Introduction

- Myths about radiation
  - Spider Man, The Hulk, Teenage Mutant Ninja Turtles
  - Radioactive Material Glows
Ionizing Radiation

ALPHA ($\alpha$)

BETA ($\beta$)

GAMMA ($\gamma$)
X-ray Production

Electron

Target Nucleus
Tungsten

X-rays

(BREMSSTRAHLUNG)

X-rays

(CCHARACTERISTIC)
Quantities and Units

- **Activity**
  - Curie (Ci, mCi, µCi…)
  - Becquerel (Bq, kBq, MBq…)

- **Radiation measurement**
  - Exposure: Roentgen (R)
  - Absorbed Dose: Rad \(1 \text{ Gy} = 100 \text{ RAD}\)
  - Dose Equivalent: Rem \(1 \text{ Sv} = 100 \text{ REM}\)
Exposure Standards

- **Whole Body** - 5 Rem/yr (50 mSv/yr)
  - TEDE (Sum I+E)
- **Lens of Eye** - 15 Rem/yr (150 mSv/yr)
- **Skin** (Averaged over 1 cm²) - 50 Rem/yr (500 mSv)
- **Extremities** - 50 Rem/yr (500 mSv)
- **Minors** - 10% Annual Limits
- **Embryo / Fetus** - 500 mRem (Gestation Period) (5 mSv)
- **General Public** - 100 mRem/yr; 2 mRem/hr (1 mSv/yr; 0.02 mSv/hr)
Additional Terms

- **Annual Limit on Intake (ALI):**
  - Inhalation or Ingestion Over 1 Yr
  - ALI = Smaller of CEDE (5 Rem/Yr) or CDE (50 Rem to any organ or tissue)

- **Derived Air Concentrations (DAC):**
  - Concentration if breathed for 2000 hours (or 1 YR), light work, will result in 1 ALI
  - 2000 DAC-Hours = 1 ALI = 5 Rem/Yr
Protect Yourself By:

- **TIME** -- Limit time near source
- **DISTANCE** -- Stay away
- **SHIELDING** -- Absorb energy
- **CONTAMINATION CONTROL**
Common Industrial Uses

137 Cs

55 AmBe

Co

60 27

Ir

192 77
Common Industrial Uses

Static Eliminators with Po-210
Common Industrial Uses

- Flow gauges
- Thickness gauges

Radioactive isotopes:
- Cs-137
- Kr-85
- Sr-90
- Sr-38
- Cs-55
Common Medical Uses

Medical

Brachytherapy

I-125 Seeds

Nuclear Medicine

Normal bone scan

X-rays
X-ray Analysis
Other Common Uses

Radioactive exit signs
Radiation Sterilization
Electron Particle Accelerator
Security

X-rays
Consumer Products
Old – Not So Good Ideas!