**SNS COLLEGE OF ALLIED HEALTH SCIENCE**

Affiliated to The Tamil Nadu Dr. M.G.R Medical University, Chennai

**DEPARTMENT OF RADIOGRAPHY AND IMAGING TECHNOLOGY**

**COURSE NAME :**Quality Control, Radiobiology andRadiation Safety in Radiodiagnosis/Imaging otherthan X-ray related.

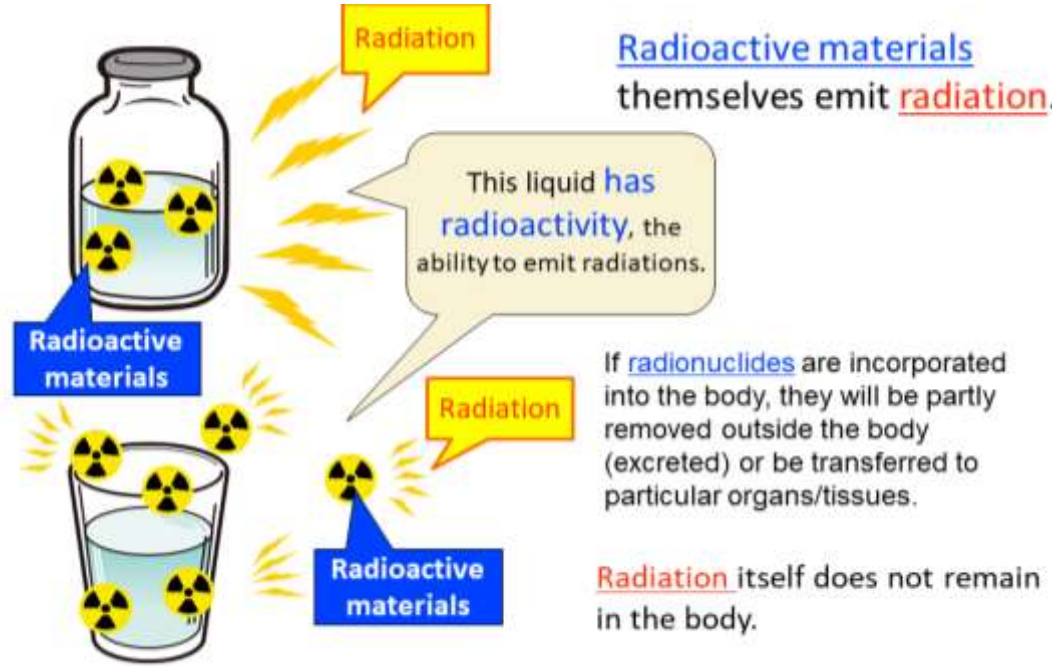
**UNIT:1**Radiation Quantities and Units

**TOPICS :** RADIOACTIVY

**FACULTY NAME :** Ms. DHANA LAKSHMI .M

# INTRODUCTION TO RADIOACTIVIE MATERIAL

- Measures rate of decay (decays per second)
- Becquerel (Bq) – Modern SI unit
- → 1 Bq = 1 decay per second
- Curie (Ci) – Old (but still used) unit

