



Natural and Man-Made Radiation Sources



Health Physics Society - Power Reactor Section
Radiation Science Education



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Introduction

- Scientists have studied radiation for over 100 years and we know a great deal about it.
- Radiation is part of nature. All living creatures, from the beginning of time, have been, and are still being, exposed to radiation.
- Sources of radiation can be divided into two categories:
 - **Natural Background Radiation**
 - **Man-Made Radiation**

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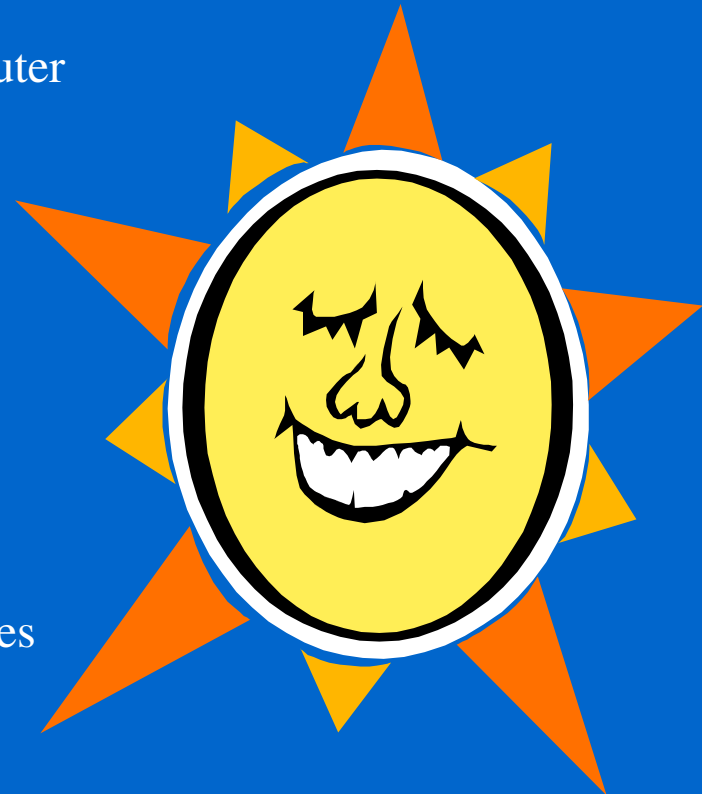
Natural Background Radiation

- Cosmic Radiation
- Terrestrial Radiation
- Internal Radiation

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Cosmic Radiation

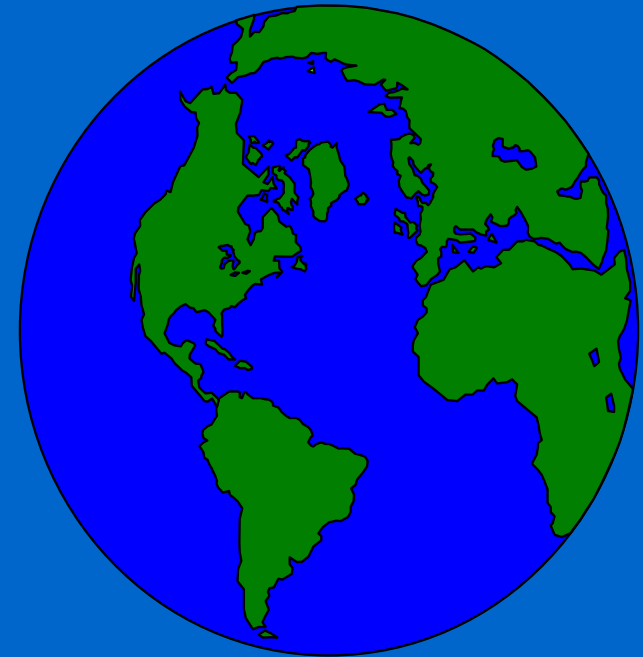
- The earth, and all living things on it, are constantly bombarded by **radiation** from outer space, similar to a steady drizzle of rain.
- Charged particles from the sun and stars interact with the earth's atmosphere and magnetic field to produce a shower of radiation.
- The amount of cosmic radiation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



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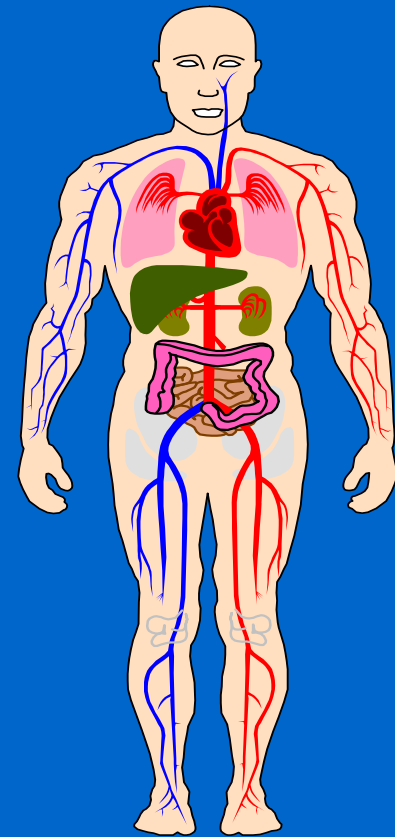
Terrestrial Radiation

- **Radioactive material** is also found throughout nature in soil, water, and vegetation.
- Important radioactive elements include uranium and thorium and their radioactive decay products which have been present since the earth was formed billions of years ago.
- Some radioactive material is ingested with food and water. Radon gas, a radioactive decay product of uranium is inhaled.
- The amount of terrestrial radiation varies in different parts of the world due to different concentrations of uranium and thorium in soil.



