

| WASTE STREAM | 9E321 | Contaminated Soil LLW |
|--------------|-------|-----------------------|
|--------------|-------|-----------------------|

**SITE** Oldbury

**SITE OWNER** Nuclear Decommissioning Authority

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

**WASTE TYPE** LLW

#### WASTE VOLUMES

|                        | Reported (m <sup>3</sup> ) | OR     | Conditioned (m <sup>3</sup> ) | Packaged (m <sup>3</sup> ) |
|------------------------|----------------------------|--------|-------------------------------|----------------------------|
| Stocks:                | At 1.4.2025                | = 0    |                               |                            |
| Future arisings:       | 1.4.2080 - 31.3.2099       | 1000.0 |                               |                            |
| Total future arisings: |                            | 1000.0 |                               |                            |
| Total waste volume:    |                            | 1000.0 |                               |                            |

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

Comment on arising rates: For inventory purposes the arisings are assumed to arise at a uniform rate over 20 years

Additional information on quantities: Reactor Dismantling & Site Clearance is assumed to commence in 2080 and last for 20 years.

Uncertainty factors on volumes:

|                |     |                   |        |
|----------------|-----|-------------------|--------|
| Stock (upper): | x - | Arisings (upper): | x 1.20 |
| Stock (lower): | x - | Arisings (lower): | x 0.80 |

**WASTE SOURCE** Contaminated soil that has resulted from plant operation and maintenance.

#### PHYSICAL CHARACTERISTICS

General description: Based on made ground, topsoil and upper natural material descriptions: topsoil rarely described in reference, assumed to be derived largely from upper natural. Predominantly a sandy silty clay material with inclusions of limestone and siltstone and occasionally brick, concrete, peat and shale.

Changes since waste generated: -

Bulk density (t/m<sup>3</sup>): ~ 1.7

Comment on density: The bulk density is an estimate and may be subject to revision. Assumes bulkage factor (physical expansion) of 1.3 (higher for cohesive materials than granular). Available information about the soil types indicates that the bulkage factor could be 1.5 and the density would then be 1.45t/m<sup>3</sup>.

#### CHEMICAL COMPOSITION

General description and components (%wt): Soil, rubble, organic material and water. Percentages are not estimated.

Chemical state: Neutral

Sheet metal proportion / thickness: There are no bulk or sheet metal items present in the waste.

Metals and alloys (%wt):

|                           | (%wt) | Type(s) / Grades(s) with proportions                      | % of total C14 activity |
|---------------------------|-------|-----------------------------------------------------------|-------------------------|
| Stainless steel.....      | = 0   | -                                                         |                         |
| Other ferrous metals..... | = 0   | -                                                         |                         |
| Iron.....                 |       | -                                                         |                         |
| Aluminium.....            | = 0   | -                                                         |                         |
| Beryllium.....            | 0     | -                                                         |                         |
| Cobalt.....               |       | -                                                         |                         |
| Copper.....               | = 0   | -                                                         |                         |
| Lead.....                 | = 0   | -                                                         |                         |
| Magnox/Magnesium.....     | = 0   | -                                                         |                         |
| Nickel.....               |       | -                                                         |                         |
| Titanium.....             |       | -                                                         |                         |
| Uranium.....              |       | -                                                         |                         |
| Zinc.....                 | = 0   | -                                                         |                         |
| Zircaloy/Zirconium.....   | = 0   | -                                                         |                         |
| Other metals.....         | = 0   | Other metals are not expected except in their oxide form. |                         |

Organics (%wt):

|                                     | (%wt) | Type(s) and comment | % of total C14 activity |
|-------------------------------------|-------|---------------------|-------------------------|
| Total cellulose.....                | NE    | -                   |                         |
| Paper, cotton.....                  | NE    | -                   |                         |
| Wood.....                           | NE    | -                   |                         |
| 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.....                             | = 75.0 | -                   |                         |
| Brick/Stone/Rubble.....               | = 0    | -                   |                         |
| Cementitious material.....            | = 0    | -                   |                         |
| Sand.....                             | 25.0   | -                   |                         |
| Glass/Ceramics.....                   | = 0    | -                   |                         |
| Graphite.....                         | = 0    | -                   |                         |
| Desiccants/Catalysts.....             |        | -                   |                         |
| Asbestos.....                         | = 0    | -                   |                         |
| Non/low friable.....                  |        | -                   |                         |
| Moderately friable.....               |        | -                   |                         |
| Highly friable.....                   |        | -                   |                         |
| Free aqueous liquids.....             | NE     | -                   |                         |
| 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.....                 | TR    | -                   |
| 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.....                |       | -                   |
| Caesium.....                |       | -                   |
| Selenium.....               |       | -                   |
| Chromium.....               |       | -                   |
| Molybdenum.....             |       | -                   |
| Thallium.....               |       | -                   |
| Tin.....                    |       | -                   |
| Vanadium.....               |       | -                   |
| Mercury compounds.....      |       | -                   |
| Others.....                 |       | -                   |

Complexing agents (%wt):

Not yet determined

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

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                                             |                    |                 |
| Decay storage                                              |                    |                 |
| Low force compaction                                       |                    |                 |
| Supercompaction (HFC)                                      |                    |                 |
| 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                                                       |                    | 100.0           |

Comments on planned treatments:

-

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): -

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         | 1.7              | 2080       |
| 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: 17 05 03\*, 17 05 04

Opportunities for alternative disposal routing: No

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

**RADIOACTIVITY**

Source: Contamination that has resulted from plant maintenance and operation. Cs-137 is expected to dominate.

Uncertainty: -

Measurement of radioactivities: Provision of detailed data will have to await detailed site characterisation.

Chemical form of radionuclides:

H-3: The tritium content is insignificant.  
C-14: The carbon 14 content is insignificant.  
Cl-36: The chlorine 36 content is insignificant.  
Se-79: The selenium content is insignificant.  
Tc-99: The technetium content is insignificant.  
I-129: -  
Ra: The radium isotope content is insignificant.  
Th: The thorium isotope content is insignificant.  
U: The uranium isotope content is insignificant.  
Np: The neptunium content is insignificant.  
Pu: The plutonium isotope content is insignificant.

| WASTE STREAM 9E321 Contaminated Soil LLW |                            |                |                 |                |                  |                            |                |                 |                |
|------------------------------------------|----------------------------|----------------|-----------------|----------------|------------------|----------------------------|----------------|-----------------|----------------|
| 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                                      |                            |                |                 | 8              | 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              | Ti 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>0</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