

| WASTE STREAM | 9A58 | Sludge (filter-precoat) from Berkeley Technology Centre |
|--------------|------|---------------------------------------------------------|
|--------------|------|---------------------------------------------------------|

**SITE** Berkeley

**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 = 14.3         |    |                               |                            |
| Future arisings:       |                            |    |                               |                            |
| Total future arisings: | 0.0                        |    |                               |                            |
| Total waste volume:    | 14.3                       |    |                               |                            |

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

Comment on arising rates: -

Additional information on quantities: There will be no further arisings of this waste stream. The volume was reassessed prior to the 2004 Inventory.

Uncertainty factors on volumes:

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

**WASTE SOURCE** The sludge originates from routine filtration of liquid effluents and cooling pond water at Berkeley Technology Centre.

#### PHYSICAL CHARACTERISTICS

**General description:** The waste consists of contaminated Celite, a diatomaceous earth used as a Funda filter pre-coat in the Berkeley Technology Centre Active Effluent Treatment Plant. Sludges were collected on the Funda pre-coating filter and subsequently discharged along with the pre-coat material as a dry effluent residue into a can or liner lined with a PVC bag. The trapped sludge originated predominately from the treatment of general site low activity effluent but has also resulted from the treatment of higher activity effluents from the fuel pond. It should be noted that the material discharged into the drums would be damp and not completely dry. The term 'dry' is used to indicate that the sludge is not fully flooded or diluted in water as is normal for other sludge arisings. The waste will consist of magnesium hydroxide and other particulate material present in the Berkeley Technology Centre fuel pond, along with fuel contamination and graphite dusts. There will also be cobalt hexacyanoferrate which was added to assist in the removal of caesium from the ponds during filtration in the Funda filter. The waste drums will be processed as Miscellaneous Contaminated Items. Originally, this waste stream was classified as LLW, however it will now be treated and processed as ILW. There are no large items that may require special handling.

Changes since waste generated: -

Bulk density (t/m<sup>3</sup>): = 0.40

Comment on density: The density has been calculated using weights of Celite contained in Red Cans and Black Can Liners and the volumes already identified.

#### CHEMICAL COMPOSITION

**General description and components (%wt):** There are 73 red cans and 67 black can liners containing Celite in this waste stream. The contaminated Celite consists of magnesium hydroxide, magnesium carbonate, silicon dioxide, calcium silicate, residual water and a range of other materials, including PVC (wt% not assessed). The drum is not included in this waste stream.

Chemical state: Alkali

Sheet metal proportion / thickness: Any metals present would be in particulate form.

Metals and alloys (%wt):

|                           | (%wt) | Type(s) / Grades(s) with proportions                                                                                                                                                                 | % of total C14 activity |
|---------------------------|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| Stainless steel.....      | TR    | The presence of metals has not been confirmed by measurement but there may be metal particles in the sludge. However only trace quantities are expected. There are steel drums containing the waste. |                         |
| Other ferrous metals..... | TR    |                                                                                                                                                                                                      |                         |
| Iron.....                 | -     |                                                                                                                                                                                                      |                         |
| Aluminium.....            | TR    |                                                                                                                                                                                                      |                         |
| Beryllium.....            | TR    |                                                                                                                                                                                                      |                         |
| Cobalt.....               | -     |                                                                                                                                                                                                      |                         |
| Copper.....               | TR    |                                                                                                                                                                                                      |                         |
| Lead.....                 | TR    |                                                                                                                                                                                                      |                         |
| Magnox/Magnesium.....     | TR    |                                                                                                                                                                                                      |                         |
| Nickel.....               | -     |                                                                                                                                                                                                      |                         |
| Titanium.....             | -     |                                                                                                                                                                                                      |                         |
| Uranium.....              | -     |                                                                                                                                                                                                      |                         |
| Zinc.....                 | TR    |                                                                                                                                                                                                      |                         |
| Zircaloy/Zirconium.....   | TR    |                                                                                                                                                                                                      |                         |
| Other metals.....         | TR    | "Other" metals have not been determined.                                                                                                                                                             |                         |

Organics (%wt):

