SITE Hinkley Point A

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Magnox Limited

WASTE TYPE ILW

Is the waste subject to

Scottish Policy:

No

**WASTE VOLUMES** 

Comment on volumes: Final Dismantling & Site Clearance is assumed to commence in 2081 and end in 2090.

Reactor dismantling will commence in 2085 and last for three years. Volumes and radioactivity have been calculated for 85 years after reactor shutdown, i.e. 2085.

Uncertainty factors on

volumes:

Stock (upper): x Arisings (upper) x 1.2 Stock (lower): x Arisings (lower) x 0.8

WASTE SOURCE There are 11 Debris Removal Ducts installed per reactor. These are designed to collect

reactor debris such as loose lower tubes from the gag unit assembles and a variety of other items. The Debris Removal Ducts are already included within Final Dismantling & Site Clearance but this new waste stream addresses the debris held in the Debris Removal

Ducts.

#### PHYSICAL CHARACTERISTICS

General description: Materials known to be present in the Debris Removal Ducts are the lower tubes from the

gag unit assemblies (mild steel). Other components could be present.

Physical components (%wt): Lower Tubes from the gag unit assemblies. Mild steel ~100%.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): ~1.4

Comment on density: -

### CHEMICAL COMPOSITION

General description and components (%wt):

Mild steel components present (~100%).

Chemical state: Neutral

Chemical form of

H-3: The tritium content is insignificant.

radionuclides: C-14: The chemical form of the carbon-14 has not been determined.

Se-79: The selenium content is insignificant.

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

Ra: The radium isotopes content is insignificant. Th: The throium isotopes content is insignificant. U: The uraniium isotopes content is insignificant. Np: The neptunium isotopes content is insignificant. Pu: The plutonium isotopes content is insignificant.

Metals and alloys (%wt): -

|                      | (%wt)  | Type(s) / Grade(s) with proportions                                | % of total C14<br>activity |
|----------------------|--------|--|----------------------------|
| Stainless steel      | NE     | Other components could be present (mild steel or stainless steel). |                            |
| Other ferrous metals | ~100.0 | Lower tubes from the gag unit assemblies are mild steel.           | 100.0                      |
| Iron                 |        |  |                            |
| Aluminium            | 0      |  |                            |

|            | Beryllium                         |             |  |                         |
|------------|-----------------------------------|-------------|--|-------------------------|
|            | Cobalt                            |             |  |                         |
|            | Copper                            | 0           |  |                         |
|            | Lead                              | 0           |  |                         |
|            | Magnox/Magnesium                  | 0           |  |                         |
|            | Nickel                            |             |  |                         |
|            | Titanium                          |             |  |                         |
|            | Uranium                           |             |  |                         |
|            | Zinc                              | 0           |  |                         |
|            | Zircaloy/Zirconium                | 0           |  |                         |
|            | Other metals                      | NE          | The variety of other components has not yet been determined. |                         |
| Organics ( | (%wt): -                          |             |  |                         |
|            |                                   | (%wt)       | Type(s) and comment  | % of total C14 activity |
|            | Total cellulosics                 | 0           |  | Ţ                       |
|            | 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  | erials (%wt): Graphite may be pre | esent on th | ne surfaces of any debris.                                   |                         |
|            |                                   | (%wt)       | Type(s) and comment  | % of total C14 activity |
|            | Inorganic ion exchange materials  | 0           |  | •                       |
|            | Inorganic sludges and flocs       | 0           |  |                         |
|            | Soil                              | 0           |  |                         |
|            | Brick/Stone/Rubble                | 0           |  |                         |
|            | Cementitious material             | 0           |  |                         |
|            | Sand                              |             |  |                         |
|            | Class/Caramias                    | 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 an | ions (%wt):                               |       |                     |
|              |   | (%wt) | Type(s) and comment |
|              | Fluoride                                  | 0     |                     |
|              | Chloride                                  | 0     |                     |
|              | lodide                                    | 0     |                     |
|              | Cyanide                                   | 0     |                     |
|              | Carbonate                                 | 0     |                     |
|              | Nitrate                                   | 0     |                     |
|              | Nitrite                                   | 0     |                     |
|              | Phosphate                                 | 0     |                     |
|              | Sulphate                                  | 0     |                     |
|              | Sulphide                                  | 0     |                     |
| Materials of | interest for -<br>tance criteria:         |       |                     |
| wasie accep  | tance cinteria.                           |       |                     |
|              |   | (%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 subs | stances /   |
|----------------|-------------|
| non hazardous  | pollutants: |

