Health and Uranium Mining
Overview

- What is radioactivity?
- How does it harm us?
- An overview of nuclear power generation
- Uranium mining and health
- Research
What is ionizing radiation?

- Isotopes - same # protons and electrons, different # neutrons
- stable, unstable ("radioactive")
- Subatomic particles, high energy photons ("ionizing radiation", "radioactivity")
- Decay products ("daughters", "progeny")
Uranium/Nuclear industry

- Uranium 238, 235
- Uranium mining
- Refining (Port Hope), enrichment (U.S.)
- Depleted uranium (U 238)
- Cost
Nuclear Power-Inside a Reactor

- Neutrons bombard uranium, atoms split, release more neutrons ("nuclear fission"), self-sustaining
- If uncontrolled creates massive blast, heat (nuclear bomb)
- If controlled (neutron absorbing, moderating materials, coolant) - heat – boil water – turbine - electricity
- Fuel rods (alpha)
- Spent fuel rods - fission products-+++-radioactive and toxic (gamma)
- U fragments, 200 new products
- Plutonium – reactor fuel, bombs
- Cooled, waste
Health effects of IR

- Gamma (penetrating)
- Alpha, beta (non-penetrating, internal emitters)- ingestion, inhalation
- Polonium, U 238, radon - alpha-emitters
- Strontium 90, cesium 137, iodine 131 - beta-emitters
- Acute radiation sickness
- DNA damage (cancer, birth defects, miscarriage, stillbirth, reduced fertility)
- Immune dysfunction
- Diabetes, heart disease
- Inheritable disease
Most susceptible – blood, gonads, embryonic tissue, GI tract, growing bones and cartilage

Continuous, irreversible
Background radiation

- 2.4 mSv/yr background
- Cosmic rays (gamma), radon (alpha)
- Additional 1.0 mSv/yr acceptable for the public
- Nuclear power, above ground weapons testing, accidents
- Medical procedures, air travel
• Nuclear workers 100 mSv/5 yr, max. 50 mSv/yr
• 3.2 excess cases of fatal cancer per 100 workers over a 40 year career
• 1/10,000 to 1/million fatalities are considered acceptable
Safety

- Linear non-threshold model
- No safe threshold
- Children, women more vulnerable
- Dose localized, not diffuse
- Spikes
Studies on Uranium Mining and Health

- New Mexico (Homestake Mining Co.)
- Navajo (American SW)
- Czech Republic
- Germany
- France (Areva)
- Millworkers, miners
- None Canadian
Healthy worker effect

Melatonin theory

Poor follow-up

Smoking

Different years working

Small numbers
Uranium millworkers

- Uranium, silica, vanadium dust
- Inhaled - soluble – kidneys, insoluble – lungs; ingested - kidneys
- Birth defects in animals
- Chronic renal disease
- Respiratory diseases
- Lung cancer
- Sarcomas, Hodgkin’s lymphoma
Uranium miners

- Radon
- Working level months (radon amount X months of work)
- Exposure 1950s-1990s
- Mortality of workers, comparison of disease rates in region
- Small numbers
Results

- Lung cancer, 20 year latency, smoking
- Brain/CNS, kidney (France)
- Stomach cancer (Germany)
- Respiratory diseases
- Depression
- Birth defects
- Micronuclei in lymphocytes