

| WASTE STREAM | 1A12 | ILW Containing Tritium |
|--------------|------|------------------------|
|--------------|------|------------------------|

**SITE** Amersham

**SITE OWNER** GE Healthcare

**WASTE CUSTODIAN** GE Healthcare Limited

**WASTE TYPE** ILW

#### WASTE VOLUMES

|                        | Reported (m <sup>3</sup> ) | OR | Conditioned (m <sup>3</sup> ) | Packaged (m <sup>3</sup> ) |
|------------------------|----------------------------|----|-------------------------------|----------------------------|
| Stocks:                | At 1.4.2025                |    |                               |                            |
| Future arisings:       |                            |    |                               |                            |
| Total future arisings: | 0.0                        |    |                               |                            |
| Total waste volume:    | 184.5                      |    |                               |                            |

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

Comment on arising rates: No future arisings all legacy waste for disposal.

Additional information on quantities: Volume of waste known exactly - waste is in 369 x 500l DEVA drums.

Uncertainty factors on volumes: Stock (upper): x 1.00 Arisings (upper): x -  
Stock (lower): x 1.00 Arisings (lower): x -

**WASTE SOURCE** Small scale radiochemical manufacturing from Cardiff Laboratories, which ceased in 2009 all waste has been packaged awaiting disposal therefore no further arisings.

#### PHYSICAL CHARACTERISTICS

General description: The waste consists of liquids, solids and absorbed liquids. The solids (72% by volume) include glassware, rubber gloves, paper tissues, chromatography papers, pipette tips etc. These are doubly contained in 2 tin-plate cans and 2 PVC bags and then held in 500l DEVA drums. Absorbed liquids (18% by volume) are absorbed onto vermiculite and contained in a glass jar, a tin-plate can and then a PVC bag. These are held in 500l DEVA drums. The free liquid waste stream consists of organic and inorganic (aqueous) solvents (10% by volume) held in screw top Duran bottles in a screwtop Safepak in a 6l tin-plate steel can in a sealed PVC bag. These are held in 500l DEVA drums.

Changes since waste generated: The waste will have undergone decay.

Bulk density (t/m<sup>3</sup>): ~ 0.70

Comment on density: Solids in cans (~0.26 t/m<sup>3</sup>), solids in fibreboard drums (~0.18 t/m<sup>3</sup>), absorbed liquids in cans (~0.45 t/m<sup>3</sup>), liquids (~1 t/m<sup>3</sup>). The average density (~0.7) of the overall waste container includes the weight of the outer container.

#### CHEMICAL COMPOSITION

General description and components (%wt): The liquid waste consists of organic solvents including industrial methylated spirits, ethanol and acetonitrile. (10%). The solid and absorbed liquid waste (90%) contains glass, various metals, plastics, rubber, cellulose and a wide range of organic and inorganic chemical forms. Glass (45%), cellulose (9%), metals (21%), rubber (<0.1%), plastics (0.5%), non aqueous liquids (10.2%) organic ion exchange materials (2.1%) and other organics (2.1%).

Chemical state: Neutral

Sheet metal proportion / thickness: Waste contained in tinplate cans. Thickness of waste is typically < 5mm. There is a relatively high surface area to weight ratio.

Metals and alloys (%wt):

|                           | (%wt)  | Type(s) / Grades(s) with proportions | % of total C14 activity |
|---------------------------|--------|--------------------------------------|-------------------------|
| Stainless steel.....      | < 4.5  | -                                    |                         |
| Other ferrous metals..... | < 9.0  | -                                    |                         |
| Iron.....                 | = 0    | -                                    |                         |
| Aluminium.....            | < 2.8  | -                                    |                         |
| Beryllium.....            | = 0    | -                                    |                         |
| Cobalt.....               | = 0    | -                                    |                         |
| Copper.....               | < 2.3  | -                                    |                         |
| Lead.....                 | < 0.50 | -                                    |                         |
| Magnox/Magnesium.....     | < 0.45 | -                                    |                         |
| Nickel.....               | < 0.50 | -                                    |                         |
| Titanium.....             | = 0    | -                                    |                         |
| Uranium.....              | = 0    | -                                    |                         |
| Zinc.....                 | < 0.45 | -                                    |                         |
| Zircaloy/Zirconium.....   | = 0    | -                                    |                         |
| Other metals.....         | < 0.50 | Other metals include tin.            |                         |