Complexing

None expected

|                                       | (%wt) | Type(s) and comment |
|---------------------------------------|-------|---------------------|
| Acrylamide                            |       |                     |
| 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                                |       |                     |
| Electronic Electrical Equipment (EEE) |       |                     |
| EEE Type 1                            |       |                     |
| EEE Type 2                            |       |                     |
| EEE Type 3                            |       |                     |
| EEE Type 4                            |       |                     |
| EEE Type 5                            |       |                     |
| agents (%wt): No                      |       |                     |
|                                       | (%wt) | Type(s) and comment |
| EDTA                                  |       |                     |
| DPTA                                  |       |                     |
| NTA                                   |       |                     |
| Polycarboxylic acids                  |       |                     |
| Other organic complexants             |       |                     |
| Total complexing agents               |       |                     |

Potential for the waste to contain discrete items:

Yes. Large Metal Items (LMIs)/"substantial" thickness items considered

"durable" assumed DIs. NB If recycled then DI Limits n/a

#### **PACKAGING AND CONDITIONING**

Conditioning method: The waste is not expected to be supercompacted. It will be placed in baskets in the

waste packages and is now assumed to be encapsulated.

Plant Name: None

Location: Hinkley Point A Site

Plant startup date: 2085

Total capacity ~5000.0

(m³/y incoming waste):

Target start date for 2

packaging this stream:

2085

Throughput for this stream

~1.0

(m³/y incoming waste):

Waste will be conditioned when removed from the reactor.

Likely container type:

Other information:

Container

Waste packaged (%vol)

Waste packaged (%vol)

Waste packaged (m³)

Waste packaged (m³)

Waste packaged (m³)

Payload (m³)

Likely container type

comment:

The waste is assumed to be in baskets in the waste package so the occupied volume in

the package is greater than the original waste volume.

Range in container waste

volume:

Not yet determined.

Not specified

Other information on

containers:

The container material is expected to be stainless steel.

Likely conditioning matrix:

Other information:

Conditioned density (t/m³):

Conditioned density comment:

~3.0

Other information on

conditioning:

The waste will be in baskets placed in the waste packages. Baskets of different Final Dismantling & Site Clearance ILW wastes may be in the same waste package.

It is now expected that the waste will be encapsulated. The matrix could be BFS/OPC.

Opportunities for alternative

disposal routing:

-

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

### **RADIOACTIVITY**

Source: Uncertainty: -

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:

-

Other information:

The activities quoted are those at 85 years after reactor shutdown, i.e. in 2085. There may be some contamination by Cs137.

