|----------------|-------|---------------------|
| Fluoride.....  | = 0   | -                   |
| Chloride.....  | = 0   | -                   |
| Iodide.....    | = 0   | -                   |
| Cyanide.....   | = 0   | -                   |
| Carbonate..... | = 0   | -                   |
| Nitrate.....   | = 0   | -                   |
| Nitrite.....   | = 0   | -                   |
| Phosphate..... | = 0   | -                   |
| Sulphate.....  | = 0   | -                   |
| Sulphide.....  | = 0   | -                   |

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

Hazardous substances / non hazardous pollutants:

|                             | (%wt) | Type(s) and comment                      |
|-----------------------------|-------|------------------------------------------|
| Acrylamide.....             | 0     | -                                        |
| Benzene.....                |       | -                                        |
| Chlorinated solvents.....   |       | -                                        |
| Formaldehyde.....           |       | -                                        |
| Organometallics.....        |       | -                                        |
| Phenol.....                 |       | -                                        |
| Styrene.....                |       | -                                        |
| Tri-butyl phosphate.....    |       | -                                        |
| Other organophosphates..... |       | -                                        |
| Vinyl chloride.....         |       | -                                        |
| Arsenic.....                |       | -                                        |
| Barium.....                 |       | -                                        |
| Boron.....                  |       | -                                        |
| Boron (in Boral).....       |       | -                                        |
| Boron (non-Boral).....      |       | -                                        |
| Cadmium.....                | P     | may be present in the oil as an additive |
| Caesium.....                |       |                                          |
| Selenium.....               |       |                                          |
| Chromium.....               |       |                                          |
| Molybdenum.....             |       |                                          |
| Thallium.....               | = 5.3 | Vermiculite                              |
| Tin.....                    |       |                                          |
| Vanadium.....               |       |                                          |
| Mercury compounds.....      |       |                                          |
| Others.....                 |       |                                          |

Complexing agents (%wt):

| Yes                            |       |                                                                                                                           |
|--------------------------------|-------|---------------------------------------------------------------------------------------------------------------------------|
|                                | (%wt) | Type(s) and comment                                                                                                       |
| EDTA.....                      | TR    | -                                                                                                                         |
| DPTA.....                      |       | -                                                                                                                         |
| NTA.....                       |       | -                                                                                                                         |
| Polycarboxylic acids.....      |       | -                                                                                                                         |
| Other organic complexants..... |       | Trace levels of organic complexing agents may be present as additives and stabilisers or as organic degradation products. |
| Total complexing agents.....   | TR    | -                                                                                                                         |

Physical components:

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

Comments on planned treatments:

The oil will be decay stored in 500 litre drums (18 bottles per drum) until it is LLW, and then incinerated.

Conditioning method:

-

Conditioning plants:

| Plant Name | Location |
|------------|----------|
|            |          |

Likely conditioning matrix:

-

Further information on the conditioning matrix: -

**Waste Packaging:**

|                        |           |                       |                    |              |                    |                                    |
|------------------------|-----------|-----------------------|--------------------|--------------|--------------------|------------------------------------|
| Likely container type: | Container | Waste packaged (vol%) | Waste loading (m³) | Payload (m³) | Number of packages | Estimated start date for packaging |
|                        | -         | -                     | -                  | -            | -                  | -                                  |

Range in container waste loading: -

Other information on packaging and conditioning: -

Conditioned density (t/m³): 1.3  
Conditioned density comment: -

**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         | 0.50             |            |
| 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: Tritium is the only source of activity.

