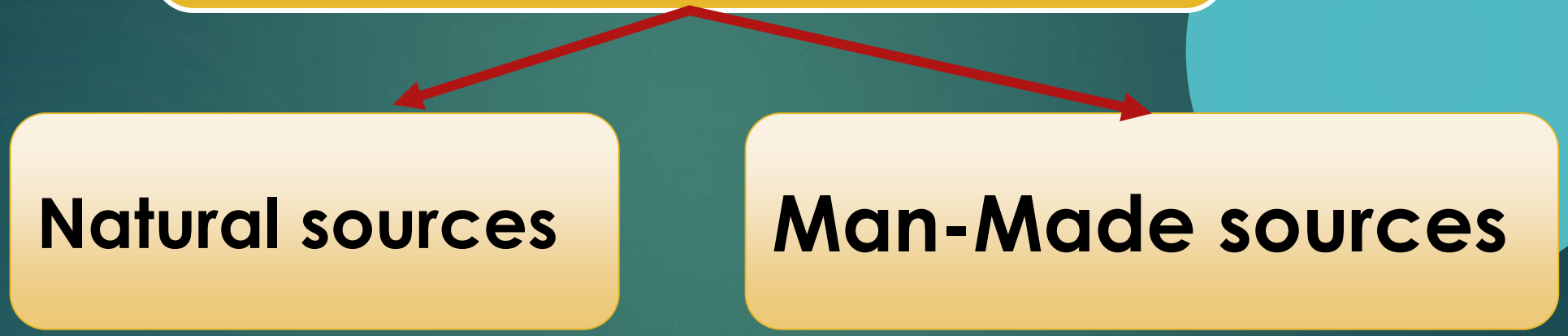
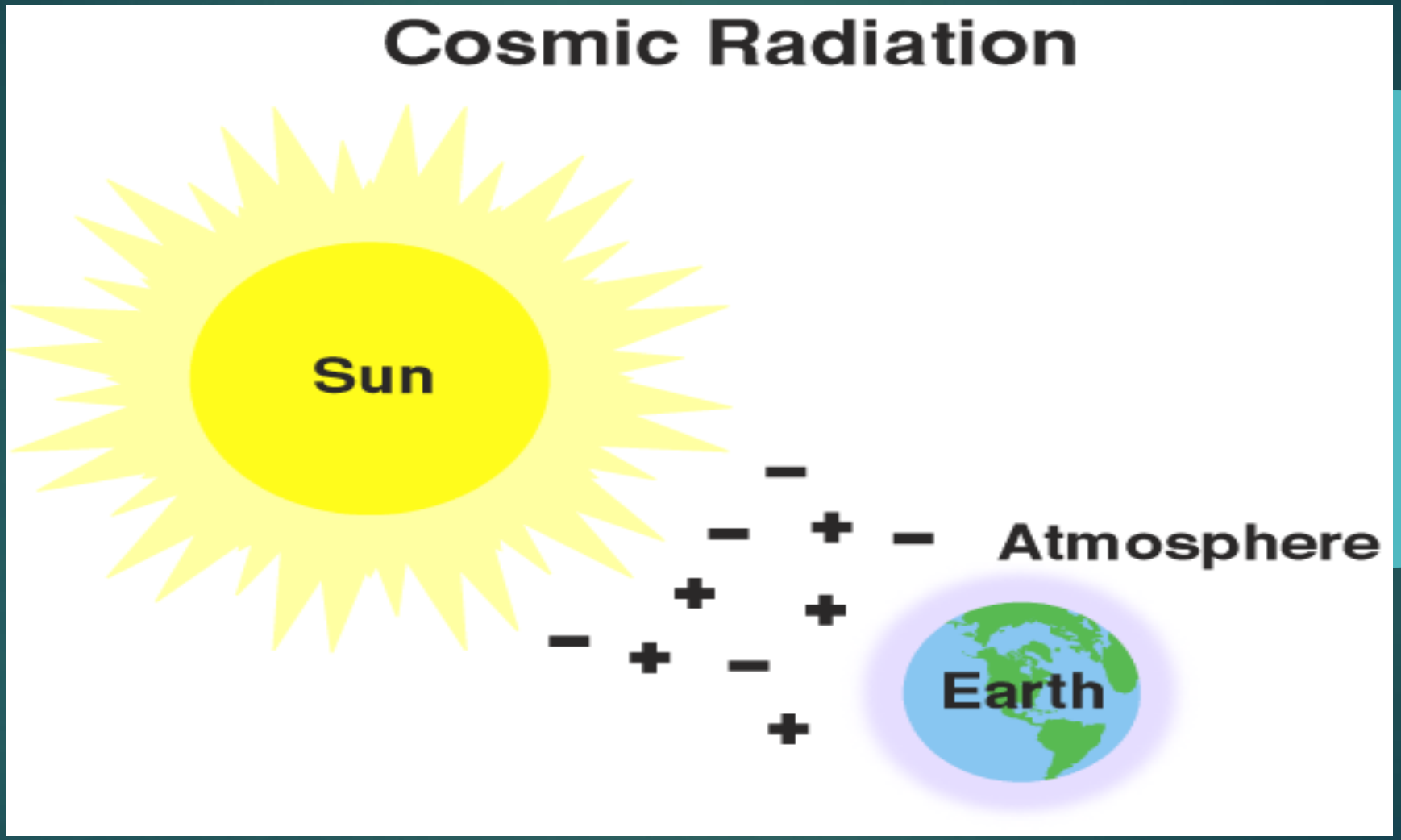
Radiation protection –Theoretical
Lec2. Radiation Sources

