

A spiral-bound notebook with a light-colored, textured cover. The spiral binding is on the left side. The text is centered on the cover.

Working Safely In A Radioisotope Laboratory

Training Notes for URI Radiation
Workers



Radiation Exposure Risks in a Radioisotope Laboratory

1. Exposure to external radiation from the radioactive materials
2. Exposure to internal radiation from the ingestion, inhalation, absorption through the skin and/or intake through a wound of radioactive materials.

Four Basic Methods to Minimize Your External Exposure



1. Time
2. Distance
3. Shielding
4. Activity

Time



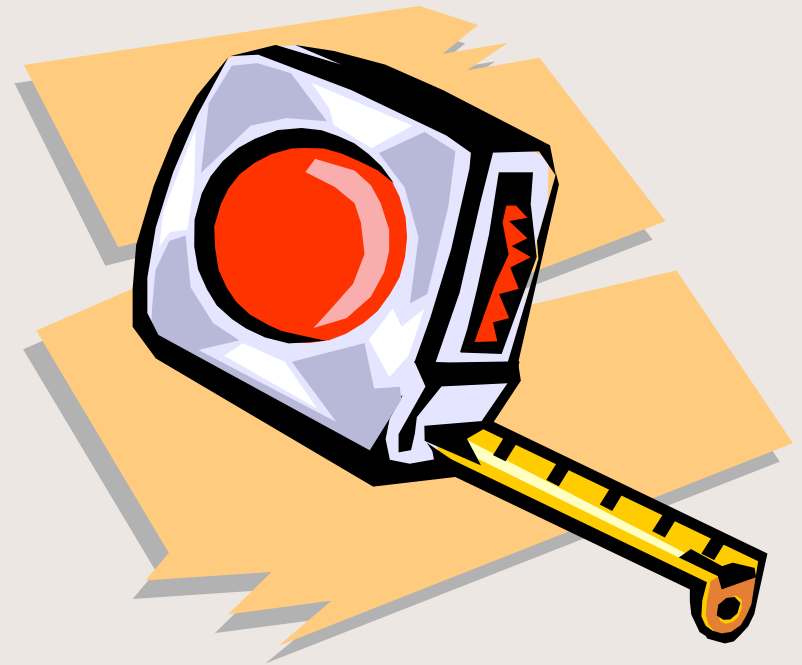
Total Dose is directly proportional to time.

$$\text{Dose} = \text{Dose Rate} \times \text{Time}$$

Minimize the amount of time that you are handling the radioisotope.

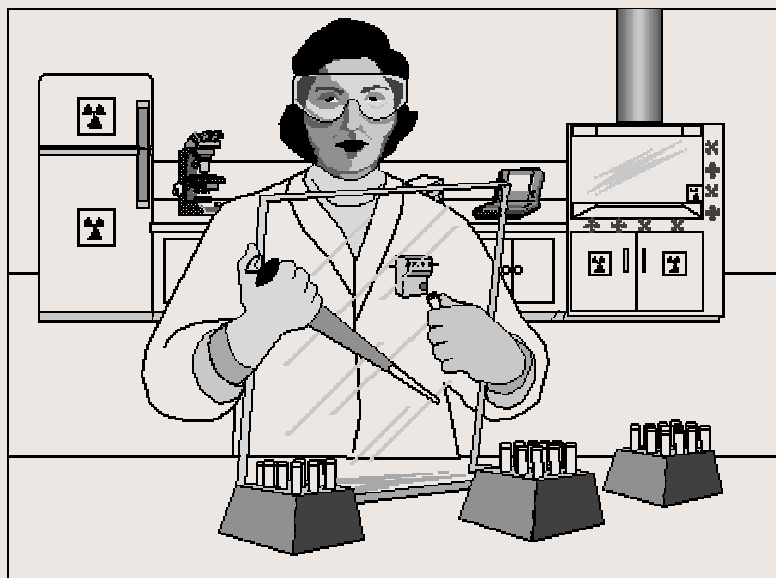
Distance

- Dose is inversely proportional to distance.
- Gamma and x-ray dose rates decrease inversely with the square of the distance from a point source.
- Beta particles have limited ranges in air.