Organics (%wt):

|                                     | (%wt)  | Type(s) and comment                                           | % of total C14 activity |
|-------------------------------------|--------|---------------------------------------------------------------|-------------------------|
| Total cellulotics.....              | ~ 9.0  | Paper.                                                        |                         |
| Paper, cotton.....                  | ~ 9.0  | -                                                             |                         |
| Wood.....                           | = 0    | -                                                             |                         |
| Halogenated plastics.....           | ~ 0.50 | PVC.                                                          |                         |
| Total non-halogenated plastics..... | ~ 0.10 | Polyethylene, polystyrene, polypropylene, perspex.            |                         |
| Condensation polymers.....          | = 0    | -                                                             |                         |
| Others.....                         | ~ 0.10 | -                                                             |                         |
| Organic ion exchange materials..... | ~ 2.1  | Dowex, Amberlite, Celite, Sephadex.                           |                         |
| Total rubber.....                   | < 0.01 | -                                                             |                         |
| Halogenated rubber.....             | < 0.01 | Neoprene.                                                     |                         |
| Non-halogenated rubber.....         | < 0.01 | Pure latex, natural latex.                                    |                         |
| Hydrocarbons.....                   | = 0    | -                                                             |                         |
| Oil or grease.....                  | = 0    | -                                                             |                         |
| Fuel.....                           | = 0    | -                                                             |                         |
| Asphalt/Tarmac (cont.coal tar)..... | = 0    | -                                                             |                         |
| Asphalt/Tarmac (no coal tar).....   | = 0    | -                                                             |                         |
| Bitumen.....                        | = 0    | -                                                             |                         |
| Others.....                         | = 0    | -                                                             |                         |
| Other organics.....                 | ~ 7.1  | Organic solvents (5%) and Organic Ion exchange Resins (2.1%). |                         |

Other materials (%wt):

|                                       | (%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.....                             | = 0     | -                   |                         |
| Glass/Ceramics.....                   | ~ 45.0  | Glass               |                         |
| Graphite.....                         | = 0     | -                   |                         |
| Desiccants/Catalysts.....             | = 0     | -                   |                         |
| Asbestos.....                         | << 0.01 | -                   |                         |
| Non/low friable.....                  | < 0.01  | -                   |                         |
| Moderately friable.....               | < 0.01  | -                   |                         |
| Highly friable.....                   | < 0.01  | -                   |                         |
| Free aqueous liquids.....             | ~ 5.0   | -                   |                         |
| Free non-aqueous liquids.....         | ~ 10.2  | -                   |                         |
| Powder/Ash.....                       |         | -                   |                         |

#### COMPONENTS OF MATERIALS, WASTE PROPERTIES, MATERIALS NOT CONTRIBUTING TO MASS

Inorganic anions (%wt):

|                | (%wt)  | Type(s) and comment |
|----------------|--------|---------------------|
| Fluoride.....  | = 0    | -                   |
| Chloride.....  | < 0.40 | -                   |
| Iodide.....    | < 0.05 | -                   |
| Cyanide.....   | = 0    | -                   |
| Carbonate..... | = 0    | -                   |
| Nitrate.....   | < 0.40 | -                   |
| Nitrite.....   | = 0    | -                   |
| Phosphate..... | < 0.90 | -                   |
| Sulphate.....  | < 0.90 | -                   |
| Sulphide.....  | < 0.60 | -                   |

Materials of interest for waste acceptance criteria:

|                                                | (%wt)  | Type(s) and comment |
|------------------------------------------------|--------|---------------------|
| Combustible metals.....                        | = 0    | -                   |
| Low flash point liquids.....                   | ~ 1.0  | -                   |
| Explosive materials.....                       | = 0    | -                   |
| Phosphorus.....                                | = 0    | -                   |
| Hydrides.....                                  | < 0.40 | -                   |
| Biological etc. materials.....                 | = 0    | -                   |
| Biodegradable materials.....                   | < 2.0  | -                   |
| Putrescible wastes.....                        | < 2.0  | -                   |
| Non-putrescible wastes.....                    | = 0    | -                   |
| Corrosive materials.....                       | = 0    | -                   |
| Pyrophoric materials.....                      | = 0    | -                   |
| Generating toxic gases.....                    | = 0    | -                   |
| Reacting with water.....                       | = 0    | -                   |
| Higher activity particles.....                 | = 0    | -                   |
| Soluble solids as bulk chemical compounds..... | = 0    | -                   |

