Bradwell SITE

SITE OWNER **Nuclear Decommissioning Authority** 

**WASTE CUSTODIAN** Magnox Limited

LLW **WASTE TYPE** 

Is the waste subject to

Scottish Policy:

No

**WASTE VOLUMES** 

Reported At 1.4.2022..... Stocks:  $0 \, \text{m}^3$ 1.4.2087 - 31.3.2090...... 80.0 m<sup>3</sup> Future arisings -Total future arisings: 80.0 m<sup>3</sup> Total waste volume: 80.0 m<sup>3</sup>

Comment on volumes: Final Dismantling & Site Clearance is assumed to commence in 2083 with reactor

dismantling commencing in 2087 and lasting for three years. Volumes and radioactivity

have been calculated for 85 years after reactor shutdown, i.e. 2087.

Uncertainty factors on

Stock (upper): volumes: Stock (lower):

Arisings (upper) x 1.2 Arisings (lower)

x 0.8

**WASTE SOURCE** 

Mild steel items from the reactor structure.

#### PHYSICAL CHARACTERISTICS

General description: A variety of mild steel items. Waste can be packaged in standard LLW packages.

Mild steel items (100%). Physical components (%wt):

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m3): ~1.4

Comment on density: The density is of the waste as cut for packaging.

### CHEMICAL COMPOSITION

General description and components (%wt):

Mild steel (100%) of which >98% is iron.

Chemical state: Neutral

Chemical form of H-3: The tritium is incorporated in the steel.

radionuclides: C-14: The carbon 14 is incorporated in the steel. There also may be some contamination

as graphite.

Cl-36: The chlorine 36 is incorporated in the steel.

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

Metals and alloys (%wt): All of the waste will be bulk metal items which have been cut for packaging. Metal

thicknesses will probably range from a few mm to about 100 mm.

% of total C14 (%wt) Type(s) / Grade(s) with proportions activity

Stainless steel.....

Other ferrous metals...... 100.0 Mild steel types are BS1503/1950, 100.0

BS150E-171, RPV STEEL, BS1501,

BS15 and BS 970 EN2/3

Iron.....

Aluminium...... 0 Beryllium.....

Cobalt..... ~0.01 Greatest measured value from the

various components.

Copper...... 0 Lead...... 0

|           | Magnox/Magnesium                 | 0          |  |                |
|-----------|----------------------------------|------------|--|----------------|
|           | Nickel                           | . ~0.07    | Greatest measured value from the various components. |                |
|           | Titanium                         |            | ·  |                |
|           | Uranium                          |            |  |                |
|           | Zinc                             | . 0        |  |                |
|           | Zircaloy/Zirconium               | . 0        |  |                |
|           | Other metals                     | . TR       | Silver and niobium.                                  |                |
| Organics  | (%wt): -                         |            |  |                |
|           |                                  | (%wt)      | Type(s) and comment                                  | % of total C14 |
|           | Total cellulosics                | 0          |  | activity       |
|           | Paper, cotton                    | 0          |  |                |
|           | Wood                             | 0          |  |                |
|           | Halogenated plastics             | 0          |  |                |
|           | Total non-halogenated plastics   | 0          |  |                |
|           | Condensation polymers            | 0          |  |                |
|           | Others                           | 0          |  |                |
|           | Organic ion exchange materials   | 0          |  |                |
|           | Total rubber                     | 0          |  |                |
|           | Halogenated rubber               | 0          |  |                |
|           | Non-halogenated rubber           | 0          |  |                |
|           | Hydrocarbons                     |            |  |                |
|           | Oil or grease                    |            |  |                |
|           | Fuel                             |            |  |                |
|           | Asphalt/Tarmac (cont.coal tar)   |            |  |                |
|           | Asphalt/Tarmac (no coal tar)     |            |  |                |
|           | Bitumen                          |            |  |                |
|           | Others                           |            |  |                |
|           | Other organics                   | 0          |  |                |
| Other mat | terials (%wt): Some graphite dus | t may be a | associated with reactor materials.                   |                |
|           |                                  | (%wt)      | Type(s) and comment                                  | % of total C14 |
|           |                                  | (/311)     | .,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,              | activity       |
|           | Inorganic ion exchange materials | 0          |  |                |
|           | Inorganic sludges and flocs      | 0          |  |                |
|           | Soil                             | 0          |  |                |
|           | Brick/Stone/Rubble               | 0          |  |                |
|           | Cementitious material            | 0          |  |                |
|           | Sand                             |            |  |                |
|           | Glass/Ceramics                   | 0          |  |                |
|           | Graphite                         | TR         |  |                |
|           | Desiccants/Catalysts             |            |  |                |
|           | Asbestos                         | 0          |  |                |
|           | Non/low friable                  |            |  |                |

