



Radiation in the Environment



Since the beginning of time, all living creatures have been, and are still being, exposed to radiation. Nonetheless, most people are not aware that is a natural part of our environment.

When our planet was formed, radiation was present — and radiation surrounds it still. Natural radiation showers down from the distant reaches of the cosmos and continuously radiates from the rocks, soil, and water on the Earth itself.

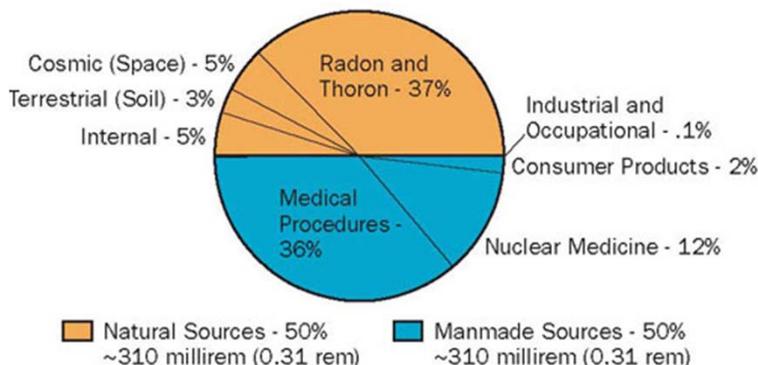
During the last century, mankind has discovered radiation, how to use it, and how to control it. As a result, some manmade radiation has been added to the natural amounts present in our environment.

Many materials — both natural and manmade — that we come into contact with in our everyday lives are radioactive. These materials are composed of atoms that release energetic particles or

waves as they change into more stable forms. These particles and waves are referred to as *radiation*, and their emission as *radioactivity*.

A chart of the public's exposure to ionizing radiation (displayed at left) shows that people generally receive a total annual dose of about 620 millirem. Of this total, natural sources of radiation account for about 50 percent, while man-made sources account for the remaining 50 percent.

Sources of Radiation Exposure in the United States



Source: NCRP Report No.160(2009)
Full report is available on the NCRP Web site at www.NCRPpublications.org.

Types of Ionizing Radiation

Radiation that has enough energy to disturb the electrical balance in the atoms of substances it passes through is called ionizing radiation. There are three basic forms of ionizing radiation.

Alpha

Alpha particles are the largest and slowest moving type of radiation. They are easily stopped by a sheet of paper or the skin. Alpha particles can move through the air only a few inches before being stopped by air molecules. However, alpha radiation is dangerous to sensitive tissue inside the body.

Beta

Beta particles are much smaller and faster moving than alpha particles. Beta particles pass through paper and can travel in the air for about 10 feet. However, they can be stopped by thin shielding such as a sheet of aluminum foil.

Gamma

Gamma radiation is a type of electromagnetic wave that travels at the speed of light. It takes a thick shield of steel, lead, or concrete to stop gamma rays. X-rays and cosmic rays are similar to gamma radiation. X-rays are produced by manmade devices; cosmic rays reach Earth from outer space.



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Cosmic Radiation

Cosmic radiation is high-energy gamma radiation that originates in outer space and filters through our atmosphere.

Sea Level.....26 mrem/year
 Atlanta (1,050 ft)..... 31 mrem/year
 Denver (5,300 ft).....50 mrem/year
 Minneapolis (815 ft).....30 mrem/year
 Salt Lake (4,000 ft).....46 mrem/year

Terrestrial Radiation

Terrestrial sources are naturally radioactive elements in the soil and water such as uranium, radium, and thorium. Average levels of these elements are 1 pCi/g of soil.

U.S. (average).....26 mrem/year
 Denver, CO.....63 mrem/year
 Nile Delta, Egypt.....350 mrem/year
 Paris, France.....350 mrem/year
 Kerala, India.....400 mrem/year
 McAlpe, Brazil.....2,448 mrem/year
 Pocos de Caldas, Brazil.....7,000 mrem/year

Buildings

Many building materials, especially granite, contain naturally radio-active elements.

U.S. Capitol Bldg.....85 mrem/year
 Statue of Liberty.....325 mrem/year
 Grand Central Sta.....525 mrem/year
 The Vatican.....800 mrem/year

Radon

Radon levels in buildings vary, depending on geographic location, from 0.1 to 200 pCi/liter.

Average indoor radon levels....1.5 pCi/liter
 Occupational working limit...100.0 pCi/liter

Because the radioactivity of individual samples varies, the numbers given here are approximate or represent an average. They are shown to provide a perspective for concentrations and levels of radioactivity rather than dose.

mrem = millirem
pCi = picocurie

Food

Food contributes an average of 20 mrem/year, mostly from potassium-40, carbon-14, hydrogen-3, radium-226, and thorium-232.

Beer.....390 pCi/liter
 Tap Water.....20 pCi/liter
 Milk.....1,400 pCi/liter
 Salad Oil.....4,900 pCi/liter
 Whiskey.....1,200 pCi/liter
 Brazil Nuts.....14 pCi/g
 Bananas.....3 pCi/g
 Flour.....0.14 pCi/g
 Peanuts & Peanut Butter.....0.12 pCi/g
 Tea.....0.40 pCi/g

Medical Treatment

The exposures from medical diagnoses vary widely according to the required procedure, the equipment, and film used for X-rays, and the skill of the operator.

Chest X-Ray..... 10 mrem
 Dental X-Ray..... 1.5 mrem

Consumer Goods

Cigarettes-2 packs/day...8,000 mrem/year (polonium-210)
 Color Television..... <1 mrem/year
 Gas Lantern Mantle.....2 mrem/year (thorium-232)
 Highway Construction..... 4 mrem/year
 Airplane Travel-39,000 ft....0.5 mrem/year (cosmic)
 Natural Gas/Heating and Cooking (radon-222).....2 mrem/year
 Phosphate Fertilizers.....4 mrem/year

Natural Radioactivity in Florida Phosphate Fertilizers (in pCi/gram)

	xxxxx	xxxxx	xxxxx
Ra-226	21.3	21.0	33.0
U-238	20.1	58.0	6.0
Th-230	18.9	48.0	13.0
Th-232	0.6	1.3	0.3

Porcelain Dentures.....1,500 mrem/year (uranium)
 Radioluminescent Clock.....<1 mrem/year (promethium-147)
 Smoke Detector.....0.01 mrem/year (americium-241)

International Nuclear Weapons Test Fallout

From pre-1980 atmospheric tests average for a U.S. citizen.....1 mrem/year

References and Further Reading:

<http://www.nrc.gov/about-nrc/radiation/around-us/sources.html>

How Do I Get More Information?

To get more information about radiation in the environment, contact:

National Park Service

- Email greatkillscleanup@nps.gov
- Call our **Public Affairs Office at 718-354-4606**