



STANDARD OPERATING PROCEDURES: IODINE-125

INTRODUCTION:

Iodine-125 is a commonly used radionuclide with a half-life of 60 days, emitting gamma rays with a maximum energy of 0.035 MeV (Million Electron Volts). See Appendix A for the decay rate information for I-125.

CONCERNS:

- The major concern with using I-125 is Radiation exposure in air over an unshielded vial. The dose rate at the opening of an unshielded vial containing 1 millicurie of I-125 can be 1,400 millirems per hour.
- One millicurie = 2.22×10^9 dpm (disintegrations per minute).

This means that the quarterly NRC limit of 18,250 millirems For the hands would be reached in 13 hours.

- The quarterly NRC limit of 1,250 millirems for the whole body (assume 3 feet from the vial) would be reached in 7,440 hours.

SHIELDING:

Lead foil is the best shield for gamma rays from I-125. The half value layer for I-125 gamma rays in Lead is 0.02 mm., i.e. every .02 mm. of Lead reduces the I-125 gamma ray beam by 50%.

DETECTION:

A small drop of contamination containing I-125 can be easily detected with a survey meter with a Sodium Iodide (NaI) Detector.

EQUIPMENT / SUPPLIES:

The following equipment and supplies must be available:

- Portable radiation detector with a Sodium Iodide crystal. (We recommend the Ludlum Model 3-98 or an equivalent)
- Lead foil for shielding. Lead foil is available from many vendors and the cost is very reasonable.
- Disposable latex or plastic gloves.
- Film badge and ring badge.
- Full-length lab coat.
- Radioactive waste receptacle.
- Pipettes dedicated to your use of I-125.
- Commercial decontaminate, i.e. DuPont's "Count Off".

SAFETY RULES:

If the following safety precautions are used, personnel radiation exposure will be as low as reasonably achievable.

1. Designate a specific area of the lab for I-125 handling.
2. Place the shielding near a wall (not toward another work area on the other side of the bench) away from the main flow of traffic in the lab.
3. All persons in the laboratory must wear a whole body film badge when in the lab, even those who are not handling I-125.
4. All persons handling I-125 must wear a ring badge on the hand which is most frequently used to handle vials, samples, pipettes, etc. containing I-125.
5. Full-length lab coats must be worn by all persons who handle I-125.
6. Protect your hands from becoming contaminated from spills by wearing two pairs of disposable gloves.
7. A detector must be in operation during the experiment, and preferably at all other times. To avoid contaminating the detector, place a thin sheet of plastic (i.e., Saran Wrap) around the detector
8. Place all vials and test tubes containing I-125 behind a Lead foil shield. Check the radiation level in front of the shield to determine if additional Lead foil should be added.
9. Do not work directly over an open container of I-125.

10. Never pipette I-125 by mouth.
11. Only use pipettes which have been dedicated to your specific use of I-125. Pipettes will easily become contaminated and therefore, should not be shared with others.
12. Check your gloves frequently for contamination with a Geiger Counter. If contamination is found, immediately dispose of the gloves in the radioactive waste container

POST-USE PROCEDURES:

After handling I-125:

- Use the Geiger Counter to check your hands, lab coat, shoes, clothing, centrifuges, water baths, work bench and floor.
- If any contamination is found on your shoes and/or clothing, contact the RSO. You will likely have to remove the item temporarily until the radiation decays. The RSO has some disposable clothing that you can wear home. We do not have any disposable shoes.
- If any contamination is found on your hands, wash thoroughly with soap and water. This will usually be sufficient to remove the surface contamination. If it does not, contact the RSO for assistance.
- If any contamination is found, use a commercial radiation contamination remover (i.e., Count Off) with paper towels to clean up the equipment.
- Place the towels in the radioactive waste receptacle.
- If contamination cannot be removed, place a “radiation” label on the equipment indicating that it is I-125, maximum cpm found, and the date you measured the level.
- If contamination is found, it can usually be removed easily with “Count Off.” If it cannot be removed, contact the RSO to obtain shielding materials.
- Inform your fellow lab workers if any unremovable contamination is found.
- Check the normal trash container to make sure no radioactive waste has been accidentally placed there.
- Store the waste temporarily in containers which are sufficient to absorb I-125's gamma rays.
- Send a Radiation Contamination Survey Report to the RSO. (Call the RSO if you have any questions about where to survey, or how to fill out the form.)
- Wash your hands thoroughly.

- Bring the waste to the Radiation Safety Office frequently. We accept waste every Tuesday and Thursday from 10:00 AM - 12:00 PM. Please call 212-305-0303 or X70303 for an appointment.

ANY QUESTIONS ABOUT THESE PROCEDURES?

Call the Radiation Safety Office, 212-305-0303 or X5-0303, or email rsocumc@columbia.edu

APPENDIX A

DECAY RATE OF I-125

Days Elapsed	% of Activity Remaining	Decay Factor
0	100.0	1.00
10	89.1	0.891
20	79.4	0.794
30	70.7	0.707
40	63.0	0.630
50	56.1	0.561
60	50.0	0.500
70	44.5	0.445
80	39.7	0.397
90	35.4	0.354
100	31.5	0.315
110	28.1	0.281
120	25.0	0.250
600 (10 half-lives)	0.1	0.001

For example, if your vial contained 500 microcuries of ¹²⁵I on 7/1/2005, the amount of activity remaining on 7/11/2005 (10 elapsed days) would be:

$$\begin{aligned} \text{Activity} \times \text{Decay Factor} &= \\ 500 \text{ microcuries} \times 0.891 &= 446 \text{ microcuries} \end{aligned}$$