| Moderately friable  |            |   |
|---|------------|---|
| Highly friable  |            |   |
| Free aqueous liquids  | 0          |   |
| Free non-aqueous liquids  | 0          |   |
| Powder/Ash  | 0          |   |
| Inorganic anions (%wt):   |            |   |
|   | (%wt)      | Type(s) and comment                                       |
| Fluoride  | 0          |   |
| Chloride  | TR         |   |
| lodide  | 0          |   |
| Cyanide   | 0          |   |
| Carbonate   | 0          |   |
| Nitrate   | 0          |   |
| Nitrite   | 0          |   |
| Phosphate   | 0          |   |
| Sulphate  | 0          |   |
| Sulphide  | 0          |   |
| Materials of interest for No materials likely to waste acceptance criteria: | pose a fir | re or other non-radiological hazard have been identified. |
|   | (%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   |            |   |
| 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 / None expected non hazardous pollutants:              |            |   |
|   | (%wt)      | Type(s) and comment                                       |
| Acrylamide  |            |   |
| Benzene   |            |   |
|   |            |   |

#### **WASTE STREAM** Mild Steel (Reactor) LLW 9B314

| Formaldehyde                |                 |       |  |
|-----------------------------|-----------------|-------|--|
| Organometallics             |                 |       |  |
| Phenol                      |                 |       |  |
| Styrene                     |                 |       |  |
| Tri-butyl phosphate         |                 |       |  |
| Other organophosph          | nates           |       |  |
| Vinyl chloride              |                 |       |  |
| Arsenic                     |                 |       |  |
| Barium                      |                 |       |  |
| Boron                       |                 |       |  |
| Boron (in Boral)            |                 |       |  |
| Boron (non-Boral).          |                 |       |  |
| Cadmium                     |                 |       |  |
| Caesium                     |                 |       |  |
| Selenium                    |                 |       |  |
| Chromium                    |                 |       |  |
| Molybdenum                  |                 | TR    |  |
| Thallium                    |                 |       |  |
| Tin                         |                 |       |  |
| Vanadium                    |                 |       |  |
| Mercury compounds           |                 |       |  |
| Others                      |                 |       |  |
| Electronic Electrical       | Equipment (EEE) |       |  |
| EEE Type 1                  |                 |       |  |
| EEE Type 2                  |                 |       |  |
| EEE Type 3                  |                 |       |  |
| EEE Type 4                  |                 |       |  |
| EEE Type 5                  |                 |       |  |
| Complexing agents (%wt): Ye | es              |       |  |
|                             |                 | (%wt) | Type(s) and comment  |
| EDTA                        |                 |       |  |
| DPTA                        |                 |       |  |
| NTA                         |                 |       |  |
| Polycarboxylic acids        |                 |       |  |
| Other organic compl         | exants          |       |  |
| Total complexing ag         | ents            | TR    |  |
|                             |                 |       | )/"substantial" thickness items considered<br>ecycled then DI Limits n/a |

TREATMENT, PACKAGING AND DISPOSAL

Potential for

Planned on-site / off-site treatment(s):

| Treatment             | On-site /<br>Off site | Stream volume % |
|-----------------------|-----------------------|-----------------|
| Low force compaction  |                       |                 |
| Supercompaction (HFC) |                       |                 |
| Incineration          |                       |                 |
| Solidification        |                       |                 |
| Decontamination       |                       |                 |
| Metal treatment       |                       |                 |
| Size reduction        |                       |                 |
| Decay storage         |                       |                 |
| Recyling / reuse      |                       |                 |
| Other / various       |                       |                 |
| None                  |                       | 100.0           |

Comment on planned treatments:

**Disposal Routes:** 

| Disposal Route   | Stream volume % | Disposal<br>density t/m3 |
|--|-----------------|--------------------------|
| Expected to be consigned to the LLW Repository Expected to be consigned to a Landfill Facility Expected to be consigned to an On-Site Disposal Facility Expected to be consigned to an Incineration Facility Expected to be consigned to a Metal Treatment Facility Expected to be consigned as Out of Scope Expected to be recycled / reused Disposal route not known | 100.0           | 1.4                      |

