

| WASTE STREAM | 9J319 | Reactor and Auxiliary Building LLW |
|--------------|-------|------------------------------------|
|--------------|-------|------------------------------------|

**SITE** Hunterston A

**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:       | 1.4.2040 - 31.3.2059       | 469.7 |                               |                            |
| Total future arisings: |                            | 469.7 |                               |                            |
| Total waste volume:    |                            | 469.7 |                               |                            |

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 2040 and last for 20 years. The volumes and radioactivity have been calculated for 50 years after reactor shutdown, i.e. 2040. Waste volumes include a proportion of secondary waste arisings.

Uncertainty factors on volumes:

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

**WASTE SOURCE** Waste arising from the reactor and auxiliary buildings during Reactor Dismantling and Site Clearance.

#### PHYSICAL CHARACTERISTICS

General description: This waste stream consists of waste arising's from areas associated with the Reactor buildings and the auxiliary buildings. The waste is described as general waste, mostly comprising of metals including miscellaneous plant items and concrete.

Changes since waste generated: -

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

Comment on density: The average waste density is approximately 0.4 t/m<sup>3</sup>. However some items within the waste are likely to be of higher density, 0.6-1.0 t/m<sup>3</sup>.

#### CHEMICAL COMPOSITION

General description and components (%wt): Metal (~83%), organic material (<10%), inorganic material (<13%)

Chemical state: Neutral

Sheet metal proportion / thickness: This waste stream will contain waste of various sizes and thicknesses.

Metals and alloys (%wt):

|                           | (%wt)  | Type(s) / Grades(s) with proportions                                                                 | % of total C14 activity |
|---------------------------|--------|------------------------------------------------------------------------------------------------------|-------------------------|
| Stainless steel.....      | ~ 4.0  | -                                                                                                    |                         |
| Other ferrous metals..... | ~ 78.0 | Nickel and chromium are present as alloying metals in steel.                                         |                         |
| Iron.....                 | -      | -                                                                                                    |                         |
| Aluminium.....            | < 1.0  | -                                                                                                    |                         |
| Beryllium.....            | 0      | -                                                                                                    |                         |
| Cobalt.....               | -      | -                                                                                                    |                         |
| Copper.....               | TR     | -                                                                                                    |                         |
| Lead.....                 | NE     | -                                                                                                    |                         |
| Magnox/Magnesium.....     | = 0    | -                                                                                                    |                         |
| Nickel.....               | NE     | Nickel and chromium are present as alloying metals in steel.                                         |                         |
| Titanium.....             | -      | -                                                                                                    |                         |
| Uranium.....              | -      | -                                                                                                    |                         |
| Zinc.....                 | = 0    | -                                                                                                    |                         |
| Zircaloy/Zirconium.....   | = 0    | -                                                                                                    |                         |
| Other metals.....         | NE     | "Other" metals have not been estimated. Nickel and chromium are present as alloying metals in steel. |                         |

Organics (%wt):

|                                     | (%wt) | Type(s) and comment | % of total C14 activity |
|-------------------------------------|-------|---------------------|-------------------------|
| Total cellulose.....                | ~ 6.0 | -                   |                         |
| Paper, cotton.....                  | = 4.0 | -                   |                         |
| Wood.....                           | ~ 2.0 | -                   |                         |
| Halogenated plastics.....           | = 0   | -                   |                         |
| Total non-halogenated plastics..... | ~ 4.0 | -                   |                         |
| Condensation polymers.....          | = 0   | -                   |                         |
| Others.....                         | ~ 4.0 | -                   |                         |
| 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.....                 | = 0   | -                   |                         |

Other materials (%wt):

|                                       | (%wt) | Type(s) and comment | % of total C14 activity |
|---------------------------------------|-------|---------------------|-------------------------|
| Inorganic ion exchange materials..... | = 0   | -                   |                         |
| Inorganic sludges and flocs.....      | = 0   | -                   |                         |
| Soil.....                             | ~ 3.5 | -                   |                         |
| Brick/Stone/Rubble.....               | ~ 3.5 | -                   |                         |
| 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.....         | = 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.....   | = 0   | -                   |
| Carbonate..... | NE    | -                   |
| Nitrate.....   | NE    | -                   |
| Nitrite.....   | NE    | -                   |
| Phosphate..... | NE    | -                   |
| Sulphate.....  | NE    | -                   |
| Sulphide.....  | NE    | -                   |

Materials of interest for waste acceptance criteria:

|                                                | (%wt) | Type(s) and comment |
|------------------------------------------------|-------|---------------------|
| Combustible metals.....                        | = 0   | -                   |
| Low flash point liquids.....                   | = 0   | -                   |
| Explosive materials.....                       | = 0   | -                   |
| Phosphorus.....                                | = 0   | -                   |
| Hydrides.....                                  | = 0   | -                   |
| Biological etc. materials.....                 | = 0   | -                   |
| Biodegradable materials.....                   | 0     | -                   |
| Putrescible wastes.....                        | = 0   | -                   |
| Non-putrescible wastes.....                    |       | -                   |
| 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                                             |                    | = 8.0           |
| Decay storage                                              |                    |                 |
| Low force compaction                                       |                    |                 |
| Supercompaction (HFC)                                      |                    |                 |
| Incineration                                               |                    |                 |
| Drying/dewatering/liquid separation                        |                    | = 68.0          |
| Tie down/fixatives/strippable coating/painting application |                    |                 |
| Decontamination                                            |                    |                 |
| Metal treatment                                            |                    |                 |
| Recycling / reuse                                          |                    |                 |
| Thermal treatment, including vitrification                 |                    | = 24.0          |
| Encapsulation                                              |                    |                 |
| Polymer encapsulation                                      |                    |                 |
| Other physical treatment                                   |                    |                 |
| Other chemical treatment                                   |                    |                 |
| Containerisation                                           |                    |                 |
| Treatment not yet determined                               |                    |                 |
| None                                                       |                    |                 |

Comments on planned treatments:

7% to Landfill as VLLW.

