

F. Radiation Units

Two types of units are used for radiation: units of activity and units of exposure (dose). Units of activity quantify the amount of radiation emitted by a given radiation source. Units of exposure quantify the amount of radiation absorbed or deposited in a specific material by a radiation source.

1. Units of Activity

- a. The unit of activity for radiation is the curie, or Ci. The curie is an amount of radioactive material emitting 2.22×10^{12} disintegrations per minute (dpm). Most of these measurements are made with a liquid scintillation counter, gamma well counter or Geiger-Mueller survey meter (GM).
- b. NCI-Frederick laboratories routinely use only millicurie (mCi) or microcurie (μ Ci) amounts of radioactive materials.

2. Units of Exposure

- a. The rad (radiation absorbed dose) and the rem (radiation equivalent man) are the two main radiation units used when assessing radiation exposure.
- b. The rad is the unit of absorbed dose and refers to the energy deposition by any type of radiation in any type of material.
- c. The rem is the unit of human exposure and is a dose equivalent. It takes into account the biological effectiveness of different types of radiation.

3. Maximum Permissible Exposure Rates

- a. An *unrestricted area* is any area in which non-radiation workers can or may be found. The maximum permissible exposure rate anywhere in an unrestricted area is 0.25 millirem per hour. All reasonable efforts should be made to keep exposure rates in unrestricted areas below this limit.
- b. A *restricted area* is an area in which only radiation workers are allowed. The maximum permissible exposure rate anywhere in a restricted area is such that no individual will receive in a calendar quarter a dose in excess of:
 - (1) 1.25 rems to the whole body, head and trunk, active blood-forming organs, or gonads
 - (2) 3.75 rems to lens of the eye

(3) 12.5 rems to the extremities

(4) 12.5 rems to the skin of the whole body.

- c. A *radiation area* is any area accessible to personnel in which the radiation dose rate is such that a major portion of the body could receive in excess of 5 millirems per hour.
- d. A *high radiation area* is any area accessible to personnel in which the radiation dose rate is such that a major portion of the body could receive a dose in excess of 100 millirems per hour.
- e. An *airborne radiation area* is any area in which the airborne radioactivity exceeds the limits prescribed in Appendix B, 10 CFR 20 of NRC regulations, or where concentrations, averaged over the number of hours in any week during which individuals are present in the area, exceed 25 percent of the limits specified in Appendix B, 10 CFR 20.