Simulation: VII-10

Preparation of a laboratory to work temporarily with unsealed sources

Introduction:

Unsealed radiation sources are used mainly in two areas namely, i) Nuclear Medicine and ii) Research applications. Unsealed radiation sources are potentially hazardous, main hazards being:

(i) external irradiation of the individuals handling the sources and
(ii) intake of the radioactive material resulting from contamination.

Therefore all steps should be taken to minimize these hazards and maximize the net benefits of the use of radioisotopes. Safety in the temporary use of unsealed sources involves the following three important aspects:
i) A spacious radioisotope laboratory (preferably in one corner of the building) to take advantage of protection by distance and to set up temporary barricades of shielding, ii) requisite safe handling equipments and monitoring instruments and iii) availability of staff well trained in radiation work in the event of an emergency.

Aim:

To set up a laboratory to work temporarily with unsealed sources

Apparatus:

- A simple chemical laboratory with good ventilation
- Two rooms, one for handling and one for counting
- Contamination monitor
- Ordinary storage (with security)
- Sink – ordinary
- Table surfaces to be covered with smooth non-absorbent material
- Remote handling tongues
- Pipette/remote pipettes
- Foot operated dust bins

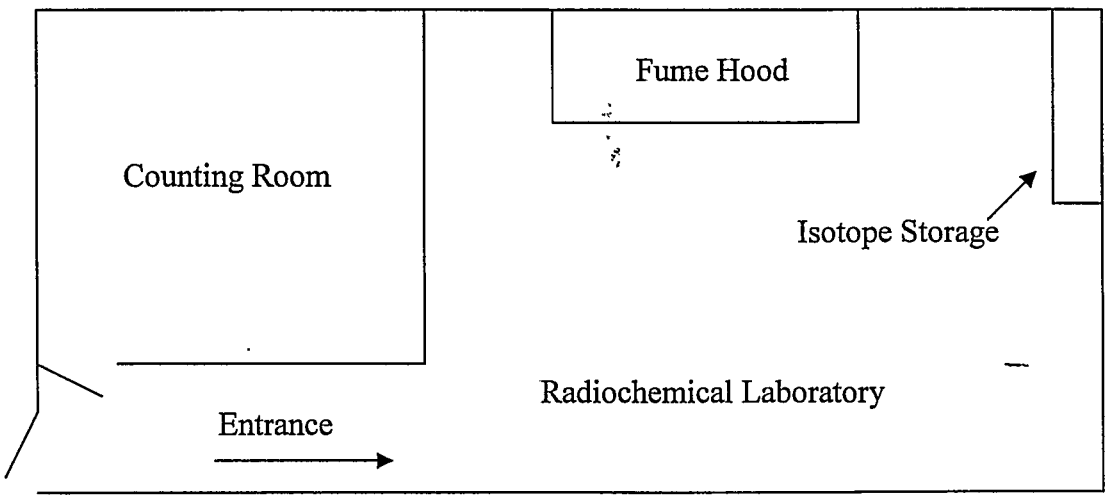

Figure 1

Procedure:
In Figure 1, the desired lay-out of the laboratory to temporarily handle the unsealed sources is shown

Ensure that the walls, floor and ceiling have a good clean finish, which is free from cracks. The porous wall material should be coated with a non-porous, washable paint. All work surfaces should be covered with polythene sheets and then with absorbent paper so that if there is any liquid spill, it is immediately absorbed by the paper, which can be easily disposed off.

From a safety standpoint, controlling contamination imposes the most stringent requirements on handling the majority of unsealed sources. Some high-energy beta emitters and some gamma emitters need to be handled cautiously to prevent unnecessary dose as well as prevent contamination.

A good starting point is general housekeeping in the laboratory including proper organization and storage of chemicals and tools, adequate space in which to work, a clutter-free environment, and ease of access to sinks, eye wash stations and safety showers. Keep fume hoods free of clutter, especially at the face and floor of the hood where the air flow may be disrupted. Work well inside the hood--not right at the hood face--and keep your face out of the hood.

Good personal hygiene can protect you from unnecessary dose. Wash hands thoroughly after every procedure and before leaving the laboratory. Always wear protective clothing and equipment. Gloves shall be worn every time you handle vessels containing radioactive material (and those that may be contaminated). Select gloves which are most appropriate for the chemical hazard. Never wear disposable gloves outside of the lab. Lab coats shall always be worn when there is a potential for exposure to hazardous materials. Lab coats shall be removed upon leaving the lab when there is a potential of contamination from a hazardous material on the lab coat. Keep lab coats buttoned up. Approved eye protection shall be worn when there is a potential exposure to the eyes from any hazardous material. Bare skin can be an important pathway for uptake of radioactive materials. Do not wear shorts, sandals, or cloth shoes in any laboratory containing hazardous materials.
Protect the laboratory as well. Accidents could require extensive decontamination--a potentially serious loss of time and resources. Double containers shall always be used to transport radioactive materials. A second, outer container with absorbent material will cushion a dropped sample or broken vessel. Establish a designated radiation work area and make sure that vessels, tools, and equipment used for radioactive materials work are labelled and stay in that area. Protect the work area with plastic-backed absorbent paper. Work on a tray that is also lined with absorbent paper.

Label all containers that hold or are contaminated with radioactive material; another worker may not know what is in or on the container or tool and may unknowingly spread contamination. Labels shall identify the radionuclide, the amount of activity, and the date. Labels help workers distance themselves from exposure hazards and help them avoid accidental intake from hand

contamination and skin absorption. Labels also help with inventory control because licensees must be able to account for all activity in stock, in use, and in waste. These labels must be removed or defaced before discarding containers or boxes. In short, labels shall provide sufficient information to permit all workers in the vicinity, or those handling the material, to take appropriate precautions to minimize their risk from contamination or exposure.
Smoking and the consumption of food and beverages are prohibited in laboratories where radioactive or other hazardous materials are used or stored. Storage of food and beverages in radiation laboratories also is prohibited. Disposal of food waste, beverage containers, or food containers inside the laboratory--even though food was consumed outside the laboratory--is prohibited.
Wear dosimeters whenever working with the radioactive materials for which dosimetry is provided.

Mouth pipetting of radioactive material is prohibited. Use bulbs, syringes, or other mechanical devices.

Monitor equipment containing radioactive material for contamination before disposal or transfer.
In general, experiments involving not more than 1 MBq per week of ^{3}H, ^{14}C, ^{125}I or ^{32}P will be readily approved immediately by the concerned radiation protection authorities if they are satisfied that appropriate laboratories and supervision are available, that the radionuclide is in a form that does not constitute a special hazard and that the procedures are sufficiently standard as mentioned above.

For experiments involving non standard procedures or radionuclides other than those listed above, or activities greater than 1 MBq per week one may need to seek specialist advice.

Questions:

1. Why contamination monitor is a must in a radioisotope laboratory?
2. Is it recommended to have all types of work of a radioisotope laboratory i.e. storage, handling, application, counting, waste storage etc. in one room? If not, why?
3. Why should all the surfaces of radioisotope laboratory be smooth without cracks and of materials which are chemically inert?

References:

1. Introduction to Health Physics by Herman Cember.
2. International Basic Safety Standards, SS-115, IAEA, Vienna, 1996.