| Nuclicide  | , IBq/m³    | oactivity, TBq/   | Mean radioa |           |      | tivity, TBq/m³ | Mean radioac |   |         |
|--|-------------|-------------------|-------------|-----------|------|----------------|--------------|---|---------|
| Be 10  |             | Future<br>arising |             | Nuclide   |      |                |              |   | Nuclide |
| C 14 Na 22 Al 26 Na 22 Al 26 Al 26 Al 38 Al 7m 170 Al 26 Al 38 Al 7m 171 Al 26 Al 39 Al 39 Al 47E-06 C C 2 Bl 20 B | 8           |                   |             | Gd 153    | 8    |                |              |   | H 3     |
| Na 22  | 8           |                   |             | Ho 163    | 8    |                |              |   | Be 10   |
| Na 22  | 8           |                   |             | Ho 166m   |      | 2.9E-02        |              |   | C 14    |
| A  26  | 8           |                   |             |           |      |                |              |   |         |
| Ci   36  | 8           |                   |             |           |      |                |              |   |         |
| Ar 39 Ar 42 Ar 43 Ar 44 Ar 42 Ar 43 Ar 44 Ar 42 Ar 44 Ar 46 Ar 47 Ar 47 Ar 48 Ar 47 Ar 48 Ar 41 Ar 48 Ar 49 Ar 49 Ar 40 Ar 41 Ar 41 Ar 42 Ar 41 Ar 42 Ar 41 Ar 42 Ar 42 Ar 42 Ar 42 Ar 42 Ar 42 Ar 41 Ar 42 Ar 41 Ar 42 Ar 43 Ar 42 Ar 42 Ar 42 Ar 43 Ar 42 Ar 43 Ar 42 Ar 43 Ar 42 Ar 43 Ar 44 Ar 43 Ar 44  | 8           |                   |             |           |      | 4 7F-06        |              |   |         |
| Ar 42  | 8           |                   |             |           |      | 4.7 L-00       |              |   |         |
| K 40 Ca 41 Mn 53 Mn 53 Mn 54 Fe 55 Ca 60 Ca 60 Ni 59 Ni 59 Ni 59 Ni 59 Ni 58 Se 79 Rr 81 Rr 85 Rr 85 Rr 85 Rr 87 Rr 81 Rr 85 Rr 82 Rr 81 Rr 85 Rr 82 Rr 82 Rr 82 Rr 82 Rr 81 Rr 85 Rr 82 Rr 84 Rr 85 Rr 84 Rr 85 Rr 85 Rr 86 Rr 86 Rr 86 Rr 87 Rr 86 Rr 87 Rr 87 Rr 88 Rr 82 Rr 87 Rr 80 Rr 82 R | 8           |                   |             |           |      |                |              |   |         |
| Ca 41  | 8           |                   |             |           |      |                |              |   |         |
| Mn 53 Mn 54 Fe 55 Co 60 Mn 54 Fe 55 Co 60 Mn 54 Fe 55 Co 60 Mn 59 Mn 54 Fe 55 Co 60 Mn 59 Mn 50  |             |                   |             |           |      |                |              |   |         |
| Mn 54  | 8           | 5 6 E 0           |             |           |      |                |              |   |         |
| Fe 55  |             | 5.6E-0            |             |           |      |                |              |   |         |
| Co 60  | 8           |                   |             |           |      | . == .=        |              |   |         |
| Ni 59 Ni 63 Ni 63 3.4E-01 CC 2 PO 210 PO 210 Reference of the process of the proc | 8           |                   |             |           |      |                |              |   |         |
| Ni 63       3.4E-01       CC       2       Po 210         Zn 65       8       Ra 223       Ra 223         Se 79       8       Ra 226       Ra 226         Kr 81       8       Ra 226       Ra 226         Kr 85       8       Ra 228       Ra 227         Rb 87       8       Ra 228       Ra 227         Sr 90       8       Th 227       Ta 24         Nb 91       8       Th 229       Th 230       Th 299         Nb 92       2.4E-09       CC 2       Th 230       Th 299         Nb 93m       6       Th 232       Th 234         Mo 93       1.8E-04       CC 2       Pa 231         Tc 99       3.3E-05       CC 2       U 232         Ru 106       8       U 233         Pd 107       8       U 234         Ag 108m       4.9E-06       CC 2       U 235         Ag 110m       8       U 236         Cd 113m       8       Pu 236         Sn 123       8       Pu 238         Sn 122       8       Pu 240         Sb 125       8       Pu 242         Te 125m       8       Pu 242  | 8           |                   |             |           |      |                |              |   |         |