Hazardous substances / non hazardous pollutants:

|                             | (%wt)  | Type(s) and comment |
|-----------------------------|--------|---------------------|
| Acrylamide.....             | 0      | -                   |
| Benzene.....                | 0      | -                   |
| Chlorinated solvents.....   | 0      | -                   |
| Formaldehyde.....           | 0      | -                   |
| Organometallics.....        | 0      | -                   |
| Phenol.....                 | 0      | -                   |
| Styrene.....                | 0      | -                   |
| Tri-butyl phosphate.....    | 0      | -                   |
| Other organophosphates..... | 0      | -                   |
| Vinyl chloride.....         | 0      | -                   |
| Arsenic.....                | 0      | -                   |
| Barium.....                 | 0      | -                   |
| Boron.....                  | ~ 0.36 | -                   |
| Boron (in Boral).....       | -      | -                   |
| Boron (non-Boral).....      | ~ 0.36 | Borosilicate glass  |
| Cadmium.....                | 0      | -                   |
| Caesium.....                | 0      | -                   |
| Selenium.....               | 0      | -                   |
| Chromium.....               | 0      | -                   |
| Molybdenum.....             | 0      | -                   |
| Thallium.....               | 0      | -                   |
| Tin.....                    | < 1.0  | tinplate cans       |
| Vanadium.....               | 0      | -                   |
| Mercury compounds.....      | 0      | -                   |
| Others.....                 | 0      | -                   |

Complexing agents (%wt):

| Yes                            |        |                                                                                                                                                                                                                                            |
|--------------------------------|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                | (%wt)  | Type(s) and comment                                                                                                                                                                                                                        |
| EDTA.....                      | < 0.50 | -                                                                                                                                                                                                                                          |
| DPTA.....                      | < 0.50 | -                                                                                                                                                                                                                                          |
| NTA.....                       | TR     | -                                                                                                                                                                                                                                          |
| Polycarboxylic acids.....      | -      | -                                                                                                                                                                                                                                          |
| Other organic complexants..... | < 2.5  | Complexing agents include amines (<0.5%), phosphines(<0.005%), citric acid (<0.5%), oxalic acid (<0.5%), succinic acid (<0.05%), LOMI reagents (<0.05%), acid/alkaline permanganate mixtures (<0.5%), citric/oxalic acid mixtures (<0.5%). |
| Total complexing agents.....   | ~ 3.5  | -                                                                                                                                                                                                                                          |

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                                             | On-site            | = 100.0         |
| Decay storage                                              |                    |                 |
| Low force compaction                                       | Off-site           | > 90.0          |
| Supercompaction (HFC)                                      |                    |                 |
| Incineration                                               | Off-site           | < 10.0          |
| Drying/dewatering/liquid separation                        |                    |                 |
| Tie down/fixatives/strippable coating/painting application |                    |                 |
| Decontamination                                            |                    |                 |
| Metal treatment                                            |                    |                 |
| Recycling / reuse                                          |                    |                 |
| Thermal treatment, including vitrification                 |                    |                 |
| Encapsulation                                              |                    |                 |
| Polymer encapsulation                                      |                    |                 |
| Other physical treatment                                   |                    |                 |
| Other chemical treatment                                   |                    |                 |
| Containerisation                                           |                    |                 |
| Treatment not yet determined                               |                    |                 |
| None                                                       |                    |                 |

Comments on planned treatments:

Waste to be decay stored on-site then repacked for disposal by incineration off site. Possible recovery and reuse of the free liquid component.

Conditioning method:

-

Conditioning plants:

| Plant Name | Location |
|------------|----------|
|            |          |

Likely conditioning matrix:

-

Further information on the conditioning matrix:

-

### Waste Packaging:

Likely container type:

| Container | Waste packaged (vol%) | Waste loading (m³) | Payload (m³) | Number of packages | Estimated start date for packaging |
|-----------|-----------------------|--------------------|--------------|--------------------|------------------------------------|
| -         | -                     | -                  | -            | -                  | -                                  |

Range in container waste loading:

Other information on packaging and conditioning:

No waste to be transferred to LLWR.