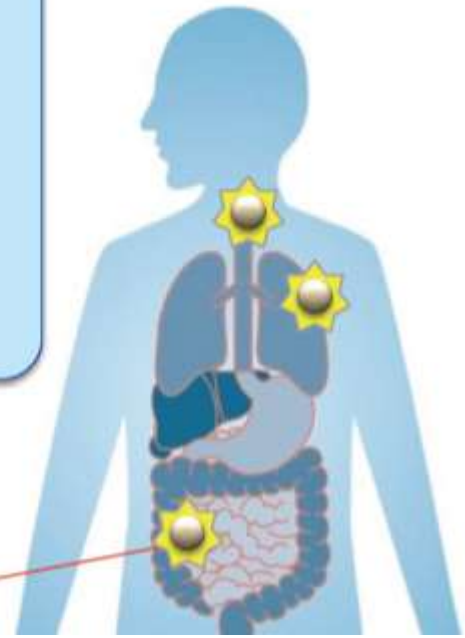


## The characteristics of radioactive materials that especially cause problems in internal exposure

(i) α-emitters > β-emitters or γ-emitters

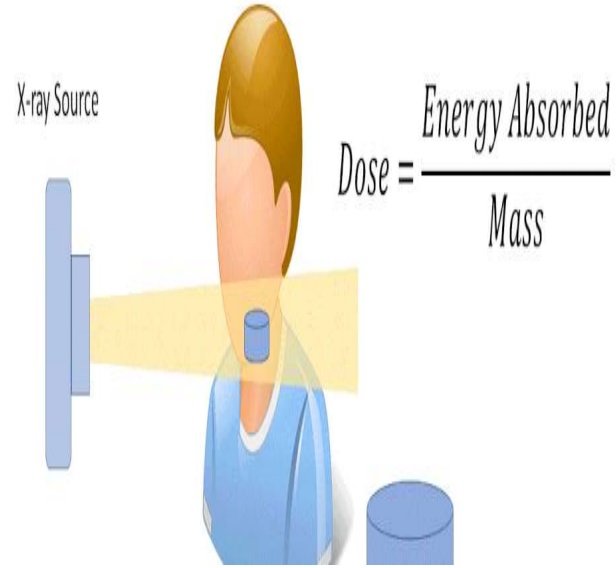
(ii) Materials that enter easily but are difficult to excrete

(iii) Materials that are likely to accumulate in specific organs



# Absorbed Dose

- Gray (Gy) – SI unit
- → 1 Gy = 1 joule of radiation energy absorbed per kg
- Rad – Old unit
- → 1 Gy = 100 rad



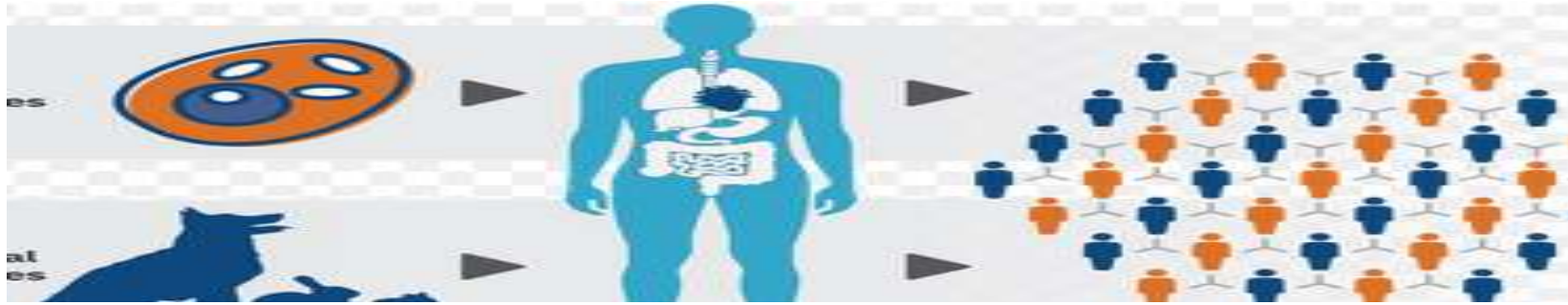
# Equivalent Dose

Same absorbed dose → different harm depending on radiation type

(α is ~20× more damaging than γ or β)