|                                     | (%wt) | Type(s) and comment | % of total C14 activity |
|-------------------------------------|-------|---------------------|-------------------------|
| Total cellulosics.....              | TR    | -                   |                         |
| Paper, cotton.....                  | TR    | -                   |                         |
| Wood.....                           | = 0   | -                   |                         |
| Halogenated plastics.....           | ~ 2.0 | PVC.                |                         |
| Total non-halogenated plastics..... | = 0   | -                   |                         |
| Condensation polymers.....          | = 0   | -                   |                         |
| Others.....                         | = 0   | -                   |                         |
| Organic ion exchange materials..... | TR    | -                   |                         |
| Total rubber.....                   | TR    | -                   |                         |
| Halogenated rubber.....             | TR    | -                   |                         |
| Non-halogenated rubber.....         | TR    | -                   |                         |
| 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..... | TR     | -                   |                         |
| Inorganic sludges and flocs.....      | ~ 98.0 | -                   |                         |
| Soil.....                             | = 0    | -                   |                         |
| Brick/Stone/Rubble.....               | = 0    | -                   |                         |
| Cementitious material.....            | = 0    | -                   |                         |
| Sand.....                             |        | -                   |                         |
| Glass/Ceramics.....                   | = 0    | -                   |                         |
| Graphite.....                         | TR     | -                   |                         |
| Desiccants/Catalysts.....             |        | -                   |                         |
| Asbestos.....                         | = 0    | -                   |                         |
| Non/low friable.....                  |        | -                   |                         |
| Moderately friable.....               |        | -                   |                         |
| Highly friable.....                   |        | -                   |                         |
| Free aqueous liquids.....             | NE     | -                   |                         |
| Free non-aqueous liquids.....         | TR     | -                   |                         |
| 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.....    | = 0   |                     |
| Cyanide.....   | TR    |                     |
| 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.....                        | TR    | -                   |
| Low flash point liquids.....                   | = 0   | -                   |
| Explosive materials.....                       | = 0   | -                   |
| Phosphorus.....                                | = 0   | -                   |
| Hydrides.....                                  | = 0   | -                   |
| Biological etc. materials.....                 | TR    | -                   |
| Biodegradable materials.....                   | 0     | -                   |
| Putrescible wastes.....                        | = 0   | -                   |
| Non-putrescible wastes.....                    | -     | -                   |
| Corrosive materials.....                       | = 0   | -                   |
| Pyrophoric materials.....                      | = 0   | -                   |
| Generating toxic gases.....                    | = 0   | -                   |
| Reacting with water.....                       | TR    | -                   |
| 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.....                |       | -                   |
| Caesium.....                |       | -                   |
| Selenium.....               |       | -                   |
| Chromium.....               |       | -                   |
| Molybdenum.....             |       | -                   |
| Thallium.....               |       | -                   |
| Tin.....                    |       | -                   |
| Vanadium.....               |       | -                   |
| Mercury compounds.....      |       | -                   |
| Others.....                 |       | -                   |

Complexing agents (%wt):

| Yes                            |       |                     |
|--------------------------------|-------|---------------------|
|                                | (%wt) | Type(s) and comment |
| EDTA.....                      | TR    | -                   |
| DPTA.....                      |       | -                   |
| NTA.....                       |       | -                   |
| Polycarboxylic acids.....      |       | -                   |
| Other organic complexants..... |       | -                   |
| 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<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 |                    |                 |

Comments on planned treatments:

-

Conditioning method:

This stream is to be co-packaged with 9A36, 9A37, 9A38, 9A57, 9A59, 9A65, 9A68, 9A69, 9A70, 9A71, 9A72, 9A75, 9A77, 9A78, 9A82. Packages are assigned to 9A68, 9A71 & 9A75.

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):

-

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) |                 |                  |            |
| 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: Dried sludge contaminated by fission products and activation products including actinides. This waste stream includes some drums known to be of comparatively high activity so that the average activity may approach the ILW/LLW limit. The error bands are intended to allow for the potential influence of these higher activity drums.

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

Measurement of radioactivities: Activities have been estimated.

Chemical form of radionuclides: H-3: Most tritium is expected to be present as water but some may be present in the form of other inorganic compounds or as organic compounds.  
C-14: Carbon 14 may be present as graphite.  
Cl-36: The chemical form of chlorine 36 has not been determined.  
Se-79: .  
Tc-99: -  
I-129: -  
Ra: -  
Th: -  
U: Chemical form of U isotopes has not been determined but may be oxides.  
Np: -  
Pu: The chemical form of plutonium isotopes has not been determined but may be plutonium oxides.

