

INVESTIGATION 10**HOW DOES RADIATION AFFECT YOU?****INTRODUCTION**

When people hear the word *radiation*, they think of nuclear war, cancer, genetic mutations, and environmental destruction. Radiation is perceived as something to be feared. It is unfortunate that important decisions in our society can be based on these perceptions, rather than on knowledge and understanding of radiation.

The long-standing connection between nuclear weapons, peaceful uses of nuclear energy, and natural sources of radiation complicate the public perception of the risks associated with radiation. Many believe that the existence of nuclear weapons poses an enormous threat to world peace and to mankind's very existence; others feel very strongly that nuclear weapons have served as a major deterrent to war. Some people accept the use of nuclear energy only if the nuclear power plant and the nuclear waste disposal site are located in someone else's town, preferably in someone else's state. Regardless, radioactive materials have come to play an increasingly important role in our society. Much research work depends on the availability of nuclear reactors and particle accelerators. Radioactive isotopes are routinely used in thousands of ways to improve the quality of our lives and for scientific research. Important uses include areas of medical diagnosis and treatment, agriculture, geology, environmental science, and biochemistry, to name a few.

Much of the utility of radioactive isotopes is attributable to the fact that they have the same chemical properties as the stable isotopes of the same element. For example, a plant can be fertilized with a radioactive isotope of phosphorus, and a Geiger counter or other radiation detector can be used to tell how much phosphorus is taken up through the roots by a particular plant, how fast it is taken up, and where it goes within the plant. Radioactive isotopes that emit gamma radiation can be used to kill bacteria, sterilize food, or treat cancers. The ratio of uranium-238 to lead-206 can be used to estimate the age of any uranium-bearing rock or mineral. Such measurements have resulted in estimates of about 4 billion years for the age of many rocks. Since the earth must be at least as old as the rocks and minerals that make up the earth, geologists tell us that the earth must be at least 4 billion years old. **In this exercise you will evaluate your personal radiation exposure over a typical year.**

OBJECTIVE

To evaluate your personal radiation dose and discriminate among the major sources of radiation exposure to the general public.

PROCEDURE

1. Complete the “Personal Radiation Chart” to estimate your annual dose of radiation from natural and man-made sources. Compare your dose with those of your classmates. Construct a frequency distribution (e.g. bar diagram) that shows the estimated annual radiation doses for all of the students in your class.

ANALYSIS

2. What factors (individual radiation sources) are responsible for placing some students at the upper end of the distribution?

CONCLUSIONS

3. How significant is radon as a natural source of radiation?

Personal Radiation Chart (modified from Brookins 1990)

Source	Radiation Dose (mrem/yr) ¹
Cosmic radiation at sea level Add 1 mrem/yr for each 100 feet that you live above sea level in addition to the base figure of 28.	28 _____
Food and beverages	28 _____
Medical x-rays Add 40 mrem/yr for each chest or body x-ray; add 14 mrem/yr for each dental x-ray received during the past year.	_____
Building materials Add 100 mrem/yr if your home is brick or cement; add 5 mrem/yr if your home is wood.	_____
Ground radiation	26 _____
Nuclear weapons fallout	4 _____
Airline travel Add 1 mrem/yr for each 1500 miles flown in a commercial jet during the past year.	_____
Power plant Add 0.3 mrem/yr if you live within 5 miles of a nuclear or coal power plant.	_____
Color TV Add 1-2 mrem/yr depending on how much you watch (approximately 0.1 mrem/yr for each hour of TV watched each week).	_____
Luminous watch dial Add 3 mrem/yr if you wear one.	_____
Indoor radon Add 100 mrem/yr for each pCi/L of radon in your household air. If your home has not been measured, use the national average of 1.5 pCi/L.	_____
Your Total Annual Radiation Dose	_____

¹Radiation dose can be measured in several ways. The unit called millirem per year (mrem/yr) is one commonly used unit of measurement.



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