Conditioned density (t/m³):

-

Conditioned density comment:

-

### Management Routes:

| Disposal Route                                                                     | Stream volume % | Raw density t/m³ | Start date |
|------------------------------------------------------------------------------------|-----------------|------------------|------------|
| Expected to be consigned to a Near Site, Near Surface Disposal Facility (Scotland) | = 100.0         | ~ 0.70           |            |
| Expected to be Non-NSD HAW managed under Scottish Government's policy              |                 |                  |            |
| Expected to be disposed to LLW Vaults NRS Dounreay                                 |                 |                  |            |
| Expected to be consigned to the Geological Disposal Facility                       |                 |                  |            |
| Expected to be consigned to a Near Surface Disposal Facility                       |                 |                  |            |
| Expected to be consigned to the LLW Repository                                     |                 |                  |            |
| Expected to be consigned to a Landfill Facility                                    |                 |                  |            |
| Expected to be disposed On-Site                                                    |                 |                  |            |
| Expected to be managed by In-Situ Disposal                                         |                 |                  |            |
| Expected to be consigned to an Incineration Facility                               |                 |                  |            |
| Expected to be consigned to a Metal Treatment Facility                             |                 |                  |            |
| Expected to be Out of Scope                                                        |                 |                  |            |
| Expected to be recycled / reused                                                   |                 |                  |            |
| Disposal route not known                                                           |                 |                  |            |

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

Opportunities for alternative disposal routing: Yes

| Baseline Management Route | Opportunity Management Route | Stream volume (%) | Opportunity Confidence | Comment                                                                                                                                            |
|---------------------------|------------------------------|-------------------|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| Incineration facility     | Recycled / reused            | ~ 10.0            | RED                    | Potential for the liquid component to be recycled via H3at (Culham) - no work completed to date. Liquid component ~10% by volume but ~50% activity |

#### RADIOACTIVITY

Source: Solid and absorbed liquid - activity exists as contaminated residues from small scale radiochemical preparations. The activity is evenly distributed between absorbed liquids and solids. Free liquids - the activity is present as radiolabelled compounds dissolved in organic/aqueous solvents. The free liquids make up 10% by volume of the wastestream but contribute 52% of the activity.

Uncertainty: Liquid component of the waste stream has been measured, solid component has been calculated by accountancy. All waste records have been QA checked back to the original record prior to transfer of the DEVA drums from Cardiff site to Grove Centre site. Uncertainty estimated at  $\pm 20\%$ .

Measurement of radioactivities: The waste only contains H-3 and is either measured by liquid scintillation counting or assessed following specific operations from radioactivity balance data. Activity was measured at time of waste generation and decay factors are applied according to the age of the waste drum.

Chemical form of radionuclides: H-3: Tritium is present as a replacement for hydrogen in the solvent or chemical dissolved in the solvent. Also < 1% present in corrosion resistant alloys as elemental tritium.

C-14: -  
Cl-36: -  
Se-79: -  
Tc-99: -  
I-129: -  
Ra: -  
Th: -  
U: -  
Np: -  
Pu: -