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Radiation Sources



- **Natural Background Sources:**
  - Cosmic Radiation
  - Terrestrial Radiation
  - Internal Radiation


Cosmic Radiation
Sun
Atmosphere
Earth

- **Cosmic Radiation :**The earth, and all living things on it, are constantly bombarded by radiation from space, similar to a steady drizzle of rain. Charged particles from the sun and stars interact with the earth's atmosphere and magnetic field to produce a shower of radiation, typically beta and gamma radiation. The dose from cosmic radiation varies in different parts of the world due to differences in elevation and to the effects of the earth's magnetic field.

- **Terrestrial Radiation Radioactive material found in:**
  - **Soil**
  - **Water**
  - **Vegetation**

- Radioactive material is also found throughout nature. It is in the soil, water, and vegetation. Low levels of uranium, thorium, and their decay products are found everywhere. Some of these materials are ingested with food and water, while others, such as radon, are inhaled. The dose from terrestrial sources also varies in different parts of the world. Locations with higher concentrations of uranium and thorium in their soil have higher dose levels. The major isotopes of concern for terrestrial radiation are uranium and the decay products of uranium, such as thorium, radium, and radon.

- **Radon : is a gas naturally occurring radioactive gas that is formed by the decay of uranium in rocks and soil. It has no smell, colour or taste. It can seep into buildings and homes and accumulate to dangerous levels. Radon can also be found in water.Radon escapes easily from the ground into the air, where it decays and produces further radioactive particles**

- **Internal Radiation**
  - **Potassium-40**
  - **Carbon-14**
  - **Lead-210**

- **In addition to the cosmic and terrestrial sources, all people also have radioactive potassium-40, carbon-14, lead-210, and other isotopes inside their bodies from birth. The variation in dose from one person to another is not as great as the variation in dose from cosmic and terrestrial sources. The average annual dose to a person from internal radioactive material is about 40 milli rems/year**

- **Man-made radiation sources result in exposures to:**
- **Members of the public**
- **Occupationally exposed individuals**

- **Man made sources**
  - **Medical source**
  - **Consumer source**
  - **Other source**

