What is Radiation?

Radiation is a type of energy moving in the form of particles or waves. Ionizing radiation is energy emitted from unstable atoms.

We are immersed in a constant sea of radiation:
» Cosmic from the sun
» Terrestrial from the earth
» Medical diagnosis and procedures
» Consumer products (watches, televisions, food, smoke detectors, airline travel)
» Atomic weapons fallout (negligible in recent years)
» Commercial nuclear power plants (2/1000 of cosmic dose at 1-mile)

Exposure vs. Contamination

**Exposure** – Exposure to ionizing radiation (Gamma, X-Rays, and Neutrons) can penetrate the body. Alpha and Beta are particles, and they do not penetrate very far into the body.

If someone is exposed to external radiation they:
» Do not become radioactive
» Pose no hazard to nearby individuals
» Do not become contaminated

**Contamination** – Unwanted radioactive material in or on the body, or spread about the environment (radioactive material in unwanted places).

If someone is externally contaminated, they can spread contamination:
» About 80% can be removed by taking off clothing
» Most remaining contamination can be removed by gently washing skin and hair

**Internal Contamination** – Can result from inhalation, ingestion, absorption, puncture or open wound.

Internally contaminated persons present a minimal risk to responders, but are usually externally contaminated as well.
Biological and Health Effects

Acute and Chronic Radiation Doses
- Acute Radiation Dose – a large dose received in a short period of time (minutes, hours, days)
  - Overwhelming damage; cells may die before repair can occur
- Chronic Radiation Dose – a small dose received over a long period of time (months, years)
  - Less damage; fewer number of cells needing repair

How Radiation Affects the Body
- Genetic effects
- Cancer (slight risk compared to natural occurrences)
- Embryo (can be damaged by high doses)

Damage to Cells Exposed to Radiation – Cells can react in four possible ways
- May pass through the cell without doing damage
- May damage the cell, but the cell may be able to repair the damage before producing new cells
- May damage the cell in such a way that the damage is passed on when new cells are formed
- Cells may die as a result of the damage

Factors Affecting Biological Damage
- Total Dose – the greater and longer the dose, the greater damage
- Gender – females are more susceptible
- Age – developing embryo/fetus, young children and the elderly more susceptible
- Organs Irradiated – sensitive organs including the intestinal tract, blood, hair follicles, reproductive organs

How to Reduce Exposure

ALARA – As Low As Reasonably Achievable
- **Time** – Decrease the time spent near the radioactive source
- **Distance** – Increase the distance between you and the radioactive source
- **Shielding** – Increase the physical shielding between you and the radioactive source