| Zn 65   Se 79  | 8           |                   |             |           |      |                |              |   |         |
| Se 79  | 8           |                   |             |           | CC 2 | 3.4E-01        |              |   |         |
| Kr 81 Kr 85 Rb 87 Kr 86 Rb 87 Kr 80 Ra 228 Rb 227 Kr 92 Rb 92 Rb 97 Rb 91 Rb 92 Rb 93 Rb 94 Rb 94 Rb 94 Rb 96 Rb 97 Rb 97 Rb 98 Rb 9 | 8           |                   |             |           | 8    |                |              |   | Zn 65   |
| 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       2.4E-09       CC 2       Th 230         Nb 93m       6       Th 232         Nb 94       6.5E-05       CC 2       Pa 231         Mo 93       1.8E-04       CC 2       Pa 231         Tc 97       8       Pa 233         Tc 99       3.3E-05       CC 2       U 232         Ru 106       8       U 234         Pd 107       8       U 236         Ag 110m       8       U 236         Cd 109       8       U 236         Cd 113m       8       Np 237         Sn 12lm       8       Pu 236         Sn 121m       8       Pu 239         Sn 126       8       Pu 241         Sb 125       8       Pu 241         Sb 126       8       Pu 242         Tc 125m       8       Am 241         Tc 127m       8       Am 242         Tc 127m       8       Am 243 <td< td=""><td>8</td><td></td><td></td><td></td><td>8</td><td></td><td></td><td></td><td>Se 79</td></td<>  | 8           |                   |             |           | 8    |                |              |   | Se 79   |
| Rb 87 Sr 90 Zr 93 Nb 91 Nb 92 Nb 93m Nb 94 6.5E-05 CC 2 Th 230 Th 228 Nb 93 Nb 93 Nb 94 No 93 Tc 97 3.3E-05 CC 2 U 232 Ru 106 Pd 107 Ag 108m Ag 110m Cd 109 Cd 113m Sn 119m Sn 123 Sn 126 Sb 125 Sb 126 Sb 125 Sb 126 Te 125m Te 127 I 129 Cs 134 Cc 137 Cs 137 La 28 C  | 8           |                   |             | Ra 226    | 8    |                |              |   | Kr 81   |
| Sr 90       8       Th 227       Th 228       Th 228       Th 229       Th 220       Th 230       Nb 94       Th 230       Th 232       Th 234       Mo 93       Th 232       Th 234       Mo 93       Th 234       Mo 93       Th 234       Mo 93       Th 234       Mo 93       Pa 233       Th 234       Mo 93       Pa 233       Th 232       Th 234       Mo 94       Mo 94       Mo 94       Mo 95       Pa 233       Th 234       Mo 94       <   | 8           |                   |             | Ra 228    | 8    |                |              |   | Kr 85   |
| Nb 91  | 8           |                   |             | Ac 227    | 8    |                |              |   | Rb 87   |
| Zr 93  | 8           |                   |             | Th 227    | 8    |                |              |   | Sr 90   |
| Nb 91 Nb 92 Nb 93m Nb 94 6.5E-05   | 8           |                   |             | Th 228    | 8    |                |              |   |         |
| Nb 92 Nb 93m Nb 94 6.5E-05 CC 2 Th 230 Th 232 Nb 94 Nb 93 Nb 93 Tc 97 Tc 97 Tc 99 3.3E-05 CC 2 U 232 Ru 106 Pd 107 Ag 108m Ag 110m Ag 110m Ag 113m Sn 121m Sn 123 Sn 126 Sb 125 Sb 125 Sb 126 Te 125m Te 127m I 129 CS 134 CS 137 CS 137 CS 137 CS 17 CS 2 CC 2  | 8           |                   |             |           |      |                |              |   |         |
| Nb 93m Nb 94 Nb 923 Nb 126 Nb 127 Nb 128 Nb 126 Nb 127 Nb 128 Nb 128 Nb 128 Nb 129 Nb 120 Nb 121 Nb 1240 Nb 1240 Nb 125 Nb 126 Nb 126 Nb 126 Nb 127 Nb 128 Nb 126 Nb 127 Nb 128 Nb 126 | 8           |                   |             | Th 230    |      | 2.4E-09        |              |   |         |
| Nb 94  | 8           |                   |             |           |      |                |              |   |         |
| Mo 93       1.8E-04       CC 2       Pa 231         Tc 97       8       Pa 233         Tc 99       3.3E-05       CC 2       U 232         Ru 106       8       U 233         Pd 107       8       U 234         Ag 108m       4.9E-06       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         Cs 134       Cm 242       Cm 243         Cs 135       Cm 243       Cm 244         Cs 137       6       Cm 244         Ba 133       6       Cm 245   | 8           |                   |             |           |      | 6 5E-05        |              |   |         |