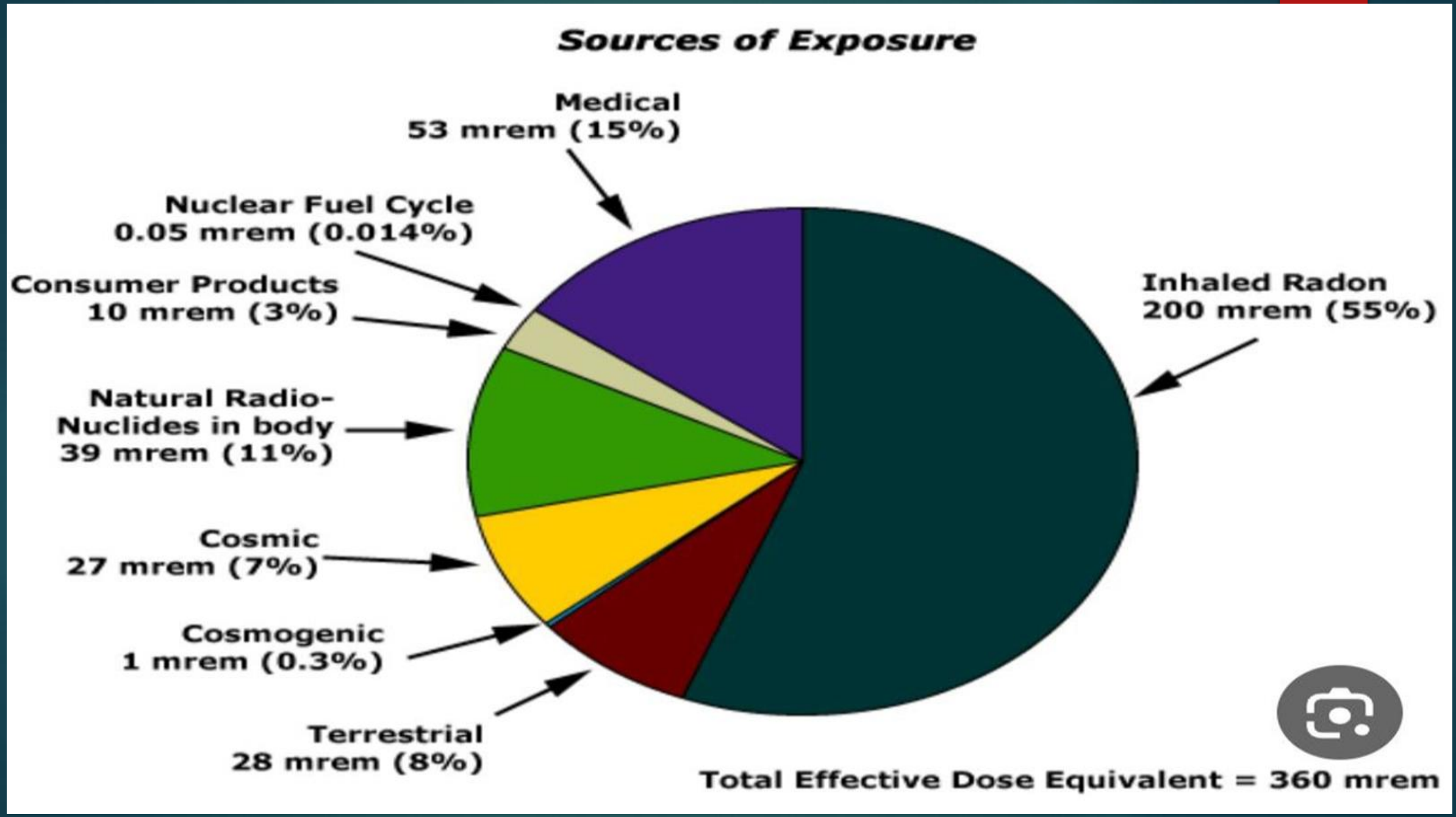
Medical Sources

The largest source of medical exposure, is from diagnostic x-rays, including both chest or limb x-rays and dental x-rays. Other sources such as nuclear medicine includes treatment of disease. Some examples are cobalt irradiation for the treatment of cancers, or the injection of radioactive jodine which concentrates in the thyroid for treatment of Graves' disease.

Consumer Products

Radiation is used in the manufacturing of many consumer products. It can be used to determine the thickness of materials and the quality of welds in structures such as bridges and buildings. This use of radiation can expose workers in the factory, but it does not make the consumer product radioactive Some consumer products naturally contain radioactive materials. They include tobacco products, phosphate fertilizers and certain ceramics, smoke detectors, fluorescent light bulbs

- **Other Sources**
- **This category includes the generation of electricity from both coal and nuclear power plants, the transportation of nuclear materials, and the storage of nuclear wastes. These sources make up less than one percent of the annual radiation exposure.**


Sources of Exposure
Medical
53 mrem (15%)
Nuclear Fuel Cycle
0.05 mrem (0.014%)
Consumer Products
10 mrem (3%)
Natural Radio-
Nuclides in body
39 mrem (11%)
Cosmic
27 mrem (7%)
Cosmogenic
1 mrem (0.3%)
Terrestrial
28 mrem (8%)
Inhaled Radon
200 mrem (55%)
Total Effective Dose Equivalent = 360 mrem