

Radiation Effects

Radiobiology

Steve Curtis

Desert Research Institute

Background Radiation

- Cosmic
- Terrestrial
- In our Bodies
- Total Radiation
 - About 300 mR per year
 - Equals about 15 X-Rays
 - Over half is from Radon

Internal vs. External Exposure

- Exposure vs. Dose
 - Energy Deposition = Dose
- External
 - Time, Distance, Shielding
 - Can Control Exposure
- Internal (Ingestion or Inhalation)
 - Near Critical Cells
 - Cannot Control Exposure

Internal Dose

- Biological half-life
- Elements spread to parts of the body
 - Close to DNA When Decay Occurs
- Heavy Elements (mostly transuranics)
 - Alpha Particle
 - Also Toxic
- Light Elements
 - Beta Particle and Gamma Rays

What Can Be Done?

- Bioassay
 - Feces
 - Urine
 - Blood
- Stable Iodine
- Chelating Agents
- Blood Transfusions
- Bone Marrow Transfusions

External Exposure

- Alpha is of no concern
- Beta is of minor concern
 - Mostly Skin Effects
- Gamma is of most concern
 - Penetrating
 - Dosimeters
- What do I do?
 - Time, Distance, Shielding
 - Anti-Cs to Stop Internal Exposure

What Does Radiation Do?

- Changes the Chemistry in our Bodies
 - Cells are the bodies' workhorses
 - DNA is the body's Master Plan
 - Water is 70% of Body Mass
- Water Chemistry Affects our Cells
 - Free Radicals
 - DNA Effects
 - Natural Anti-Oxidants

What Should Concern Us?

- Our bodies cannot sense radiation
 - Dose must be calculated
 - Radiation sensors
 - Bioassay
 - Background Radiation
- Radiation Damage
 - No effect
 - Repaired Damage
 - Cell Death
 - Unrepaired Damage (Mutations)

DNA Effects



Possible Damage Agents

Oxidative Processes
Toxins
Radiation

Short-Term Effects (Acute)

Massive Cell Death
Body Functions Cease
“Radiation Sickness”
Levels of 10,000,000 X Background

Long-Term Effects (Stochastic)

Unrepaired Damage
Mutations
Abnormal Protein Production
Unwanted Reproduction → Cancer

Possible Illnesses

- Cancer
- Premature Aging
- Damage to the Immune System
- Bad Mutations
 - Produce Genetic Diseases in the Organism
 - Produce Genetic Diseases in Progeny
- More Pronounced Effects in Dividing Cells
 - Fetus, Children
 - Crypt Cells, Stem Cells in Bone Marrow