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

## Upcoming (2022/23-2024/25) Waste Routing (if expected to change from above):

| Disposal Route   | Stream volume % |         |         |  |  |
|--|-----------------|---------|---------|--|--|
| Disposal Noute   | 2022/23         | 2023/24 | 2024/25 |  |  |
| Expected to be consigned to the LLW Repository Expected to be consigned to a Landfill Facility Expected to be consigned to an On-Site Disposal Facility Expected to be consigned to an Incineration Facility Expected to be consigned to a Metal Treatment Facility Expected to be consigned as Out of Scope Expected to be recycled / reused Disposal route not known |                 |         |         |  |  |

## Opportunities for alternative disposal routing:

| Baseline<br>Management Route | Opportunity<br>Management Route | Stream<br>volume (%) | Estimated Date that Opportunity will be realised | Opportunity<br>Confidence | Comment |
|------------------------------|---------------------------------|----------------------|--|---------------------------|---------|
|                              |                                 | _                    | _  | _                         |         |

## Waste Packaging for Disposal:

| Container  | Stream volume % | Waste loading m <sup>3</sup> | Number of packages |
|--|-----------------|------------------------------|--------------------|
| 1/3 Height IP-1 ISO 2/3 Height IP-2 ISO 1/2 Height WAMAC IP-2 ISO 1/2 Height IP-2 Disposal/Re-usable ISO 2m box (no shielding) 4m box (no shielding) Other | 100.0           | 10                           | 8                  |

Other information: Data have been presented as though the waste will be in dedicated containers.

However it is likely that this waste will be placed in containers with other LLW.

## Waste Planned for Disposal at the LLW Repository:

Container voidage: Inaccessible voidage is not expected.

Waste Characterisation

The waste meets the LLWR's Waste Acceptance Criteria (WAC).

The waste does not have a current WCH.

Waste consigned for disposal to LLWR in year of generation:

Form (WCH):

Yes.

Non-Containerised Waste for In-Vault Grouting: (Not applicable to this waste stream)

Stream volume (%):

Waste stream variation: -

Bounding cuboidal volume:

Inaccessible voidage: -

### **RADIOACTIVITY**

Other information:

Source: Activation of the mild steel and its impurities.

Uncertainty: The values quoted were derived by calculation from available material specifications and

are indicative of the activities that are to be expected. The major source of uncertainty is

the impurity levels.

Definition of total alpha and total beta/gamma:

Where totals are shown on the table of radionuclide activities they are the sums of the listed alpha or beta/gamma emitting radionuclides plus 'other alpha' or 'other beta/gamma'.

Measurement of

radioactivities:

The specific activities were estimated from neutron activation calculations of the material

and its impurities.

Other information: The activities quoted are those at 85 years after reactor shutdown, i.e. in 2087. There may

be some contamination by Cs137.