Shielding

Working Behind a Shield



Dose is inversely proportional to shielding.

As shown, 8 mm of lucite or plexiglass will stop the beta particles from P-32

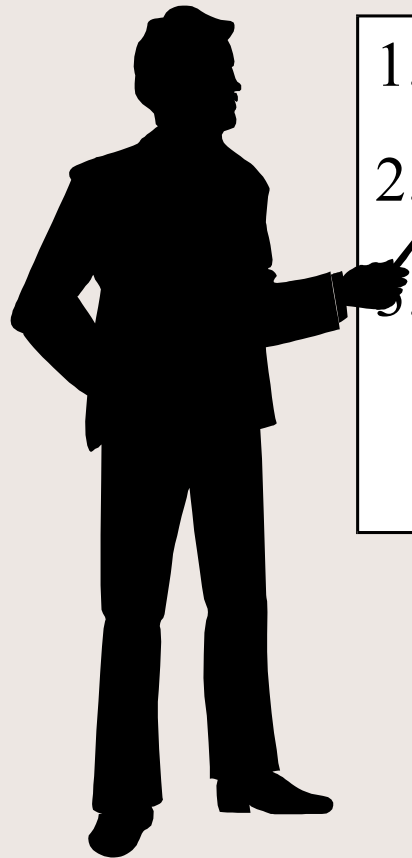
Activity



Dose rate is directly proportional to activity.

Minimize the activity that you handle by drawing an aliquot from the stock vial sufficient for several experimental runs.

Three Basic Methods to Minimize Your Internal Exposure



1. Technique
2. Housekeeping
3. Personal Protective Clothing and Equipment

All three relate to the control of contamination.

Contamination

Contamination is defined as the presence of radioactivity in an unwanted area.

Contamination is likely in any area where radioactive materials are handled.