Internal Radiation

- People are exposed to radiation from radioactive material inside their bodies. Besides radon, the most important internal radioactive element is naturally occurring potassium-40 but uranium and thorium are also present.
- The amount of radiation from potassium-40 does not vary much from one person to another. However, exposure from radon varies significantly from place to place depending on the amount of uranium in the soil.
- On average, in the United States radon contributes 55% or all radiation exposure from natural and man-made sources. Another 11% comes from the other radioactive materials inside the body.



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Man-Made Radiation Sources

- The Nuclear Regulatory Commission and other federal and state agencies regulate exposure from man-made radiation sources. Different regulations apply to two distinct groups:
 - Members of the public
 - Occupational workers

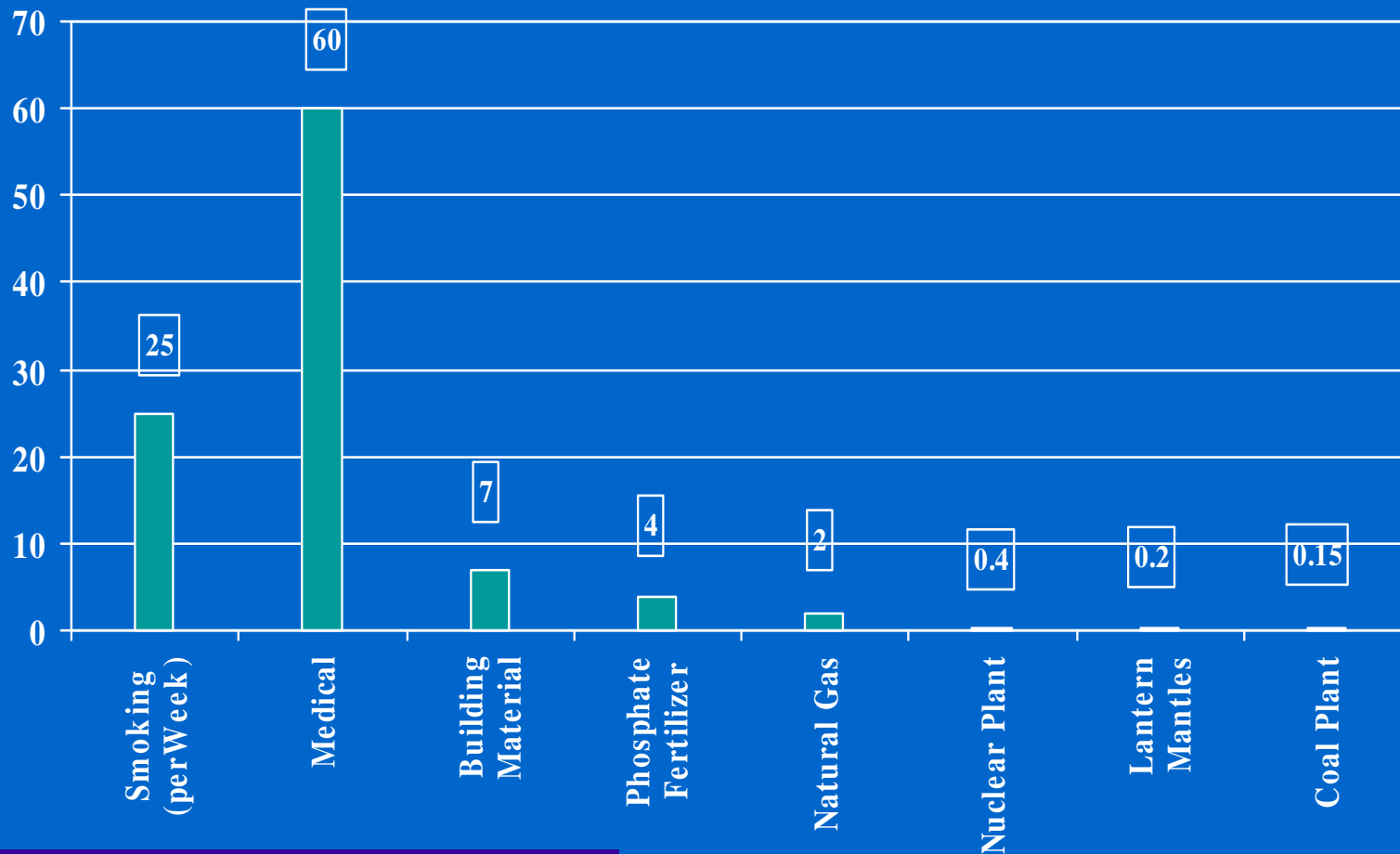
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Sources of Exposure

- Examples of man-made sources of radiation to members of the public:
 - Natural gas
 - Lantern mantles
 - Medical diagnosis
 - Building materials
 - Nuclear power plants
 - Coal power plants
 - Tobacco
 - Phosphate fertilizers
- Student activity: Guess which sources contribute the most to man-made radiation exposure:
 - (1)
 - (2)
 - (3)
 - (4)
 - (5)
 - (6)
 - (7)
 - (8)

Annual Average Dose (mrem/year)

man-made source



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How Radiation is Used

- Science

- carbon dating to determine age
- instruments to measure density
- power satellites

- Medicine

- x-rays and nuclear medicine
- diagnose and treat illness

- Industry

- smoke detectors
- kill bacteria and preserve food

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Radiation in Medicine

- Radiation used in medicine is the largest source of man-made radiation.
- Most of our exposure is from diagnostic x-rays.