#### **WASTE STREAM** Mild Steel (Reactor) LLW 9B314

| Muclide  |         | Mean radioactivity, TBq/m³ |      |          | Mean radioactivity, TBq/m³ |           |          |      |           |           |
|--|---------|----------------------------|------|----------|----------------------------|-----------|----------|------|-----------|-----------|
| H 3  | Nuclido |                            |      |          |                            | Nuclido   |          |      |           | Bands and |
| Be 10  |         | 1.4.2022                   | Code | arisings |                            |           | 1.4.2022 | Code | arisings  | Code      |
| C 14   |         |                            |      |          |                            |           |          |      |           | 8         |
| Na   122   |         |                            |      | 0.075.04 |                            |           |          |      |           | 8         |
| A   26   |         |                            |      | 8.87E-04 |                            |           |          |      |           | 8         |
| Ci 36  |         |                            |      |          |                            |           |          |      |           | 8         |
| Ar 39 Ar 442 Ar 442 Ar 442 Ar 454 Ar 460 Ca 41 Mn 53 Mn 54 Fe 55 A. 944E-09 CC 2 Co 60 B. 75E-06 CC 2 B. 120B Ni 63 P. 162E-04 CC 2 Ri 8 Ra 225 Ri 8 Ra 226 Ri 8 Ri 8 Ra 226 Ri 8 Ri 8 Ri 228 Ri 8 Ri 228 Ri 8 Ri 228 Ri 8 Ri 8 Ri 228 Ri 8 Ri 228 Ri 8 Ri 8 Ri 9   |         |                            |      | 4 005 07 |                            |           |          |      |           | 8         |
| A-142  |         | ļ                          |      | 1.66E-07 |                            |           |          |      |           | 8         |
| K 40   |         |                            |      |          |                            |           |          |      |           | 8         |
| Ca 41  |         |                            |      |          |                            |           |          |      |           | 8         |
| Mn 53  |         |                            |      |          |                            |           |          |      |           | 8         |
| Mn 54  |         |                            |      |          |                            |           |          |      | 2 13 = 00 | 8<br>CC 2 |
| Fe 56 Co 60 R.75E-06 CC 2 Bi 208 Ni 59 1.62E-04 R.75E-06 CC 2 Bi 210m Si 63 Se 79 R.78E-08 R. 8 R. 225 R.79 R.78E-08 R.7 |         |                            |      |          |                            |           |          |      | 2.13L-09  |           |
| Co 60         8.75E-06         CC 2         Bi 208           Ni 59         1.62E-04         CC 2         Bi 210m           Ni 63         9.29E-03         CC 2         Po 210           Zn 65         8         Ra 223           Se 79         8         Ra 225           Kr 81         8         Ra 226           Kr 85         8         Ra 227           Sr 90         8         Th 227           Zr 93         8         Th 229           Nb 91         8         Th 230           Nb 93m         6         Th 230           Nb 93m         1.21E-06         CC 2         Th 234           Mo 93         6.78E-06         CC 2         Th 234           Mo 93         6.78E-06         CC 2         U 233           Ru 106         8         U 233           Pd 107         8         U 233           Ag 110m         3.98E-07         CC 2         U 235           Ag 110m         8         U 236           Cd 113m         8         Np 237           Sn 121         8         Pu 238           Sn 122         8         Pu 240           Sb 125         8 </td <td></td> <td></td> <td></td> <td>4 04E 00</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>8<br/>8</td>  |         |                            |      | 4 04E 00 |                            |           |          |      |           | 8<br>8    |
| Ni 59 Ni 63 P. 29E-03 Ni 63 Ra 225 Ra 225 Ra 225 Ra 226 Ra 226 Ra 228 Ra 238 Ra 228 Ra 228 Ra 228 Ra |         |                            |      |          |                            |           |          |      |           | 8         |
| Ni 63     Zn 65     Se 79     Kr 81     Kr 85     R8 226     Kr 85     R8 7     Se 79     Kr 81     Kr 85     R8 7     Se 79     Se 8     R8 226     R8 228     R8 28     R8 228     R8 228     R8 228     R8 228     R8 228     R8 28     R8 228     R8 28     R8 228     R8 28     R8 28     R8 228     R8 28     |         |                            |      |          |                            |           |          |      |           | 8         |
| Zn 65 Se 79  |         |                            |      |          |                            |           |          |      |           | 8         |
