Radiation Safety General Awareness and ALARA Training

Authorized User

The following materials should be used to provide training to laboratory personnel that do not use radioactive material. Have each person that receives training sign and enter the date of this training. Please keep this record and the training document in your authorized user binder for review by OLS.

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Please Sign in and take a handout

Radiation Awareness Training

GWU Office of Lab Safety

Special thanks to The Department of Environmental Health and Safety at Cornell University for resources for this training

Purpose of this Instruction

- The instruction will teach you the basics of radiation safety and the radiological risks associated with the use of radioactive material at GWU.
- This training is required workers whose job duties may require them to be in areas where radioactive materials are used or stored.
- This training does not authorize you to directly handle radioactive materials but only serves as awareness training.

Big Picture

Small quantities of radioactive materials are used at GWU. Only very small radiation doses are expected for the users of radiation/radioactive material. No doses are expected for any other personnel. No biological effects are expected at these low dose levels.

Radiation Safety at George Washington University

U.S. Nuclear Regulatory Commission (License)

Radiation Safety Committee
(Authorizes Principal Investigators and Use of Radioactive Material)

Radiation Safety Officer

Principal Investigator - Authorized User

Radioactive dose

Radioactive molecules give off energy as particles or waves and this energy is absorbed by the cells in your body.

- Dose is measured in REM

Interaction of Radiation With Living Cells

Low Doses = Potential Long Term Effect of Radiation

- Risk to a cell depends on how much dose
- Risk to a person depends on how much dose and which tissues receive the dose

High Doses of Radiation

- Acute effect or Short Term effect
Short Term Effects of Radiation
- Only very high levels of radiation cause short term effects; this is virtually impossible on our campus.
- Symptoms appear quickly (hours to days) and can only result from very high radiation doses that occur only around large radiation sources (not used by GWU).
- Examples:
  - skin irritation, skin burn,
  - hair loss,
  - temporary sterility
  - blood effects
  - gastrointestinal effects
  - central nervous system effects

Dose Response - Short Term Effects
- Definite Threshold where Effects Begins
- Similar to Pattern for most toxic chemicals

Long Term Effects of Radiation
- The primary concern for the very low doses that MAY be encountered by users of radioactive material and radiation sources.
- Result from damage to cells.
- Effects do not appear for many years.
- Examples: cancer, genetic effects.

Dose Response - Long Term Effects
- The risk of the effect is depends on the dose.
- Conservative assumption that there is no threshold where effects begins.

Cancer Risks
- Cancer risk from ionizing radiation varies with type of tissue, age and sex.
- Simplified risk factor:
  - 10,000 individuals receive 1,000 mrem whole body dose while working
  - Result – 4 additional fatal cancers

Background cancer risk:
- 10,000 individuals with no radiation exposure at work
- Result – 2,500 fatal cancers

Dose Limits (mrem)
- Annual dose limit, public, whole body
- 100
- Annual dose limits for radiation worker
  - Whole body
    - 5,000
  - Eye
    - 15,000
  - Skin, hands, feet or single organ
    - 50,000
  - Fetus of “declared pregnant worker”
    - 500
- Typical annual dose from background
  - 350
- Range of annual dose from background
  - 130 to 25,000
- Chest X-ray - diagnostic
  - 10
- Thyroid treatment - therapeutic (whole body)
  - 7,000
- Clinically observable changes in blood
  - 25,000
- Serious skin burn
  - 200,000
- Lethal whole body dose (single dose)
  - 300,000
Two Ways to Receive a Dose

EXTERNAL RADIATION
A field of radiant energy that extends beyond the surface of a container of radioactive material.

CONTAMINATION
Any amount of radioactive material that is outside of the intended container.

Keep dose as low as possible
- Time - Limit the amount of time spent in radiation fields
- Distance – maximize your distance from the source
- Shielding – Block radiation with a material of appropriate material and thickness. Plexiglas for beta and lead for Gamma/X-rays

Distance

Dose Rate = 1
Dose Rate = 1/4
Dose Rate = 1/16
Distance = 1
Distance = 2
Distance = 4

Shielding
Radiation can be stopped or reduced by certain materials
Plexiglas
lead

AMOUNT
Activity
- Number of atoms decaying (disintegrating) per unit time
- 1 Curie = 2.22 x 10^{12} disintegrations per minute
- Activity changes over time and must be associated with the reference date.
Half-life
- Amount of time for the initial amount of activity to reduce by one half
For instance: Phosphorus-32 half life (32P) = 14 days. If you start with 1 mCi, after 2 weeks you will only have 0.5 mCi remaining.

Hall Placard
Door sign
Recognize rooms where radioactive materials are used

Radiation Areas
- Dose rates are between 5 - 100 mrem/h at 1 foot from the source(s).
- Do not enter the area without a meter.

RAM use/storage

Areas and equipment where radioactive materials are used or stored are clearly labeled

Procedure if Individuals are Contaminated
If you find personnel contamination, take the following steps:
1. Have someone call OLS, 4-2630
2. Remove clothing that is contaminated (take measures for modesty if someone must disrobe)
3. Start washing area gently with a mild soap and do not scrub hard
4. Ensure contamination is not spread to other areas (keep people from leaving if they may be contaminated)
5. Complete a GWU incident form and submit it to your supervisor

Note: for serious medical emergency, ignore radiation contamination until medical situation is under control.

Security
- Radiation marked rooms must be locked
- All radioactive material must be secured when not in the possession of an authorized person
- Do not let unauthorized persons into a radiation lab unattended.
- If a sealed radiation shipping package is discovered secure the package and contact OLS at 4-2630
- If the package is damaged, leaking or open or if the material is not in a shipping package, do not touch the material and keep people away from the area

Rad labels
If a package is discovered with the following markings it may contain radioactivity: