Delegation of Authority

MIT has appointed a Radiation Protection Committee to oversee all uses of radiation at the Institute. They give the RPP authority to stop any experiment or process involving radiation that is deemed unsafe.

When to Call RPP

• Security Issues
• Survey meter not working/out of calibration
• Iris Scanner problems
• Irradiator not working
• Need Special training

Irradiator Access

Requirements for unescorted access to the irradiator: Safety training, hands-on training for the unit you will be working with, federal criminal background check, personal reference check

Requirements for entering the room: MIT ID access card and dosimeter

NEVER . . .

• Share your ID or access codes with anyone
• Leave escorted persons alone with irradiator
• Escort a non-radiation worker into irradiator rooms or bring anyone into the irradiator room that you do not know

Emergency Response

If alarms sound while you are in the room with the irradiator, leave immediately, ensuring door is fully closed, and notify MIT police (dial 100).

If MIT Police show up, provide full cooperation and assist them as needed.

If phone rings while you are in the room, answer it . . . MIT Police or EHS RPP may need to reach you.

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Annual Occupational Dose Limits

Whole Body (5 rem)
Lens of Eye (15 rem)
Extremities (50 rem)
Declared Pregnant Worker (0.5 rem)
General Public (0.1 rem)

Most MIT radiation workers receive less than 10 mrem each year from occupational exposure!

Personal Dosimetry

Anyone likely to receive 500 mrem (10% of the annual dose limit) is required to wear a dosimetry badge.

At MIT, you will be assigned a dosimeter if you are working with an Irradiator.

BACKGROUND RADIATION

You receive about 1-2 millirem per day due to background radiation

Man-made 50 %
Natural Occurring 50 %

Common Isotopes

Cesium-137 (Cs-137)
Half-life: 30.7 years
Gamma Emission: 661.6 keV gamma at 85%.

Cobalt-60 (Co-60)
Half-life: 5.27 years
Gamma Emitter: 2 photons; 1.17 MeV and 1.33 MeV

LEAD SHIELDING IS USED FOR BOTH Co-60 & Cs-137

ALARA

Keeping all radiation doses at MIT As Low As Reasonably Achievable

How to MINIMIZE external exposure:

Time....Minimize Time
Distance ....Maximize Distance
Shielding......Use Proper Shielding

9 Traits of a Positive Safety Culture

1. Leadership Safety Values and Actions
2. Problem Identification and Resolution
3. Personal Accountability
4. Work Processes
5. Continuous Learning
6. Environment for Raising Concerns
7. Effective Safety Communication
8. Respectful Work Environment
9. Questioning Attitude

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Before and after working with the irradiator, always perform a survey of the chamber door before opening.

- Check calibration date on detector
- Check battery
- Check response using check source mounted on instrument.

- Measure the background exposure rate in an area known to have low radiation.
- Scan around the chamber door by holding detector face ~1 cm away from the surface moving slowly (about 2 inches/s).

Notify RPP if greater than 2 mR/hr

**Absorbed Dose:** The energy imparted to matter by ionizing radiation per unit mass or irradiated material at the point of interest. Unit for Absorbed Dose: rad: A unit of dose (Radiation Absorbed Dose). One RAD equal 100 ergs per gram, or 0.01 Joules/kg, of absorbing material. SI Unit is the Gray (Gy), and 1 Gy = 100 rad = 1 J/kg.

- **Dose Equivalent:** The product of the absorbed dose at a point in the tissue or organ and the appropriate quality factor for the type of radiation giving rise to the dose. A measure of the dose to a tissue or organ designed to reflect the amount of harm caused. Unit for dose equivalent: rem: The unit of dose equivalent, which is a measure of radiation dose related to biological effect. SI Unit is Sievert (Sv), and 1 Sv = 100 rem.

- **Exposure:** A measure of the ionization produced in air by X or Gamma radiation. Unit for Exposure: Roentgen (R): The unit of exposure. One Roentgen equals $2.58 \times 10^4$ Coulombs per kilogram of dry air at STP. Gamma Radiation ($\gamma$): Short wavelength electromagnetic radiation of nuclear origin. VERY high penetration ability.

- **Ionizing Radiation:** Electromagnetic (X ray and gamma) or particulate (alpha, beta) radiation capable of producing ions or charged particles.

- **Radiation:** Energy transmitted as electromagnetic waves or particles from a source.

- **Radioactivity:** The property of certain nuclides of spontaneously emitting particles or gamma radiations or emitting X-rays following orbital electron capture. Measured units are Curies (Ci) or SI unit, Becquerel’s (Bq). 1 Bq = 1 disintegration per second. 1 Ci = $3.7 \times 10^{10}$ Bq.

- **RAM:** Radioactive Material

**Security Alarm System**

If you experience any problems with the irradiator room security alarm system, RPP during business hours or MIT Police after hours.

- Radiation Protection (8a-5p M-F) Institute phone: 2-3477
- Cell phone: 617-452-3477
- MIT Police (off-hours) Institute phone: 100
- Cell phone: 617-253-1212