| Tc 97 Tc 99 Ru 106 Pd 107 Ag 108m Ag 110m Cd 109 Cd 113m Sn 119m Sn 121m Sn 123 Sn 126 Sb 125 Sb 126 Te 125m Te 127m I 129 I 238 Cm 243 Cc 137 Ba 133  Ru 106 Pd 233 Ru 232 Ru 232 Ru 232 Ru 233 Ru 232 Ru 233 Ru 234 Ru 234 Ru 235 Ru 236 Ru 238 Ru 239 Ru 239 Ru 240 Ru 240 Ru 241 Ru 241 Ru 242 Ru 241 Ru 242 Ru 241 Ru 242 Ru 244 Ru 242 Ru 244 Ru 243 Ru 243 Ru 243 Ru 243 Ru 243 Ru 243 Ru 244 Ru 243 Ru 244 Ru 244 Ru 244 Ru 245 Ru 246 Ru 247 Ru 247 Ru 248 Ru 248 Ru 249 Ru 249 Ru 249 Ru 249 Ru 240 Ru 241 Ru 242 Ru 242 Ru 244 Ru 242 Ru 244 Ru 243 Ru 243 Ru 244 Ru 243 Ru 244 Ru 243 Ru 244 Ru 244 Ru 245 Ru 246 Ru 247 Ru 248 Ru 248 Ru 248 Ru 248 Ru 249 Ru 24 | 8           |                   |             |           |      |                |              |   |         |
| Tc 99 Ru 106 Pd 107 Ag 108m Ag 110m Cd 109 Cd 113m Sn 121m Sn 123 Sn 126 Sb 125 Sb 126 Te 125m Te 127m I 129 Cs 134 Cs 135 Cs 137 Ba 133   3.3E-05 CC 2 U 232 U 233 U 234 U 235 U 236 U 236 U 238 V 238 V 238 V 238 Pu 238 Pu 238 Pu 239 Sn 1240 Sb 125 Sb 126 Sb 126 Sb 127 Sb 129 Sc 134 Cs 134 Cs 135 Cs 137 Ba 133   | 8           |                   |             |           |      | 1.02-04        |              | 1 |         |
| Ru 106 Pd 107 Ag 108m Ag 110m Cd 109 Cd 113m Sn 119m Sn 123 Sn 123 Sn 126 Sb 125 Sb 126 Te 125m Te 127m I 129 Cs 134 Cs 135 Cs 137 Ba 133  | 8           |                   |             |           |      | 2 25 05        |              |   |         |
| Pd 107 Ag 108m Ag 110m Cd 109 Cd 113m Sn 119m Sn 121m Sn 123 Sn 126 Sb 125 Sb 126 Te 125m Te 127m I 1129 Cs 134 Cs 135 Cs 137 Ba 133   | 8           |                   |             |           |      | 3.3E-03        |              |   |         |
| Ag 108m Ag 10m Cd 109 Cd 113m Sn 119m Sn 121m Sn 123 Sn 126 Sb 125 Sb 126 Te 125m Te 127m I 1129 Cs 134 Cs 135 Cs 137 Ba 133  4.9E-06 CC 2 U 235 U 236 U 238 U 238 Pu 237 Sn U 236 Sn U 238 Pu 239 Sn U 240 Sn U 240 Sn U 241 Sn U 242 Sn U 241 Sn U 242 Sn U 243 Sn U 243 Sn U 244 Sn U 245 Sn U 245  | 8           |                   |             |           |      |                |              |   |         |
| Ag 110m Cd 109 Cd 113m Sn 119m Sn 121m Sn 123 Sn 126 Sb 125 Sb 126 Te 125m Te 127m I 1129 Cs 134 Cs 135 Cs 137 Ba 133  S U 236 U 238 U 238 Fu 236 S Pu 238 S Pu 239 S Pu 240 S Pu 240 S Pu 241 S Pu 242 S Pu 244 S Pu 245 S Pu 246 S Pu 247 S Pu 248 S Pu 248 S Pu 249 S Pu 240 S Pu 241 S Pu 242 S Pu 242 S Pu 244 S Pu 245 S Pu 246 S Pu 247 S Pu 246 S Pu 247 S Pu 248 S Pu 248 S Pu 248 S Pu 249 S Pu 240 S Pu 240 S Pu 241 S Pu 242 S Pu 242 S Pu 244 S Pu 244 S Pu 246 S Pu 247 S Pu 248 S Pu 248 S Pu 248 S Pu 249 S Pu 240 S Pu 240 S Pu 240 S Pu 240 S Pu 241 S Pu 242 S Pu 244 S Pu 242 S Pu 244 S Pu 242 S Pu 244 S Pu 246 S | 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         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   |             |                   |             |           |      | 4.9E-06        |              |   | -       |
| Cd 113m  | 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       8       Cm 242         Cs 135       8       Cm 243         Cs 137       6       Cm 244         Ba 133       8       Cm 245  | 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 241         Te 127m       8       Am 242m         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   | 8           |                   |             | *         |      |                |              |   |         |
| Sn 123 Sn 126 Sb 125 Sb 126 Te 125m Te 127m I 129 Cs 134 Cs 135 Cs 137 Ba 133  8 Pu 239 Pu 240 8 Pu 240 8 Pu 241 8 Pu 242 8 Am 241 8 Am 241 8 Cm 242 Cm 243 Cm 244 Cm 244 Cm 244 Cm 244 Cm 245   | 8           |                   |             |           | 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       8       Cm 243         Cs 137       6       Cm 244         Ba 133       8       Cm 245  | 8           |                   |             |           | 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     8     Cm 242       Cs 135     8     Cm 243       Cs 137     6     Cm 244       Ba 133     8     Cm 245  | 8           |                   |             |           | 8    |                |              |   | Sn 123  |
| Sb 126 Te 125m Te 127m B Am 242m I 129 Cs 134 Cs 135 Cs 137 Ba 133  S Pu 242 Am 241 Am 242m Am 242m Am 243 Cm 242 Cm 242 Cm 243 Cm 244 Cm 245  | 8           |                   |             |           | 8    |                |              |   | Sn 126  |
| Te 125m Te 127m I 129 September 129 Cs 134 Cs 135 Cs 137 Ba 133 September 129 Ba Am 241 Am 242m Am 243 Cm 243 Cm 242 Cm 243 Cm 244 Cm 244 Cm 244 Cm 244 Cm 245 Cm 245  | 8           |                   |             |           | 8    |                |              |   | Sb 125  |
| Te 125m Te 127m I 129 Cs 134 Cs 135 Cs 137 Ba 133  Respond to the state of the stat | 8           |                   |             |           | 8    |                |              |   | Sb 126  |
| Te 127m I 129 Cs 134 Cs 135 Cs 137 Ba 133  Respond to the state of the | 8           |                   |             |           | 8    |                |              |   |         |
| 1 129     8     Am 243       Cs 134     8     Cm 242       Cs 135     8     Cm 243       Cs 137     6     Cm 244       Ba 133     8     Cm 245   | 8           |                   |             | Am 242m   |      |                |              |   |         |
| Cs 134 Cs 135 Cs 137 Ba 133  8   | 8           |                   |             | Am 243    |      |                |              |   |         |
| Cs 135<br>Cs 137<br>Ba 133 8 Cm 244<br>Cm 245  | 8           |                   |             | Cm 242    |      |                |              |   |         |
| Cs 137<br>Ba 133 6 Cm 244<br>Cm 245  | 8           |                   |             | Cm 243    |      |                |              |   |         |
| Ba 133 8 Cm 245  | 8           |                   |             | Cm 244    |      |                |              |   |         |
|  | 8           |                   |             |           |      |                |              |   |         |
| La 137 8 Cm 246  | 8           |                   |             | Cm 246    |      |                |              |   |         |
| La 138 8 Cm 248  | 8           |                   |             |           |      |                |              |   |         |
| 20.00  | 8           |                   |             |           |      |                |              |   |         |
| 0 0000   | 8           |                   |             |           |      |                |              |   |         |
| 7 111 110  | 8           |                   |             |           |      |                |              |   |         |
|  | 8           |                   |             |           |      |                |              |   |         |
| 9 00   | 0           |                   |             |           |      |                |              |   |         |
| Sili 101   |             |                   |             |           |      |                |              |   |         |
| Eu 152 8 Other b/g   | •           |                   |             | _         |      |                |              |   |         |
| Eu 154 8 Total a 0   | 0           |                   |             |           | 8    |                |              |   |         |
| Eu 155 8 Total b/g 0 3.7   | 74E-01 CC 2 | 3.74E-0           | 0           | Total b/g | 8    |                |              |   | Eu 155  |

#### 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 mean radioactivity.

### Code

- Measured activity
   Derived activity (best estimate)
   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