| Se 79       8       Ra 225         Kr 81       8       Ra 228         Kr 85       8       Ra 228         Rb 87       8       Ac 227         Sr 90       2       Th 228         Nb 91       8       Th 229         Nb 92       8       Th 229         Nb 93m       1.21E-06       CC 2       Th 234         Mb 93       6.78E-06       CC 2       Pa 231         Tc 97       8       Pa 233         Tc 97       8       Pa 233         Tc 99       1.52E-06       CC 2       U 232         Ru 106       8       U 233         Pd 107       8       U 234         Ag 110m       3.98E-07       CC 2       U 235         Ag 110m       8       U 236         Cd 113m       8       Pu 238         Sn 12m       8       Pu 238         Sn 12m       8       Pu 238         Sn 12a       8       Pu 240         Sb 12b       8       Pu 241         Sb 12c       8       Pu 242         Te 12m       8       Am 241         Te 12fm       8       Cm 242 <td< td=""><td></td><td></td><td></td><td>9.29E-03</td><td></td><td></td><td></td><td></td><td></td><td>8</td></td<>   |         |                            |      | 9.29E-03 |                            |           |          |      |           | 8         |
| Kr 81 Kr 85 Kr 86 Kr 86 Kr 87 Kr 86 Kr 87 Kr 87 Kr 80 Kr 80 Kr 80 Kr 90  |         |                            |      |          |                            |           | !<br>[   |      |           | 8         |
| Kr 85       8       Ra 228         Rb 87       8       Ac 227         Sr 90       8       Th 227         Zr 93       8       Th 228         Nb 91       8       Th 229         Nb 92       8       Th 230         Nb 93m       6       Th 232         Nb 94       1.21E-06       CC 2       Th 234         Mo 93       6.78E-06       CC 2       Pa 231         Tc 97       8       Pa 233         Tc 99       1.52E-06       CC 2       U 232         Ru 106       8       U 234         Pd 107       8       U 234         Ag 10m       8       U 236         Qd 109       8       U 236         Cd 109       8       U 238         Cd 109       8       U 238         Sn 121m       8       Pu 238         Sn 121m       8       Pu 239         Sn 122       8       Pu 240         Sb 126       8       Pu 241         Sb 126       8       Pu 241         Sb 126       8       Pu 242         Tc 125m       8       Am 243         Cc 134       8   |         |                            |      |          |                            |           |          |      |           | 8         |
| Rb 87       8       Ac 227         Sr 90       8       Th 227         27 93       8       Th 228         Nb 91       8       Th 229         Nb 92       8       Th 229         Nb 93m       6       Th 232         Nb 94       1.21E-06       CC 2       Pa 231         Tc 97       8       Pa 233         Tc 99       1.52E-06       CC 2       U 232         Ru 106       8       U 233         Pd 107       8       U 233         Ag 108m       3.98E-07       CC 2       U 235         Ag 110m       8       U 236         Cd 109       8       U 238         Cd 113m       8       Pu 236         Sn 12m       8       Pu 238         Sn 121m       8       Pu 238         Sn 122       8       Pu 240         Sb 125       8       Pu 241         Sb 126       8       Pu 242         Te 127m       8       Am 241         Te 127m       8       Am 243         Cs 134       8       Cm 244         Cs 137       8       Cm 244         Ca 137   |         |                            |      |          |                            |           |          |      |           | 8         |
| Sr 90 Zr 93 Nb 91 Nb 91 Nb 92 Nb 93 Nb 93 Tc 97 Tc 99 1.52E-06 CC 2 Ru 106 Ru 107 Ag 108m Ag 118m Sh 119m Sh 121m Sh 123 Sh 124m Sh 125 Sh 125 Sh 125 Sh 125 Sh 125 Sh 126 Sh 126 Sh 127 Sh 133 Sh 121m Sh 128 Sh 126 Sh 126 Sh 126 Sh 127 Sh 133 Sh 127 Sh 133 Sh 128 Sh 127 Sh 133 Sh 128 Sh 129 Sh 126 Sh 126 Sh 127 Sh 133 Sh 127 Sh 133 Sh 128 Sh 129 Sh 129 Sh 129 Sh 120 Sh 12 |         |                            |      |          |                            |           |          |      |           | 8         |
| Zr 93  |         |                            |      |          |                            |           |          |      |           | 8         |
| Nb 91 Nb 92 Nb 93 Nb 93 Nb 93 Nb 93 Tc 97 Tc 97 Tc 99 1.52E-06 CC 2 Ru 106 Pd 107 Rg 108 Rg 110m Cd 109 Cd 109 Sn 121m Sn 121m Sn 121m Sn 122m Sn 126 Sb 127 Sm 133 La 133 La 137 La 138 La 137 La 138 La 137 La 138 Cc 144 Pm 145 Pm 147 Sm 167 Sc C 2 Th 230 Th 229 Th 230 Th 229 Th 230 Th 229 Th 234 Th 229 Th 232 Th 234 Th 232 |         |                            |      |          |                            |           |          |      |           | 8         |
| Nb 92 Nb 93m Nb 94 1.21E-06  |         |                            |      |          |                            |           |          |      |           | 8         |
| Nb 93m   |         |                            |      |          |                            |           |          |      |           | 8         |