Uncertainty: -

Measurement of radioactivities: -

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

| WASTE STREAM 2C15 Rotary Pump Oil |                            |                |                 |                |                  |                            |                |                 |                |
|-----------------------------------|----------------------------|----------------|-----------------|----------------|------------------|----------------------------|----------------|-----------------|----------------|
| Nuclide                           | Mean radioactivity, TBq/m³ |                |                 |                | Nuclide          | Mean radioactivity, TBq/m³ |                |                 |                |
|                                   | Waste at 1.4.2025          | Bands and Code | Future Arisings | Bands and Code |                  | Waste at 1.4.2025          | Bands and Code | Future Arisings | Bands and Code |
| H 3                               | 2.24E+01                   | C C 2          |                 |                | Gd 153           |                            | 8              |                 |                |
| Be 10                             |                            | 8              |                 |                | Ho 163           |                            | 8              |                 |                |
| C 14                              |                            | 8              |                 |                | Ho 166m          |                            | 8              |                 |                |
| Na 22                             |                            | 8              |                 |                | Tm 170           |                            | 8              |                 |                |
| Al 26                             |                            | 8              |                 |                | Tm 171           |                            | 8              |                 |                |
| Cl 36                             |                            | 8              |                 |                | Lu 174           |                            | 8              |                 |                |
| Ar 39                             |                            | 8              |                 |                | Lu 176           |                            | 8              |                 |                |
| Ar 42                             |                            | 8              |                 |                | Hf 178n          |                            | 8              |                 |                |
| K 40                              |                            | 8              |                 |                | Hf 182           |                            | 8              |                 |                |
| Ca 41                             |                            | 8              |                 |                | Pt 193           |                            | 8              |                 |                |
| Mn 53                             |                            | 8              |                 |                | Tl 204           |                            | 8              |                 |                |
| Mn 54                             |                            | 8              |                 |                | Pb 205           |                            | 8              |                 |                |
| Fe 55                             |                            | 8              |                 |                | Pb 210           |                            | 8              |                 |                |
| Co 60                             |                            | 8              |                 |                | Bi 208           |                            | 8              |                 |                |
| Ni 59                             |                            | 8              |                 |                | Bi 210m          |                            | 8              |                 |                |
| Ni 63                             |                            | 8              |                 |                | Po 210           |                            | 8              |                 |                |
| Zn 65                             |                            | 8              |                 |                | Ra 223           |                            | 8              |                 |                |
| Se 79                             |                            | 8              |                 |                | Ra 225           |                            | 8              |                 |                |
| Kr 81                             |                            | 8              |                 |                | Ra 226           |                            | 8              |                 |                |
| Kr 85                             |                            | 8              |                 |                | Ra 228           |                            | 8              |                 |                |
| Rb 87                             |                            | 8              |                 |                | Ac 227           |                            | 8              |                 |                |
| Sr 90                             |                            | 8              |                 |                | Th 227           |                            | 8              |                 |                |
| Zr 93                             |                            | 8              |                 |                | Th 228           |                            | 8              |                 |                |
| Nb 91                             |                            | 8              |                 |                | Th 229           |                            | 8              |                 |                |
| Nb 92                             |                            | 8              |                 |                | Th 230           |                            | 8              |                 |                |
| Nb 93m                            |                            | 8              |                 |                | Th 232           |                            | 8              |                 |                |
| Nb 94                             |                            | 8              |                 |                | Th 234           |                            | 8              |                 |                |
| Mo 93                             |                            | 8              |                 |                | Pa 231           |                            | 8              |                 |                |
| Tc 97                             |                            | 8              |                 |                | Pa 233           |                            | 8              |                 |                |
| Tc 99                             |                            | 8              |                 |                | U 232            |                            | 8              |                 |                |
| Ru 106                            |                            | 8              |                 |                | U 233            |                            | 8              |                 |                |
| Pd 107                            |                            | 8              |                 |                | U 234            |                            | 8              |                 |                |
| Ag 108m                           |                            | 8              |                 |                | U 235            |                            | 8              |                 |                |
| Ag 110m                           |                            | 8              |                 |                | U 236            |                            | 8              |                 |                |
| Cd 109                            |                            | 8              |                 |                | U 238            |                            | 8              |                 |                |
| Cd 113m                           |                            | 8              |                 |                | Np 237           |                            | 8              |                 |                |
| Sn 119m                           |                            | 8              |                 |                | Pu 236           |                            | 8              |                 |                |
| Sn 121m                           |                            | 8              |                 |                | Pu 238           |                            | 8              |                 |                |
| Sn 123                            |                            | 8              |                 |                | Pu 239           |                            | 8              |                 |                |
| Sn 126                            |                            | 8              |                 |                | Pu 240           |                            | 8              |                 |                |
| Sb 125                            |                            | 8              |                 |                | Pu 241           |                            | 8              |                 |                |
| Sb 126                            |                            | 8              |                 |                | Pu 242           |                            | 8              |                 |                |
| Te 125m                           |                            | 8              |                 |                | Am 241           |                            | 8              |                 |                |
| Te 127m                           |                            | 8              |                 |                | Am 242m          |                            | 8              |                 |                |
| I 129                             |                            | 8              |                 |                | Am 243           |                            | 8              |                 |                |
| Cs 134                            |                            | 8              |                 |                | Cm 242           |                            | 8              |                 |                |
| Cs 135                            |                            | 8              |                 |                | Cm 243           |                            | 8              |                 |                |
| Cs 137                            |                            | 8              |                 |                | Cm 244           |                            | 8              |                 |                |
| Ba 133                            |                            | 8              |                 |                | Cm 245           |                            | 8              |                 |                |
| La 137                            |                            | 8              |                 |                | Cm 246           |                            | 8              |                 |                |
| La 138                            |                            | 8              |                 |                | Cm 248           |                            | 8              |                 |                |
| Ce 144                            |                            | 8              |                 |                | Cf 249           |                            | 8              |                 |                |
| Pm 145                            |                            | 8              |                 |                | Cf 250           |                            | 8              |                 |                |
| Pm 147                            |                            | 8              |                 |                | Cf 251           |                            | 8              |                 |                |
| Sm 147                            |                            | 8              |                 |                | Cf 252           |                            | 8              |                 |                |
| Sm 151                            |                            | 8              |                 |                | Unsp a           |                            |                |                 |                |
| Eu 152                            |                            | 8              |                 |                | Unsp b/g         |                            |                |                 |                |
| Eu 154                            |                            | 8              |                 |                | <b>Total a</b>   | <b>0</b>                   | <b>*</b>       | <b>0</b>        | <b>*</b>       |
| Eu 155                            |                            | 8              |                 |                | <b>Total b/g</b> | <b>2.24E+01</b>            | <b>*</b>       | <b>0</b>        | <b>*</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 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