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 |
|------------------------|----------------------------------------------------|-----------------------|--------------------|--------------|--------------------|------------------------------------|
|                        | 1/2 Height IP-2 Disposal/Re-usable ISO (TC01/TC02) | 17.0                  | 7.0                | 18.3         | 12                 | -                                  |

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                                     | = 17.0          |                  | 2040       |
| Expected to be consigned to a Landfill Facility                                    | = 7.0           |                  | 2040       |
| Expected to be disposed On-Site                                                    |                 |                  |            |
| Expected to be managed by In-Situ Disposal                                         |                 |                  |            |
| Expected to be consigned to an Incineration Facility                               | = 8.0           |                  | 2040       |
| Expected to be consigned to a Metal Treatment Facility                             | = 68.0          |                  | 2040       |
| 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 04 05, 17 04 07, 17 06 01\*

Opportunities for alternative disposal routing: No

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

**RADIOACTIVITY**

Source: -

Uncertainty: Activity values are current best estimates. Specific activity is a function of Station operating history. The values quoted are indicative of the activities that would be expected.

Measurement of radioactivities: The specific activities have been estimated from the waste stream fingerprint for 9J948 decayed to 2040.

Chemical form of radionuclides:

H-3: Tritium may be present as tritiated water.

C-14: The chemical form of carbon 14 may be graphite.

Cl-36: The chemical form of chlorine 36 has not been determined.

Se-79: The chemical form of selenium has not been determined.

Tc-99: The chemical form of technetium has not been determined.

I-129: -

Ra: The radium isotope content is insignificant.

Th: The thorium isotope content is insignificant.

U: The uranium isotope content is insignificant.

Np: Neptunium isotope content is expected to be insignificant.

Pu: The chemical form of plutonium isotopes has not been determined but may be plutonium oxides.

| WASTE STREAM 9J319 Reactor and Auxiliary Building 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                                                   |                            |                | 3.21E-06        | C C 2          | Gd 153           |                            |                |                 | 8              |
| Be 10                                                 |                            |                |                 | 8              | Ho 163           |                            |                |                 | 8              |
| C 14                                                  |                            |                | 2.52E-07        | C C 2          | Ho 166m          |                            |                |                 | 8              |
| Na 22                                                 |                            |                |                 | 8              | Tm 170           |                            |                |                 | 8              |
| Al 26                                                 |                            |                |                 | 8              | Tm 171           |                            |                |                 | 8              |
| Cl 36                                                 |                            |                | 3.61E-06        | C C 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                                                 |                            |                |                 | 8              | Pb 210           |                            |                |                 | 8              |
| Co 60                                                 |                            |                | 1.17E-08        | C C 2          | Bi 208           |                            |                |                 | 8              |
| Ni 59                                                 |                            |                |                 | 8              | Bi 210m          |                            |                |                 | 8              |
| Ni 63                                                 |                            |                | 2.37E-07        | C C 2          | 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                                                 |                            |                | 5.86E-08        | C C 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                                                 |                            |                | 5.29E-09        | C C 2          | Th 234           |                            |                |                 | 8              |
| Mo 93                                                 |                            |                |                 | 8              | Pa 231           |                            |                |                 | 8              |
| Tc 97                                                 |                            |                |                 | 8              | Pa 233           |                            |                |                 | 8              |
| Tc 99                                                 |                            |                | 9.43E-09        | C C 2          | U 232            |                            |                |                 | 8              |
| Ru 106                                                |                            |                |                 | 8              | U 233            |                            |                |                 | 8              |
| Pd 107                                                |                            |                |                 | 8              | U 234            |                            |                |                 | 8              |
| Ag 108m                                               |                            |                | 4.64E-09        | C C 2          | 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           |                            |                | 1.24E-09        | C C 2          |
| Sn 126                                                |                            |                |                 | 8              | Pu 240           |                            |                | 1.24E-09        | C C 2          |
| Sb 125                                                |                            |                |                 | 8              | Pu 241           |                            |                | 3.41E-08        | C C 2          |
| Sb 126                                                |                            |                |                 | 8              | Pu 242           |                            |                |                 | 8              |
| Te 125m                                               |                            |                |                 | 8              | Am 241           |                            |                | 1.22E-08        | C C 2          |
| Te 127m                                               |                            |                |                 | 8              | Am 242m          |                            |                |                 | 8              |
| I 129                                                 |                            |                | 5.91E-09        | C C 2          | Am 243           |                            |                |                 | 8              |
| Cs 134                                                |                            |                |                 | 8              | Cm 242           |                            |                |                 | 8              |
| Cs 135                                                |                            |                |                 | 8              | Cm 243           |                            |                |                 | 8              |
| Cs 137                                                |                            |                | 1.96E-08        | C C 2          | Cm 244           |                            |                |                 | 8              |
| Ba 133                                                |                            |                | 2.18E-09        | C C 2          | 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                                                |                            |                | 1.80E-07        | C C 2          | Unsp a           |                            |                |                 | 8              |
| Eu 152                                                |                            |                | 3.34E-08        | C C 2          | Unsp b/g         |                            |                |                 | 8              |
| Eu 154                                                |                            |                | 4.24E-09        | C C 2          | <b>Total a</b>   | <b>0</b>                   | <b>*</b>       | <b>1.47E-08</b> | <b>*</b>       |
| Eu 155                                                |                            |                |                 | 8              | <b>Total b/g</b> | <b>0</b>                   | <b>*</b>       | <b>7.68E-06</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