| WASTE STREAM 9A58 Sludge (filter-precoat) from Berkeley Technology Centre |                            |                |                 |                |                  |                            |                |                 |                |
|---------------------------------------------------------------------------|----------------------------|----------------|-----------------|----------------|------------------|----------------------------|----------------|-----------------|----------------|
| 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                                                                       | < 1.09E-04                 | D 3            |                 |                | Gd 153           |                            | 8              |                 |                |
| Be 10                                                                     |                            | 8              |                 |                | Ho 163           |                            | 8              |                 |                |
| C 14                                                                      | 6.00E-07                   | C D 2          |                 |                | Ho 166m          |                            | 8              |                 |                |
| Na 22                                                                     |                            | 8              |                 |                | Tm 170           |                            | 8              |                 |                |
| Al 26                                                                     |                            | 8              |                 |                | Tm 171           |                            | 8              |                 |                |
| Cl 36                                                                     | 6.00E-09                   | C D 2          |                 |                | 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              |                 |                | Ti 204           |                            | 8              |                 |                |
| Mn 54                                                                     |                            | 8              |                 |                | Pb 205           |                            | 8              |                 |                |
| Fe 55                                                                     | 2.06E-08                   | C D 2          |                 |                | Pb 210           |                            | 8              |                 |                |
| Co 60                                                                     | 2.81E-06                   | C D 2          |                 |                | Bi 208           |                            | 8              |                 |                |
| Ni 59                                                                     | 1.00E-07                   | C D 2          |                 |                | Bi 210m          |                            | 8              |                 |                |
| Ni 63                                                                     | 7.93E-06                   | C D 2          |                 |                | Po 210           |                            | 8              |                 |                |
| Zn 65                                                                     |                            | 8              |                 |                | Ra 223           |                            | 8              |                 |                |
| Se 79                                                                     | 1.72E-09                   | C D 2          |                 |                | Ra 225           |                            | 8              |                 |                |
| Kr 81                                                                     |                            | 8              |                 |                | Ra 226           |                            | 8              |                 |                |
| Kr 85                                                                     |                            | 8              |                 |                | Ra 228           |                            | 8              |                 |                |
| Rb 87                                                                     |                            | 8              |                 |                | Ac 227           |                            | 8              |                 |                |
| Sr 90                                                                     | 4.55E-04                   | C D 2          |                 |                | 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           | 1.00E-07                   | C C 2          |                 |                |
| Mo 93                                                                     |                            | 8              |                 |                | Pa 231           |                            | 8              |                 |                |
| Tc 97                                                                     |                            | 8              |                 |                | Pa 233           | 1.06E-08                   | C C 2          |                 |                |
| Tc 99                                                                     | 2.00E-07                   | C D 2          |                 |                | U 232            |                            | 8              |                 |                |
| Ru 106                                                                    |                            | 8              |                 |                | U 233            |                            | 8              |                 |                |
| Pd 107                                                                    |                            | 8              |                 |                | U 234            | 1.01E-07                   | C D 2          |                 |                |
| Ag 108m                                                                   |                            | 8              |                 |                | U 235            | 3.00E-09                   | C D 2          |                 |                |
| Ag 110m                                                                   |                            | 8              |                 |                | U 236            | 1.00E-08                   | C D 2          |                 |                |
| Cd 109                                                                    |                            | 8              |                 |                | U 238            | 1.00E-07                   | C D 2          |                 |                |
| Cd 113m                                                                   |                            | 8              |                 |                | Np 237           | 1.07E-08                   | C D 2          |                 |                |
| Sn 119m                                                                   |                            | 8              |                 |                | Pu 236           |                            | 8              |                 |                |
| Sn 121m                                                                   |                            | 8              |                 |                | Pu 238           | 3.47E-05                   | C D 2          |                 |                |
| Sn 123                                                                    |                            | 8              |                 |                | Pu 239           | 5.00E-05                   | C D 2          |                 |                |
| Sn 126                                                                    | 4.35E-09                   | C D 2          |                 |                | Pu 240           | 6.00E-05                   | C D 2          |                 |                |
| Sb 125                                                                    |                            | 8              |                 |                | Pu 241           | 8.43E-04                   | C D 2          |                 |                |
| Sb 126                                                                    |                            | 8              |                 |                | Pu 242           | 5.00E-08                   | C D 2          |                 |                |
| Te 125m                                                                   |                            | 8              |                 |                | Am 241           | 1.34E-04                   | C D 2          |                 |                |
| Te 127m                                                                   |                            | 8              |                 |                | Am 242m          | 2.76E-07                   | C D 2          |                 |                |
| I 129                                                                     |                            | 8              |                 |                | Am 243           | 9.99E-08                   | C D 2          |                 |                |
| Cs 134                                                                    |                            | 8              |                 |                | Cm 242           | 2.28E-07                   | C D 2          |                 |                |
| Cs 135                                                                    | 1.00E-08                   | C D 2          |                 |                | Cm 243           | 4.61E-08                   | C D 2          |                 |                |
| Cs 137                                                                    | 4.62E-04                   | C D 2          |                 |                | Cm 244           | 3.51E-07                   | C D 2          |                 |                |
| 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                                                                    | 7.72E-09                   | C D 2          |                 |                | Cf 251           |                            | 8              |                 |                |
| Sm 147                                                                    |                            | 8              |                 |                | Cf 252           |                            | 8              |                 |                |
| Sm 151                                                                    | 2.61E-06                   | C D 2          |                 |                | Unsp a           |                            |                |                 |                |
| Eu 152                                                                    | 7.87E-08                   | C D 2          |                 |                | Unsp b/g         |                            |                |                 |                |
| Eu 154                                                                    | 1.18E-06                   | C D 2          |                 |                | <b>Total a</b>   | <b>2.80E-04</b>            | *              | <b>0</b>        | *              |
| Eu 155                                                                    | 7.76E-08                   | C D 2          |                 |                | <b>Total b/g</b> | <b>1.88E-03</b>            | *              | <b>0</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