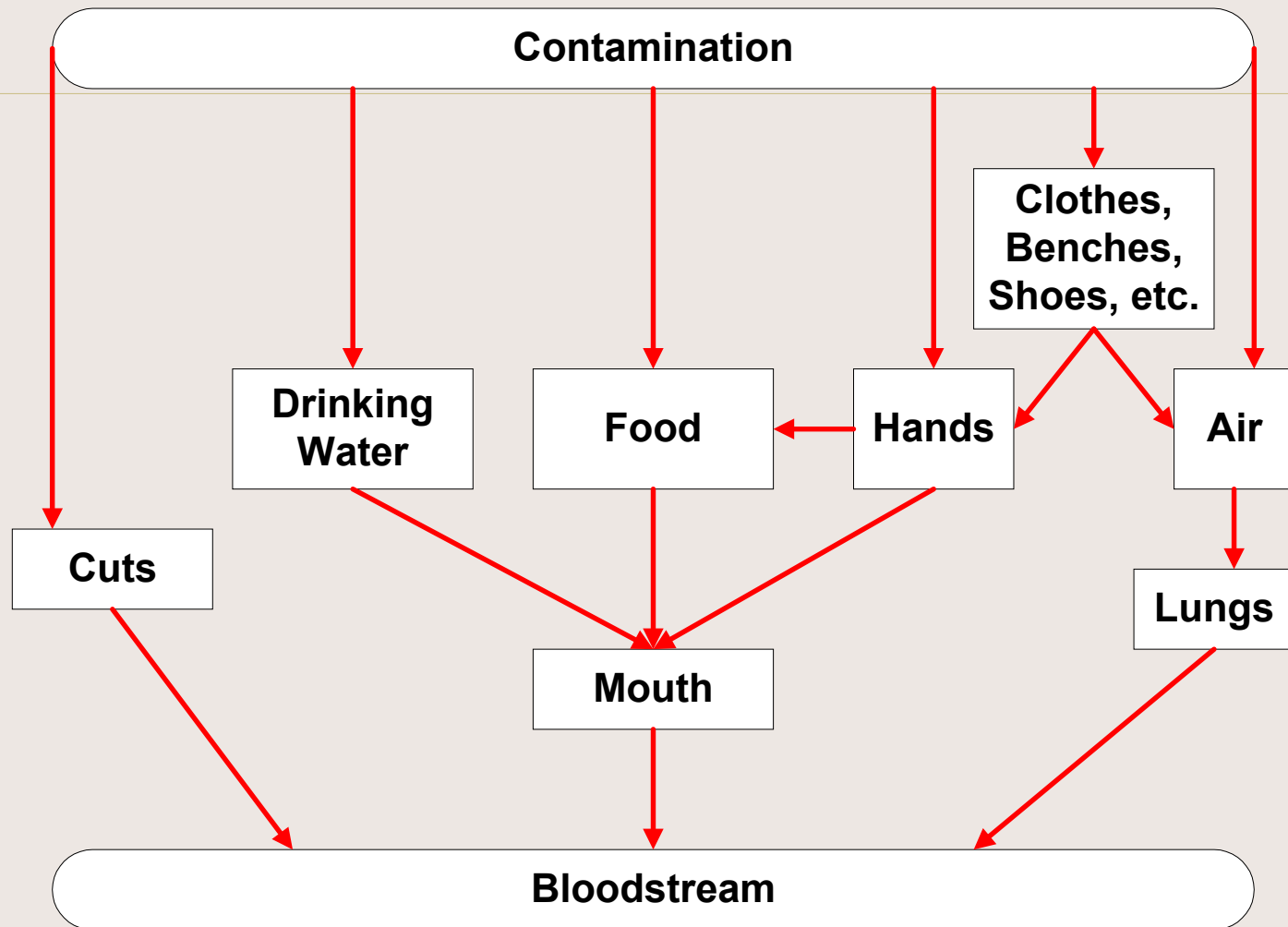
Contamination is a hazard to your health and it may ruin your experiments.

Contaminated Equipment

A piece of contaminated equipment may give off radiation and constitute an external hazard.

However, its main risk is internal exposure from a variety of pathways.

Potential Entry Pathways for Contamination



Technique



Before beginning any work with radioactive materials, develop a detailed plan for carrying out the procedures.

Your plan should consider 7 basic operations.

Seven Basic Radioisotope Laboratory Operations

1. Reception and storage of radioactive material
2. Dissolving, dispensing or subdividing the active material
3. Experimental manipulation of the radioactive material
4. Removal and preparation of a sample for assay
5. Determination of count-rate or activity
6. Disposal or storage of radioactive waste
7. Decontamination of equipment

Technique

Practice your procedures
before you handle
radioactive materials



Practice



Practice operations to improve dexterity and speed before using radioactive materials.



Handling Radioactive Materials

Whenever possible use tools (forceps or tongs) to handle primary vials and potentially contaminated items.

Minimize Internal Exposures

Do not work directly over open containers.

Handle potentially volatile chemical forms in the hood.

Do not open any container or work with Iodine-125 in unbound form on the bench.

Hygiene



Smoking, drinking, eating or applying cosmetics in laboratories or work areas in which unsealed forms of radioactive materials are used or stored is prohibited at URI.

Personal Item Storage



Store personal items (calculators, briefcases, book bags, purses, combs, cosmetics, etc.) in clean areas. The desk is a good location.

Do not store any personal items where radioactive material is used.

Food/Beverage Storage

Do not store food or beverages in “hot” areas, (e.g., cabinets, refrigerators, freezers, etc. containing radioactive material).