| Nb 94 Mo 93 Tc 97 Tc 97 Ro 99 Ru 106 Pd 107 Ag 108m Ag 10m Cd 109 Cd 113m Sn 123 Sn 124 Sb 125 Sb 126 Te 125m Te 127m It 129 Cs 134 Cs 137 Ba 133 La 137 La 138 Ce 144 Pm 145 Pm 147 Sm 151   |         |                            |      |          |                            |           |          |      |           | 8         |
| Mo 93       6.78E-06       CC 2       Pa 231         Tc 97       8       Pa 233       Pa 233         Tc 99       1.52E-06       CC 2       U 232         Ru 106       8       U 234         Pd 107       8       U 234         Ag 108m       3.98E-07       CC 2       U 235         Ag 110m       8       U 236         Cd 109       8       U 238         Cd 113m       8       Np 237         Sn 119m       8       Pu 236         Sn 121m       8       Pu 238         Sn 123       8       Pu 240         Sb 125       8       Pu 241         Sb 126       8       Pu 241         Te 125m       8       Am 241         Te 127m       8       Am 242         I 129       8       Am 243         Cs 134       8       Cm 242         Cs 135       8       Cm 243         Cs 137       8       Cm 244         Ba 133       8       Cm 245         La 138       8       Cm 246         La 138       8       Cf 249         Pm 147       8       Cf 250  |         |                            |      | 1 21F-06 |                            |           |          |      |           | 8         |
| Tc 97 Tc 99 Ru 106 Ru 106 Ru 107 Ag 108m Ag 110m Cd 109 Cd 113m Sn 121m Sn 121m Sn 122m Sn 126 Sb 126 Sb 126 Sb 126 Sb 126 Sc 134 Cc 134 Cc 135 Cc 135 Cc 137 Ba 133 La 137 La 138 La 137 La 138 La 137 La 147 Sm 167 Sn 123 Sn 126 Sc 2 Sc 2 Sc 2 Sc 3 Sc 3 Sc 2 Sc 2 Sc 3 Sc 3 Sc 2 Sc 2 Sc 3 Sc 2 Sc 3 Sc 3 Sc 3 Sc 2 Sc 2 Sc 3   |         |                            |      |          |                            |           |          |      |           | 8         |
| Tc 99 Ru 106 Pd 107 Ag 108m Ag 108m Ag 110m Cd 109 Cd 113m Sn 121m Sn 123 Sn 126 Sb 125 Sb 126 Te 125m Te 127m I 129 I 25 Cs 135 Cs 137 Ba 133 La 137 La 138 Ce 144 Pm 145 Pm 147 Sm 167 Sa 20 Sa 22 |         |                            |      | 0.702 00 |                            |           |          |      |           | 8         |
| Ru 106 Pd 107 Ag 108m Ag 108m 3.98E-07 CC 2 U 235 Ag 110m Cd 109 B Cd 113m Sn 119m Sn 121m Sn 123 Sn 123 Sn 126 Sb 126 B Pu 240 Sb 125 Sb 126 Te 127m Te 127m Te 127m Te 127m Te 127m Te 137 Sc 134 Cc 135 Cc 137 Ba 133 Ba 133 Ba 133 Ba 133 Ba 133 Ba 133 Cc 144 Pm 145 Pm 147 Sm 147 Sm 151 Ba 153 Cf 255 Sm 147 Sm 147 Sm 151  |         |                            |      | 1.52F-06 |                            |           |          |      |           | 8         |
| Pd 107       8       U 234         Ag 108m       3.98E-07       CC 2       U 235         Ag 110m       8       U 236         Cd 109       8       U 238         Cd 113m       8       Np 237         Sn 119m       8       Pu 236         Sn 121m       8       Pu 238         Sn 123       8       Pu 239         Sn 126       8       Pu 240         Sb 125       8       Pu 241         Sb 126       8       Pu 242         Te 125m       8       Am 242m         I 129       8       Am 243         Cs 134       8       Cm 242         Cs 134       8       Cm 243         Cs 137       8       Cm 244         Ba 133       8       Cm 246         La 138       8       Cm 248         Ce 144       8       Cf 249         Pm 147       8       Cf 251         Sm 147       8       Other a   |         |                            |      | 1.022 00 |                            |           |          |      |           | 8         |
| Ag 108m       3.98E-07       CC 2       U 235         Ag 110m       8       U 236         Cd 109       8       U 238         Cd 113m       8       Np 237         Sn 119m       8       Pu 236         Sn 121m       8       Pu 238         Sn 123       8       Pu 239         Sn 126       8       Pu 240         Sb 125       8       Pu 241         Sb 126       8       Pu 242         Te 125m       8       Am 241         Te 127m       8       Am 243         I 129       8       Am 243         Cs 134       8       Cm 242         Cs 137       6       Cm 244         Ba 133       8       Cm 245         La 137       8       Cm 246         La 138       8       Cm 248         Ce 144       8       Cf 250         Pm 147       8       Cf 251         Sm 147       8       Cf 252         Sm 151       Other a  |         |                            |      |          |                            |           |          |      |           | 8         |
| Ag 110m Cd 109 Cd 113m Sn 119m Sn 12m Sn 121m Sn 123 Sn 123 Sn 126 Sb 126 Sb 126 Sb 126 Te 125m Te 127m Sc 134 Cc 134 Cc 135 Cc 137 Ba 133 La 137 La 138 Ce 144 Pm 145 Pm 145 Pm 147 Sm 151   |         |                            |      | 3 98F-07 |                            |           |          |      |           | 8         |
