Additional Procedures for the use of Iodine-125

Use of Iodine-125

Iodine-125 is an electron capture radionuclide emitting low energy X and gamma radiation with a maximum energy of 35 keV. Due to the volatile nature of iodine, the most significant hazard is from inhalation, the critical organ for uptake being the thyroid. The Annual Limits on Intake (ALI) for I-125 are the lowest found for nuclides commonly used in laboratories, the values given for inhalation and ingestion being 2 MBq and 1 Mbq respectively. In addition to the general procedures for working with open sources all work with I-125 must comply with the following procedure:-

1. Solutions containing iodide ions should neither be made acidic nor stored frozen; both lead to formation of volatile elemental iodine.

2. Care should be taken when opening vials to avoid the production of minute airborne droplets. Activated charcoal vents may be used.

3. Iodine-labelled compounds can penetrate surgical rubber gloves. Two pairs should be worn, or polythene over rubber.

4. Low activity RIA kits (< 370 kBq) may normally be handled on the open bench, but all other work with iodine should be carried out in a fume cupboard.

5. For work with higher activities special transparent shielding made from lead impregnated acrylic is commercially available which has a lead equivalence value of 0.5mm. Sample pots containing I-125 should be shielded with 1mm of lead.

6. Direct handling is to be avoided. Forceps, shielded syringes etc. must be used.

7. Spillages of iodine may require special treatment because of the volatility problem. An alkaline solution of 5% sodium thiosulphate (25g sodium thiosulphate + 2g sodium iodide in 1 litre of 1M sodium hydroxide) should be used to render the spill chemically stable prior to decontamination by the normal methods.

8. A portable monitor with a scintillation detector (Mini type 44a, 42) should be used to monitor for surface contamination. Geiger probes are generally unsuitable as they are not sufficiently sensitive.

9. All workers handling radioiodine should regularly monitor their thyroids following the instructions shown below.

10. In the case of an accident involving possible ingestion/inhalation of radioiodine the RPS must be contacted as, with medical supervision, it may be possible to block uptake to the thyroid by the administration of potassium iodide tablets. (200mg given two hours after ingestion will reduce uptake by 80%).

11. Radioiodinations may only be undertaken within Controlled Radiation Areas which have been inspected and approved by the RPA.
Guidance on Monitoring the Thyroid for Iodine-125

Routine monitoring is best carried out about 24 hours after exposure to risk of ingestion, but if a significant ingestion is suspected measurements should take place on the day of exposure.

A Mini-Instruments scintillation monitor, type 5.40 or series 900, with a type 42 or 44 X-ray crystal probe, such as normally used for the detection of I-125 surface contamination, is suitable for detecting I-125 in the thyroid using the following method:

1. Apply the probe end to the surface of the neck with its rim tangential to one clavicle and the midline of the neck (Figure 5).
2. Point the probe radially into the neck and move it slowly up and down. Note the maximum reading on the monitor.
3. Repeat on the other side of the midline and again note the maximum reading.
4. Add the two maximum values together, after subtracting the background from each, and compare the sum with the action level given in Table 1.

If the sum exceeds the value given in the table notify the URPO and arrangements will be made with Medical Physics, RVI, for a more accurate test.

Measurements should be made well away from any other sources of activity after carrying out a battery check on the instrument for at least 10 seconds. The background count-rate should be noted and a written record kept of all observations.

![Figure 1: Probe position for $^{125}$I Monitoring](image)

Table 1: Action Levels for Iodine-125 in the thyroid

<table>
<thead>
<tr>
<th>Probe</th>
<th>Action Level (cps above background)</th>
<th>Calibration (cps/kBq)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mini Type 42 A or B</td>
<td>20</td>
<td>27</td>
</tr>
<tr>
<td>Mini Type 44 A or B</td>
<td>70</td>
<td>95</td>
</tr>
</tbody>
</table>

The action levels correspond to an activity of approximately 0.75 kBq of I-125 in the thyroid. As the Annual Limit on Intake for I-125 is 1 MBq, these levels in no way imply a biologically significant intake of radioactivity, but values of this order obtained regularly would indicate poor laboratory practice and suggest the need for an investigation into both the methods used and the ways of improving them.