| WASTE STREAM |                            | 1A12              |                 | ILW Containing Tritium |           |                            |                   |                 |                   |
|--------------|----------------------------|-------------------|-----------------|------------------------|-----------|----------------------------|-------------------|-----------------|-------------------|
| Nuclide      | Mean radioactivity, TBq/m³ |                   |                 |                        | Nuclide   | Mean radioactivity, TBq/m³ |                   |                 |                   |
|              | Waste at<br>1.4.2025       | Bands and<br>Code | Future Arisings | Bands and<br>Code      |           | Waste at<br>1.4.2025       | Bands and<br>Code | Future Arisings | Bands and<br>Code |
| H 3          | = 9.14E+00                 | A A 1             |                 |                        | Gd 153    |                            |                   |                 |                   |
| Be 10        |                            |                   |                 |                        | Ho 163    |                            |                   |                 |                   |
| C 14         |                            |                   |                 |                        | Ho 166m   |                            |                   |                 |                   |
| Na 22        |                            |                   |                 |                        | Tm 170    |                            |                   |                 |                   |
| Al 26        |                            |                   |                 |                        | Tm 171    |                            |                   |                 |                   |
| Cl 36        |                            |                   |                 |                        | Lu 174    |                            |                   |                 |                   |
| Ar 39        |                            |                   |                 |                        | Lu 176    |                            |                   |                 |                   |
| Ar 42        |                            |                   |                 |                        | Hf 178n   |                            |                   |                 |                   |
| K 40         |                            |                   |                 |                        | Hf 182    |                            |                   |                 |                   |
| Ca 41        |                            |                   |                 |                        | Pt 193    |                            |                   |                 |                   |
| Mn 53        |                            |                   |                 |                        | Tl 204    |                            |                   |                 |                   |
| Mn 54        |                            |                   |                 |                        | Pb 205    |                            |                   |                 |                   |
| Fe 55        |                            |                   |                 |                        | Pb 210    |                            |                   |                 |                   |
| Co 60        |                            |                   |                 |                        | Bi 208    |                            |                   |                 |                   |
| Ni 59        |                            |                   |                 |                        | Bi 210m   |                            |                   |                 |                   |
| Ni 63        |                            |                   |                 |                        | Po 210    |                            |                   |                 |                   |
| Zn 65        |                            |                   |                 |                        | Ra 223    |                            |                   |                 |                   |
| Se 79        |                            |                   |                 |                        | Ra 225    |                            |                   |                 |                   |
| Kr 81        |                            |                   |                 |                        | Ra 226    |                            |                   |                 |                   |
| Kr 85        |                            |                   |                 |                        | Ra 228    |                            |                   |                 |                   |
| Rb 87        |                            |                   |                 |                        | Ac 227    |                            |                   |                 |                   |
| Sr 90        |                            |                   |                 |                        | Th 227    |                            |                   |                 |                   |
| Zr 93        |                            |                   |                 |                        | Th 228    |                            |                   |                 |                   |
| Nb 91        |                            |                   |                 |                        | Th 229    |                            |                   |                 |                   |
| Nb 92        |                            |                   |                 |                        | Th 230    |                            |                   |                 |                   |
| Nb 93m       |                            |                   |                 |                        | Th 232    |                            |                   |                 |                   |
| Nb 94        |                            |                   |                 |                        | Th 234    |                            |                   |                 |                   |
| Mo 93        |                            |                   |                 |                        | Pa 231    |                            |                   |                 |                   |
| Tc 97        |                            |                   |                 |                        | Pa 233    |                            |                   |                 |                   |
| Tc 99        |                            |                   |                 |                        | U 232     |                            |                   |                 |                   |
| Ru 106       |                            |                   |                 |                        | U 233     |                            |                   |                 |                   |
| Pd 107       |                            |                   |                 |                        | U 234     |                            |                   |                 |                   |
| Ag 108m      |                            |                   |                 |                        | U 235     |                            |                   |                 |                   |
| Ag 110m      |                            |                   |                 |                        | U 236     |                            |                   |                 |                   |
| Cd 109       |                            |                   |                 |                        | U 238     |                            |                   |                 |                   |
| Cd 113m      |                            |                   |                 |                        | Np 237    |                            |                   |                 |                   |
| Sn 119m      |                            |                   |                 |                        | Pu 236    |                            |                   |                 |                   |
| Sn 121m      |                            |                   |                 |                        | Pu 238    |                            |                   |                 |                   |
| Sn 123       |                            |                   |                 |                        | Pu 239    |                            |                   |                 |                   |
| Sn 126       |                            |                   |                 |                        | Pu 240    |                            |                   |                 |                   |
| Sb 125       |                            |                   |                 |                        | Pu 241    |                            |                   |                 |                   |
| Sb 126       |                            |                   |                 |                        | Pu 242    |                            |                   |                 |                   |
| Te 125m      |                            |                   |                 |                        | Am 241    |                            |                   |                 |                   |
| Te 127m      |                            |                   |                 |                        | Am 242m   |                            |                   |                 |                   |
| I 129        |                            |                   |                 |                        | Am 243    |                            |                   |                 |                   |
| Cs 134       |                            |                   |                 |                        | Cm 242    |                            |                   |                 |                   |
| Cs 135       |                            |                   |                 |                        | Cm 243    |                            |                   |                 |                   |
| Cs 137       |                            |                   |                 |                        | Cm 244    |                            |                   |                 |                   |
| Ba 133       |                            |                   |                 |                        | Cm 245    |                            |                   |                 |                   |
| La 137       |                            |                   |                 |                        | Cm 246    |                            |                   |                 |                   |
| La 138       |                            |                   |                 |                        | Cm 248    |                            |                   |                 |                   |
| Ce 144       |                            |                   |                 |                        | Cf 249    |                            |                   |                 |                   |
| Pm 145       |                            |                   |                 |                        | Cf 250    |                            |                   |                 |                   |
| Pm 147       |                            |                   |                 |                        | Cf 251    |                            |                   |                 |                   |
| Sm 147       |                            |                   |                 |                        | Cf 252    |                            |                   |                 |                   |
| Sm 151       |                            |                   |                 |                        | Unsp a    |                            |                   |                 |                   |
| Eu 152       |                            |                   |                 |                        | Unsp b/g  |                            |                   |                 |                   |
| Eu 154       |                            |                   |                 |                        | Total a   | 0                          | *                 | 0               | *                 |
| Eu 155       |                            |                   |                 |                        | Total b/g | 9.14E+00                   | *                 | 0               | *                 |

#### 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