| Cd 109       8       U 238         Cd 113m       8       Np 237         Sn 119m       8       Pu 236         Sn 121m       8       Pu 238         Sn 123       8       Pu 239         Sn 126       8       Pu 240         Sb 125       8       Pu 241         Sb 126       8       Pu 242         Te 125m       8       Am 241         Te 127m       8       Am 243         Cs 134       8       Cm 242         Cs 134       8       Cm 242         Cs 137       6       Cm 244         Ba 133       8       Cm 245         La 137       8       Cm 246         La 138       8       Cm 248         Ce 144       8       Cf 249         Pm 147       8       Cf 250         Sm 147       8       Cf 252         Sm 151       Other a   | -       | İ                          |      | 0.002 07 |                            |           |          |      |           | 8         |
| Cd 113m       8       Np 237         Sn 119m       8       Pu 236         Sn 121m       8       Pu 238         Sn 123       8       Pu 239         Sn 126       8       Pu 240         Sb 125       8       Pu 241         Sb 126       8       Pu 242         Te 125m       8       Am 241         Te 127m       8       Am 243         I 129       8       Am 243         Cs 134       Cm 242       Cm 242         Cs 135       Cm 243       Cm 243         Cs 137       6       Cm 244         Ba 133       8       Cm 245         La 138       Cm 248       Cf 249         Ce 144       8       Cf 249         Pm 145       8       Cf 250         Pm 147       8       Cf 251         Sm 147       8       Other a  | -       |                            |      |          |                            |           |          |      |           | 8         |
| Sn 119m       8       Pu 236         Sn 121m       8       Pu 238         Sn 123       8       Pu 239         Sn 126       8       Pu 240         Sb 125       8       Pu 241         Sb 126       8       Pu 242         Te 125m       8       Am 241         Te 127m       8       Am 242m         I 129       8       Am 243         Cs 134       Cm 242       Cm 243         Cs 135       Cm 243       Cm 244         Ba 133       Cm 246       Cm 246         La 137       Cm 248       Cm 248         Ce 144       Rm 145       Cm 248         Pm 145       Rm 145       Cf 250         Pm 147       Rm 147       Cf 252         Sm 147       Cf 252       Cf 252         Sm 151       Other a   |         |                            |      |          |                            | Np 237    |          |      |           | 8         |
| Sn 121m       8       Pu 238         Sn 123       8       Pu 239         Sn 126       8       Pu 240         Sb 125       8       Pu 241         Sb 126       8       Pu 242         Te 125m       8       Am 242m         Te 127m       8       Am 242m         I 129       8       Am 243         Cs 134       8       Cm 242         Cs 135       6       Cm 243         Cs 137       6       Cm 244         Ba 133       8       Cm 245         La 137       8       Cm 246         La 138       6       Cm 248         Ce 144       8       Cf 249         Pm 145       8       Cf 250         Pm 147       8       Cf 251         Sm 147       8       Cf 252         Sm 151       Other a   |         |                            |      |          |                            | Pu 236    |          |      |           | 8         |
| Sn 123       8       Pu 239         Sn 126       8       Pu 240         Sb 125       8       Pu 241         Sb 126       8       Pu 242         Te 125m       8       Am 241         Te 127m       8       Am 242m         I 129       8       Am 243         Cs 134       8       Cm 242         Cs 135       6       Cm 243         Cs 137       6       Cm 244         Ba 133       8       Cm 245         La 137       8       Cm 246         La 138       6       Cm 248         Ce 144       8       Cf 249         Pm 145       8       Cf 250         Pm 147       8       Cf 252         Sm 147       8       Other a   |         |                            |      |          |                            | Pu 238    |          |      |           | 8         |
| Sn 126       8       Pu 240         Sb 125       8       Pu 241         Sb 126       8       Pu 242         Te 125m       8       Am 241         Te 127m       8       Am 242m         I 129       8       Am 243         Cs 134       8       Cm 242         Cs 135       6       Cm 243         Cs 137       6       Cm 244         Ba 133       8       Cm 245         La 137       8       Cm 246         La 138       Cm 248       Cf 249         Ce 144       8       Cf 250         Pm 147       8       Cf 251         Sm 147       8       Other a  |         |                            |      |          |                            | Pu 239    |          |      |           | 8         |
| Sb 125       8       Pu 241         Sb 126       8       Pu 242         Te 125m       8       Am 241         Te 127m       8       Am 242m         I 129       8       Am 243         Cs 134       Cm 242       Cm 242         Cs 135       Cm 243       Cm 243         Cs 137       6       Cm 244         Ba 133       8       Cm 245         La 137       8       Cm 246         La 138       Cm 248       Cf 249         Ce 144       8       Cf 250         Pm 145       8       Cf 251         Sm 147       8       Cf 252         Sm 151       8       Other a  |         |                            |      |          |                            | Pu 240    |          |      |           | 8         |
