RADIATION, RADIOACTIVITY AND RISK ASSESSMENT

What is Radiation?

Radiation
- Energy moving through space as invisible waves

Non-ionizing Radiation
- Light, sound, heat or infrared waves, microwaves, radio waves, low frequency power line radiation

Ionizing Radiation

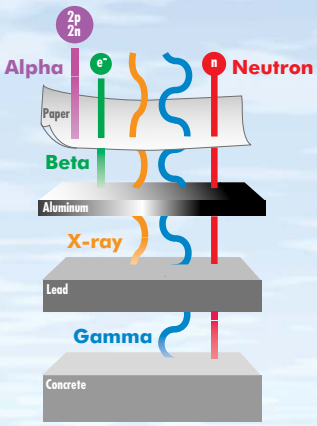
Alpha particles
(Fast moving helium nucleus)

Beta particles
(Fast moving electron)

Neutrons


Gamma, X-ray

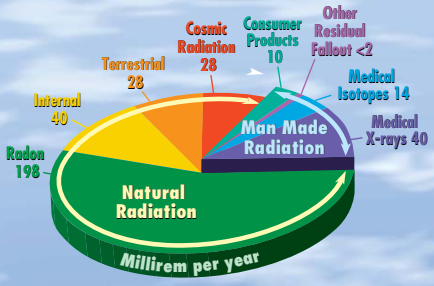
Different Types of Radiation Have Different Penetrating Powers



How do we Quantify Radiation Exposure?

REM (millirem = 1/1000 REM)
- Unit of absorbed dose in the body measuring the damage done by the energy deposited

Where Does Radiation Come From?



Total Average Yearly Radiation Dose is 360 Millirem

What is Radioactivity?

Radioactivity
- Spontaneous emission of radiation
- Is reduced as radioactive atoms decay

Radioactive Atoms
- Are unstable
- Change or ***decay*** until they become stable
- Give off surplus energy by emitting radiation

Half-Life
- The time taken to reach half the previous radioactivity
- Iodine–131 8 days
- Carbon–14 5730 years
- Uranium–238 4.5 billion years

How Do We Quantify Radioactivity?

Disintegrations Per Second (d/s)
- The number of atomic nuclei that decay each second

Radioactivity of Some Natural and Man-Made Materials

What is Risk Assessment?

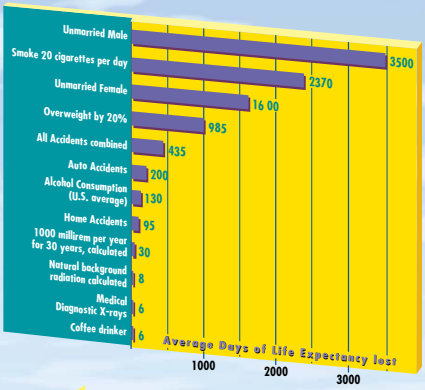
Risk Assessment
- Evaluating benefits versus risk
- Is a smoke detector worth its radiation risks?

No answer to the question:
- What is a safe level of radiation exposure? (What is a safe driving speed?)

Appropriate question to ask is:
- What is the risk associated with a given exposure? (What is the risk of injury for this situation and speed?)

Health Risks from Radiation Compared with Other Situations

Estimated Loss of Life Expectancy



Radiation Doses in Millirem from Various Exposures (annual dose unless otherwise stated)

450,000.	Acute dose, LD 50/60 (a lethal dose to 50% of a population within 60 days if no medical treatment)
100,000.	Acute dose, radiation sickness, reduced blood count, recovery
25,000.	Acute dose, reduced fertility & temporary sterility
10,000.	Dose to Chernobyl evacuees
5,000.	U.S. Occupational Dose limit
2,000.	Tobacco smoking
1,500.	Underground uranium mines
500.	NY. Grand Central Station
480.	Denver (~ 2x U.S. avg. dose)
360.	Average U.S. dose
15.	Chest X-ray
4.	Fallout
1.	Nuclear power
0.5	TV at surface
0.1	Sleeping with another human

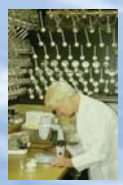
Applications / Careers

Industry
- Thickness measurement of paper and steel
- X-ray photography of jet engines
- Radioactive tracing

Archeology
- Carbon–14 dating

Agriculture
- Pest control/sterilization
- Nutrient analysis

Food
- Preservation
- Sterilization



Energy
- Nuclear power

Medicine
- X-ray diagnosis
- Radio isotope diagnosis
- Radiation therapy
- Instrument sterilization