

# 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

## 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

## What is Risk Assessment?

### Risk Assessment

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

### No answer to the question:

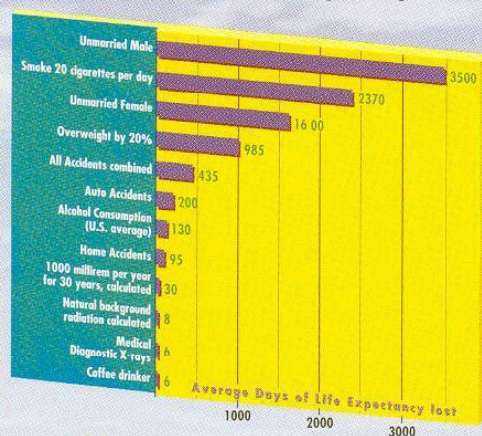
- What is a safe level of radiation exposure? (What is a safe driving speed?)

### Appropriate question to ask is:

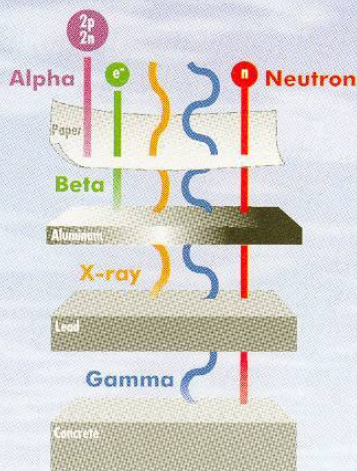
- What is the risk associated with a given exposure? (What is the risk of injury for this situation and speed?)

## Health Risks from Radiation Compared with Other Situations

Estimated Loss of Life Expectancy



## Different Types of Radiation Have Different Penetrating Powers

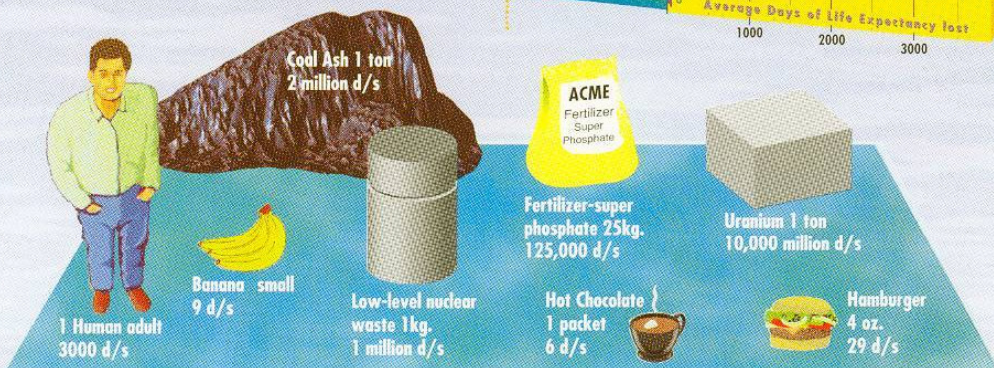


## How Do We Quantify Radioactivity?

### Disintegrations Per Second (d/s)

- The number of atomic nuclei that decay each second

## Radioactivity of Some Natural and Man-Made Materials

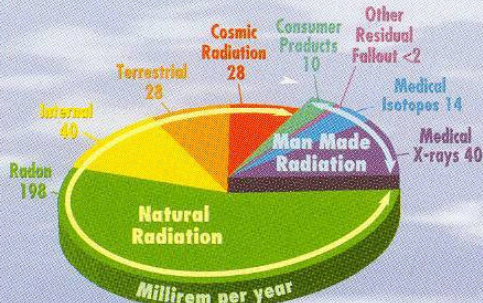


## How do we Quantify Radiation Exposure?

### 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

## 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)	500. NY. Grand Central Station
100,000. Acute dose, radiation sickness, reduced blood count, recovery	480. Denver (~ 2x U.S. avg. dose)
25,000. Acute dose, reduced fertility & temporary sterility	360. Average U.S. dose
10,000. Dose to Chernobyl evacuees	15. Chest X-ray
5,000. U.S. Occupational Dose limit	4. Fallout
2,000. Tobacco smoking	1. Nuclear power
1,500. Underground uranium mines	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