Other Items



Keep telephones, papers, books, etc., in clean areas

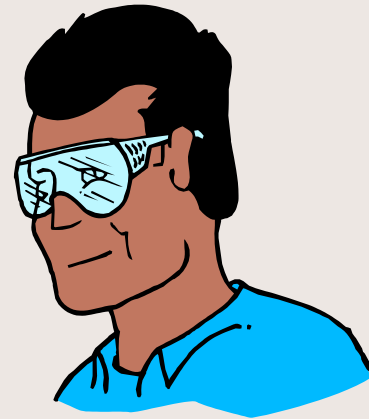
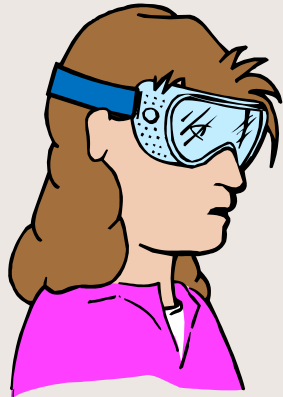
Remove your gloves before handling them to reduce the possibility of contamination.

Personal Protective Clothing and Equipment

Laboratory coats, gloves, safety glasses, and dosimetry should be worn whenever you are working within a radioisotope laboratory.



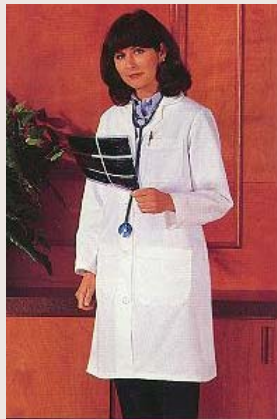
Safety Glasses



Wear eye protection to protect the eyes from splashes of radioactive and other hazardous materials.

Wearing eye protection also reduces high energy beta exposures to the eyes.

Lab Coat



Wear a lab coat with sleeves long enough to cover the arms to the wrists, and long enough to cover the torso to the thighs.

Wear it with the closures fastened.

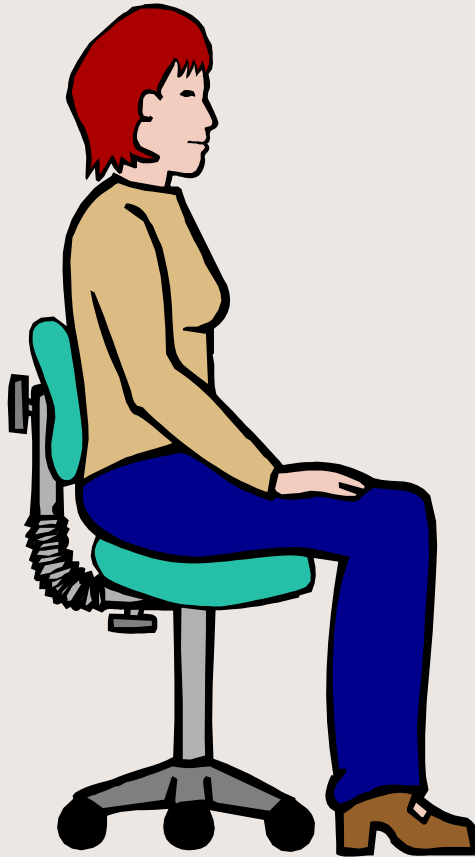
Gloves



Disposable gloves should be worn to protect the skin of the hands and wrists from contamination.

Check your gloves - even new gloves can have microscopic holes, tears, or other imperfections.

Pants or a long dress



Wear pants or a long dress to protect the legs from splashes and spills.

Do not wear shorts in a radioisotope laboratory.

Shoes



Acceptable



Unacceptable

Wear closed-toed shoes to protect the feet from splashes and spills.

Do not wear sandals or open-toed shoes.

Add shoe covers if the floor is contaminated.

Summary of Hazard Control

Hazard

**External
Radiation
Exposure**

**Internal
Radiation
Exposure**

Causes

**Handling beta-
gamma sources**

**Handling &
using
contaminated
apparatus &
working in
contaminated
areas**

Control

**Time, distance,
shielding &
activity**

**Technique,
housekeeping,
& personal
protective
equipment**