

Principal Investigator Exam Preparation Guide, Non Human-Use

I. Study References:

- A. Review of Radiation Safety Committee Policies and Procedures Manual:
http://publicsafety.tufts.edu/ehs/files/Tufts-University-RSC-Policies-and-Procedures-Manual-3_27_13.pdf
- B. NRC Reg Guide, 8.13, Instruction Concerning Prenatal Radiation Exposure
- C. NRC Reg Guide, 8.29, Instruction Concerning Risks from Occupational Radiation Exposure
- D. Demonstration of the need to provide Monitoring to Occupationally Exposed Persons (MA-98-01- April 20, 1998: <http://www.mass.gov/eohhs/gov/departments/dph/programs/environmental-health/exposure-topics/radiation/info-notice/monitoring-to-occupationally-exposed-persons.html>
- E. PerkinElmer Inc. “Guide to the Safe Handling of Radioactive Materials in Research”:
http://www.perkinelmer.com/CMSResources/Images/44-73406gde_safehandlingradioactivematerials.pdf
- F. Department of Public Health Radiation Control Program Standards for Protection Against Radiation: <http://www.mass.gov/eohhs/docs/dph/regs/105cmr120-200.pdf>
- G. Radiological Health Text Book Loaned by EHS : “ An Introduction to Radiation Protection” [Paperback] [Alan Martin](#) (Author), [Samuel A. Harbison](#) (Author)
 - a) Chapter 2, 3, 4 (pp. 31-36), 5, 6, 8 (pp. 64-70), 9 (pp. 82-87, 94-96), 11, 14, 15 & 17
- H. Closing meeting with Radiation Safety Officer: “Principal Investigator Obligation and Responsibilities”

II. Outline for PI’s:

A general understanding of the following terms and their associated concepts and a detailed understanding of the Rules and Mode of Functioning of the TUSM Radiation Hazards Control Group are expected.

A. Basic Radiation Safety Theory and Fundamentals (Ref. E, G)

1. Radiation
 - a. Ionizing radiation and non ionizing
 - b. Electromagnetic and particulate radiations (gamma, beta, alpha)
 - c. Penetrating ability (gamma, beta, alpha)
 - d. Relative internal and external hazard (gamma, beta, alpha)
 - e. Interactions with matter
2. The quantities and units of measure
 - a. Radioactivity
 - i. Curie (Ci)
 - ii. Disintegrations per minute (dpm)
 - iii. Becquerel (Bq)
 - b. Exposure, Dose , Biological Effect
 - i. Roentgen, Rad, Gray, Sievert, Rem
 - ii. Quality Factors
3. Internal Dose (Ref. E, F)
4. External Dose (Ref. E, F)

5. Acute & Chronic exposure conditions
6. Total effective dose equivalent (TEDE)
7. The characteristics of radioactive material
 - a. Physical Half-life
 - b. Biological Half-life
 - c. Effective Half-life
8. The properties of radionuclides (^3H , ^{14}C , ^{35}S , ^{32}P , ^{125}I , etc.). (Ref. E)

B. Sources of Ionizing Radiation (Ref. E, G)

1. Sources of ionizing radiation under your supervision
 - a. Radiation-generating equipment
 - b. Radioactive materials- all isotopes used under your supervision
 - c. Licensed Radioactive Materials versus Naturally Occurring Radioactive Materials
2. Sources of background radiation exposure to U.S. population, (F)
 - a. Natural background
 - b. Manmade contribution background radiation

C. Biological Effects and Risks of Exposure to Ionizing Radiation (Ref. E,G, H)

1. Biological response to ionizing radiation
 - a. Stochastic
 - b. Deterministic
 - c. Genetic
 - d. Teratogenic
2. Factors affecting biological response
 - a. Total dose received
 - b. Dose rate
 - c. Type and energy of the radiation
 - d. Area of the body irradiated
 - e. Cell sensitivity
 - f. Individual sensitivity
3. Radiation risks
 - a. Quantifying risks
 - b. The acceptability of risks
 - c. Perceived risks versus actual risks

D. Radiation Protection Standards (Ref. F, G, H)

1. Occupational limits and basis
 - a. Epidemiological studies
 - b. Dose response models
 - c. National and international recommendations

E. Applied Radiation Safety Fundamentals (Ref. A, F, H)

1. Irradiation by
 - a. Internal sources/modes of intake
 - b. External sources
2. Radiation versus radioactive material and radioactive contamination
3. ALARA

4. Signs, labels, and postings
5. Access control to Radioactive Material Use Areas
6. Radiation exposure control- Time, Distance, Shielding
7. Personal protective equipment
8. Contamination control

F. Radiation/Contamination Monitoring (Ref. A, E, H)

1. Radiation detection, measurement, and instrumentation of laboratory instruments
 - a. Principles of detection (Gas-filled and scintillation fundamentals)
 - b. Portable survey meters
 - c. Laboratory detectors (GM, NaI)
2. Personnel monitoring
 - a. External monitoring (Personnel dosimeters)
 - b. Internal monitoring (Bioassay assessment)

G. Various Institutional Responsibilities for Radiation Protection (Ref. A, H)

1. Institution's and Radiation Committee Responsibilities
2. Radiation Safety Officer's and Health Physics Section's Role and Responsibilities
3. PI's responsibilities
 - a. Rules and Mode of Radiation Committee-Institutional Policies
 - i. Security of Radioactive Materials
 - ii. Training requirements of laboratory staff
 - iii. Radiation and contamination survey frequencies and record keeping requirements
 - iv. Radioactive waste management
 - v. Radioactive material orders
 - vi. Laboratory visitors, minors in laboratory
 - vii. Where copies of the applicable regulations, DPH-Radiation Control Program License, and its application are posted or made available for examination
4. Individual's responsibilities
 - a. Following all radiological worker requirements, postings, and controls
 - b. Obligated to report unsafe conditions to the RSO
5. Individual's rights
 - a. Informed of risks and associated controls prior to commencing work
 - b. Access to radiation dose records
 - c. Access to copies of the applicable regulations, DPH-Radiation Control Program License, and Notice of Violations.
 - d. Protection of the embryo/fetus (including the right of the worker to request "declared pregnant worker status")

H. Emergency Response (Ref. A, G)

1. Response to Major and Minor radioactive spills
2. Personnel Decontamination methods