Sievert (Sv) – SI unit for equivalent dose

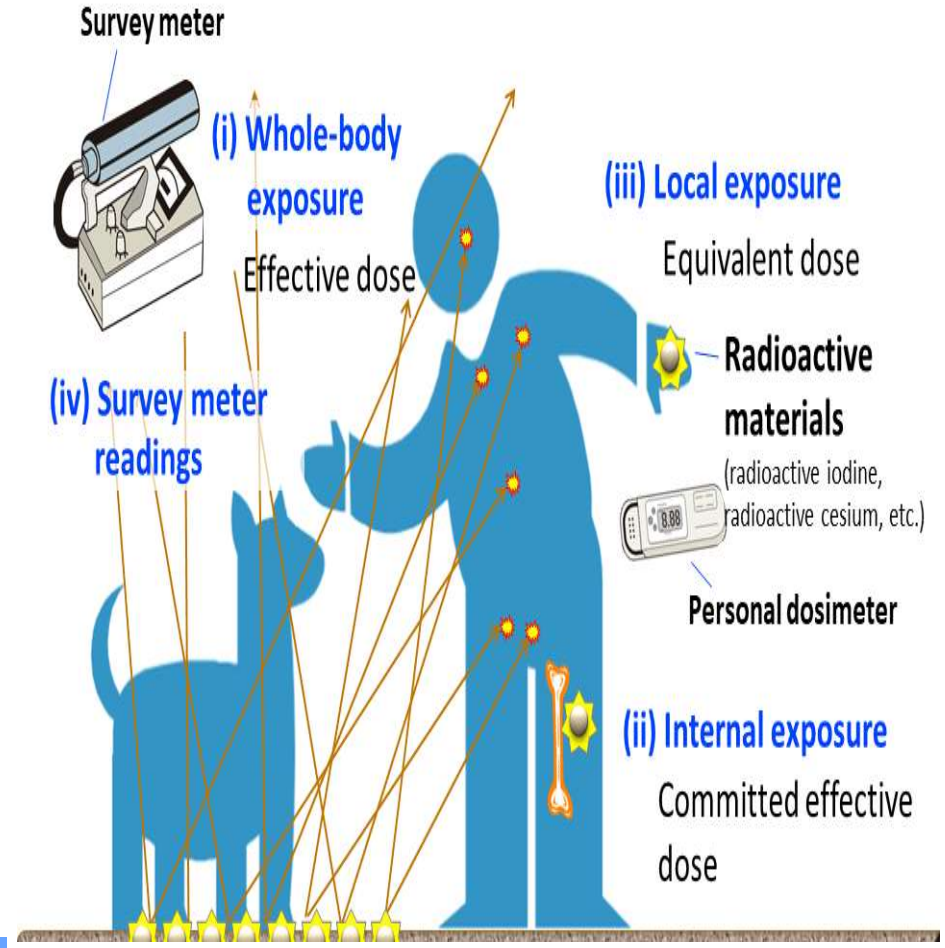
→ Equivalent dose (Sv) = Absorbed dose (Gy) × Radiation Weighting Factor (WR)



| Radiation Type | Weighting Factor (WR) |
|---|---|
| γ-rays, X-rays, β | 1 |
| γ-rays, X-rays, β | 2-5 |
| α-particles | 20 |
| Neutrons | 5–20 (energy dependent) |

# Effective Dose

- Accounts for which organs are exposed (some organs more sensitive)
- Also in Sievert (Sv)
- → Effective dose = Σ (Equivalent dose × Tissue weighting factor)