| Te 125m Te 127m I 129  |         |                            |      |          |                            | Pu 241    |          |      |           | 8         |
| Te 125m Te 127m I 129  | Sb 126  |                            |      |          | 8                          | Pu 242    |          |      |           | 8         |
| 1 129  |         |                            |      |          |                            | Am 241    |          |      |           | 8         |
| I 129       8       Am 243         Cs 134       8       Cm 242         Cs 135       8       Cm 243         Cs 137       6       Cm 244         Ba 133       8       Cm 245         La 137       8       Cm 246         La 138       6       Cm 248         Ce 144       8       Cf 249         Pm 145       8       Cf 250         Pm 147       8       Cf 251         Sm 147       8       Other a         Sm 151       8       Other a   |         |                            |      |          |                            |           |          |      |           | 8         |
| Cs 134       8       Cm 242         Cs 135       8       Cm 243         Cs 137       6       Cm 244         Ba 133       8       Cm 245         La 137       8       Cm 246         La 138       Cm 248       Cm 248         Ce 144       8       Cf 249         Pm 145       8       Cf 250         Pm 147       8       Cf 251         Sm 147       8       Other a         Sm 151       8       Other a   |         |                            |      |          |                            |           |          |      |           | 8         |
| Cs 135 Cs 137 Ba 133 La 137 La 138 Ce 144 Pm 145 Pm 147 Sm 147 Sm 151  S   |         | 1                          |      |          | 8                          |           |          |      |           | 8         |
| Ba 133 La 137 La 138 Ce 144 Pm 145 Pm 147 Sm 147 Sm 151  Ba Cm 245 Cm 246 Cm 248 Cm 248 Cf 249 Cf 250 Cf 250 Cf 251 Sm 151 Cf 252 Sm 151  Cm 245 Cf 249 Cf 252 Cf 2 |         | 1                          |      |          | 8                          |           |          |      |           | 8         |
| La 137 La 138 Ce 144 Pm 145 Pm 147 Sm 147 Sm 151  8  | Cs 137  |                            |      |          | 6                          |           |          |      |           | 8         |
| La 138 Ce 144 Pm 145 Pm 147 Sm 147 Sm 151  Reference Service S | Ba 133  |                            |      |          | 8                          |           |          |      |           | 8         |
| Ce 144 Pm 145 Pm 147 Sm 147 Sm 151  8  | La 137  | 1                          |      |          | 8                          |           |          |      |           | 8         |
| Pm 145     8     Cf 250       Pm 147     8     Cf 251       Sm 147     8     Cf 252       Sm 151     8     Other a   | La 138  | 1                          |      |          | 8                          |           |          |      |           | 8         |
| Pm 147 Sm 147 Sm 151  8  |         |                            |      |          | 8                          |           |          |      |           | 8         |
| Sm 147     8     Cf 252       Sm 151     8     Other a   | Pm 145  | 1                          |      |          | 8                          |           |          |      |           | 8         |
| Sm 151 8 Other a   | Pm 147  |                            |      |          | 8                          |           |          |      |           | 8         |
|  | Sm 147  | 1                          |      |          | 8                          |           |          |      |           | 8         |
| 1 0 1/   | Sm 151  |                            |      |          | 8                          |           |          |      |           |           |
| 24 102   | Eu 152  | 1                          |      |          | 8                          | Other b/g |          |      |           |           |
| Eu 154 8 <b>Total a 0 0</b>  | Eu 154  | 1                          |      |          | 8                          |           | 0        |      |           |           |
| Eu 155 8 <b>Total b/g 0 1.04E-02</b>   | Eu 155  | 1                          |      |          | 8                          | Total b/g | 0        |      | 1.04E-02  | CC 2      |

## 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

Bands quantify uncertainty in mean radioactivity.

## Code

- 1 Measured activity
- 2 Derived activity (best estimate) 3 Derived activity (upper limit)
- 4 Not present
- 5 Present but not significant
- 7 Present in significant duantities but not determined 8 Not expected to be present in significant quantity