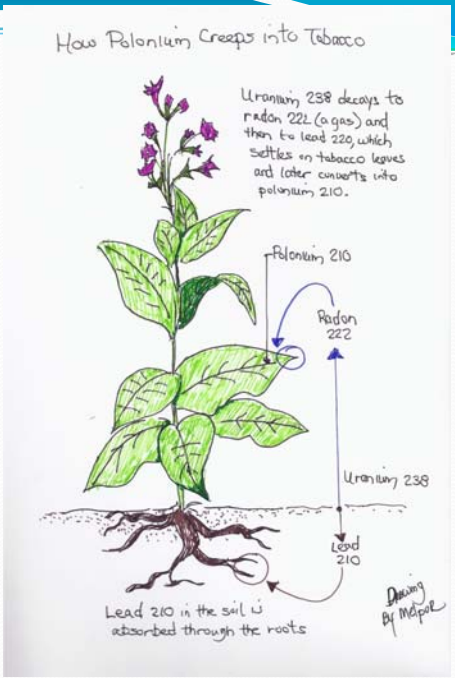
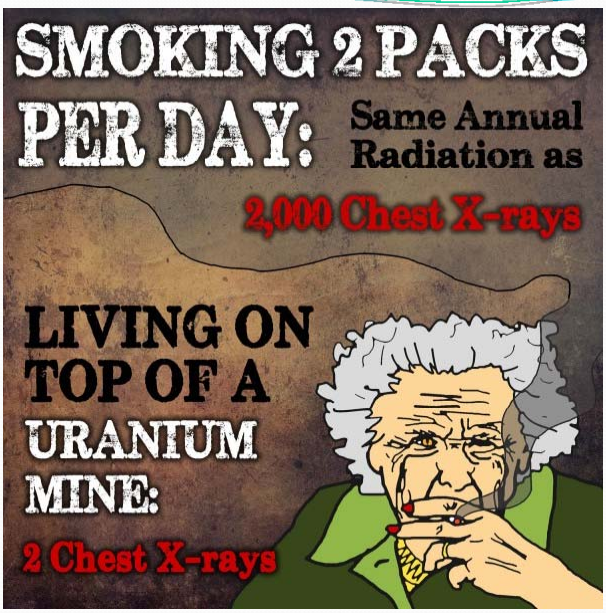
Everyday Sources and Uses of Radiation

Is All Radiation Bad?

Tobacco

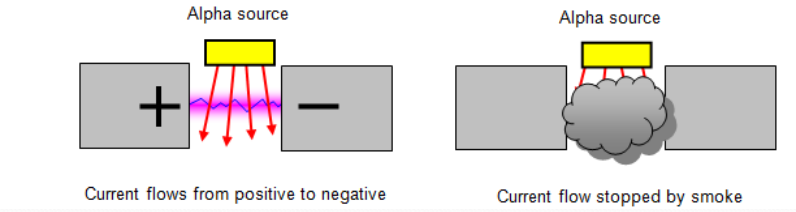
- How tobacco causes cancer:
  - Radioactive materials in the atmosphere stick to the tobacco leaves and remain on the plant throughout the manufacturing process.
  - The lead-210 and polonium-210 radiation emitted by the tobacco smoke is trapped in the lungs of the people exposed to it.
  - Over the course of decades of inhaling tobacco smoke, the smoker's lungs are damaged, and the smoker -- and folks exposed to the second-hand smoke -- may develop lung cancer.



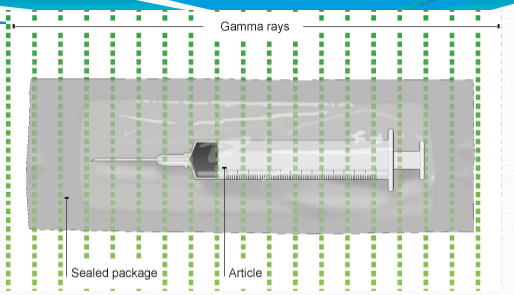


Smoke Detectors

- Two types of smoke detectors:
  - Ionization smoke detectors detect use radioactive isotopes.
  - Photoelectric smoke detectors utilize a light sensor.
- An ionizing smoke detector does not pose a danger to you as long as you don't take it apart.
  - Radioactive americium-241 that is sealed in a chamber and emits alpha particles and gamma rays. Ionizing smoke detectors work by sounding an alarm when smoke interrupts the flow of alpha particles.



Gamma Sterilization

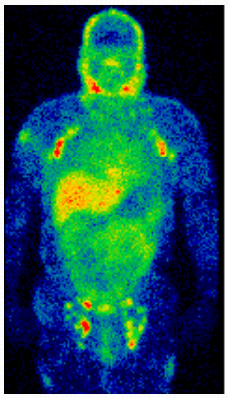


- Safe, reliable, highly effective, and environmentally preferred
- A clean instrument is sealed inside an air-tight bag. The bag and instrument are then treated with gamma radiation that can penetrate the bag
- These gamma rays can kill the bacteria (cells); and the air-tight bag will keep the instrument sterile until the bag is opened in the medical facility.

Radioactive Tracers

- Used to investigate the body without the need for invasive surgery.
- Tracer is ingested or injected depending on which part of the body is being investigated.
- The radioactive material is given enough time to move around the body before a detector is placed outside the body to detect any gamma rays or beta particles that pass out of the body
- This creates a picture of the internal organs
- The radioisotopes used have short half-lives so that they are quickly eliminated from the body.

- The patient is given an injection of a substance that consists of a small amount of radioactively labeled sugar. The radioactive sugar can help in locating a tumor, because cancer cells take up or absorb sugar more avidly than other tissues in the body.



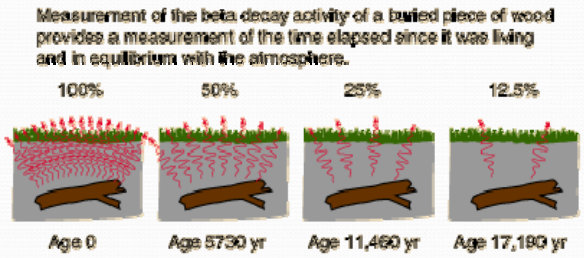
Blood Transfusions

- Patients with compromised immune systems can develop severe problems if they are exposed to foreign antibodies and bacteria from donors' blood.
- Expose the donated blood to radiation to kill off the unwanted antibodies while keeping the red cells intact.
- Caesium-137 is used in small hospital units to treat blood before transfusion

Food Preservation

- Food irradiation is the process of exposing boxes or pallets of food products to radiation from a cobalt-60 source
- Lower doses of radiation delay ripening, inhibit sprouting, and extend shelf-life by reducing spoilage
- Slightly higher doses are effective for the dis-infestation of insects in food - eliminating the risk of introducing foreign insects to other countries.
- Higher doses significantly reduce or kill pathogens such as E.coli, listeria, and salmonella in seafood, meats, and poultry

Carbon Dating



- Carbon 14 breaks down radioactively over time at constant rate.
- Scientists use the ratio of carbon 14 isotopes within an object to figure out the object's approximate age.