# Common annual doses

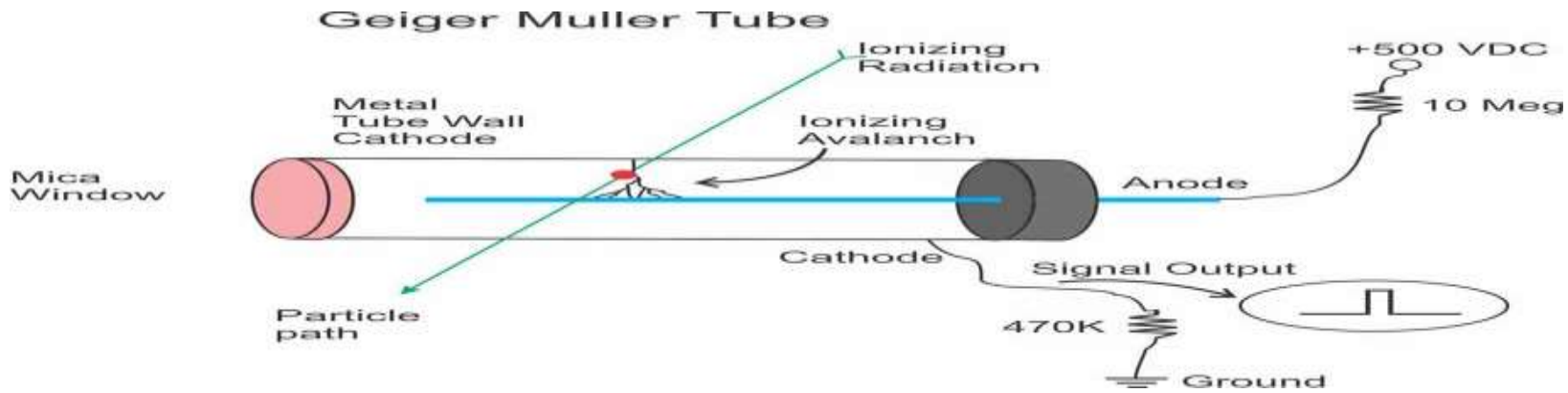
| Source | Typical Dose |
|---|---|
| Natural background | 2–3 mSv/year |
| Chest X-ray | 0.02–0.1 mSv |
| CT scan (chest/abdomen) | 0.02–0.1 mSv |
| Flight Europe–USA | 5–10 mSv |
| Fukushima evacuation limit | 0.03–0.08 mSv |
| Fatal acute dose | 20 mSv/year |

# Detection of Radiation

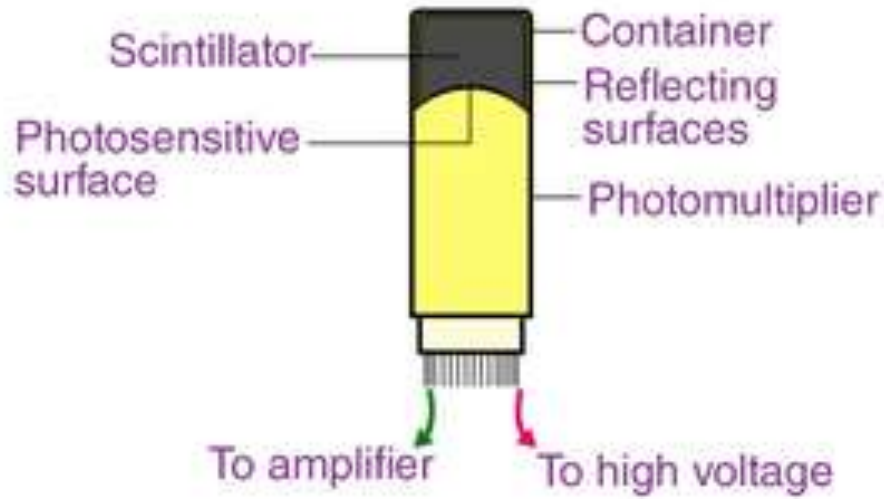
Common detectors and how they work:

•**Geiger-Müller (GM) Counter** – "Click" sound for each ionization

– Best for β and γ, not good for α – Very sensitive, used in surveys



**Scintillation Detector** – Material glows when hit by radiation → light detected – Used in medical imaging & high-precision work



## Cloud/Bubble Chamber

- Beautiful tracks of particles (historical & teaching)
- Personal dosimeters: Film badge, TLD (thermoluminescent), electronic dosimeters
- Image suggestion: Photo of GM counter + cloud chamber tracks

# SUMMARY

- Radioactivity is natural and all around us
- Three main types: α, β, γ with very different properties
- Half-life governs how long isotopes remain dangerous/useful
- When handled properly → extremely useful tool
- When mishandled → serious health risk
- “Radiation is like fire: respect it, control it, and it serves us well.”

# References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- https://www.slideshare.net/slideshow/radioactivity-spectrum-of-diagnostic-imaging-and-therapy-x-raypptx/266253279