Background radiation

From Wikipedia, the free encyclopedia
http://en.wikipedia.org/wiki/Background_radiation

Background radiation is the ionizing radiation from several natural radiation sources: sources in the Earth and from those sources that are incorporate in our food and water, which are incorporated in our body, and in building materials and other products that incorporate those radioactive sources; radiation sources from space (in the form of cosmic rays); and sources in the atmosphere which primarily come from both the radon gas that is released from the earth's surface and subsequently decays to radioactive atoms that become attached to airborne dust and particulates, and the production of radioactive atoms from the bombardment of atoms in the upper atmosphere by high-energy cosmic rays.
Since 1945 it also comes from low levels of global radioactive contamination due to nuclear testing.

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Natural background radiation

Natural background radiation comes from three primary sources: cosmic radiation, terrestrial sources, and radon. The worldwide average background dose for a human being is about 2.4 mSv per year [1] (pdf). This exposure is mostly from cosmic radiation and natural isotopes in the Earth.

Cosmic radiation

The Earth, and all living things on it, are constantly bombarded by radiation from outside our solar system of positively charged ions from protons to iron nuclei. This radiation interacts in the atmosphere to create secondary radiation that rains down, including X-rays, muons, protons, alpha particles, pions, electrons and neutrons. The dose from cosmic radiation is largely from muons, neutrons, and electrons.

The dose rate from cosmic radiation varies in different parts of the world based

largely on the geomagnetic field and altitude.

Terrestrial sources

Radioactive material is found throughout nature. It occurs naturally in th
soil,
rocks, water, air, and vegetation. The major radionuclides of concern for
terrestrial radiation are potassium, uranium and thorium. Each of these
sources
has been decreasing in activity since the birth of the Earth so that our
present
dose from potassium-40 is about 1⁄2 what it would have been at the daw
of life
on Earth. Some of the elements that make up the human body have
radioactive
isotopes, such as potassium-40, so there is also a very small amount of
internal
radiation.

Radon

Radon gas seeps out of uranium-containing soils found across most of
the world
and may concentrate in well-sealed homes. It is often the single largest
contributor to an individual's background radiation dose and is certainly
the most
variable in the United States. Many areas of the world, including
Cornwall and
Aberdeenshire in the United Kingdom have high enough natural
radiation levels

that nuclear licensed sites cannot be built there—the sites would already exceed
legal radiation limits before they opened, and the natural topsoil and rock would
all have to be disposed of as low-level nuclear waste.

Artificial "background" radiation

Every above-ground nuclear detonation scatters a certain amount of radioactive contamination. Some of this contamination is local, rendering the immediate surroundings highly radioactive, while some of it is carried longer distances as nuclear fallout; some of this material is dispersed worldwide. Nuclear reactors may also release a certain amount of radioactive contamination. Under normal circumstances, a modern nuclear reactor releases minuscule amounts of radioactive contamination. However, reprocessing plants released waste, including plutonium, directly into the ocean. Major accidents, which have fortunately been relatively rare, have also released some radioactive contamination into the environment; this is the case, for example, with the Windscale fire (Sellafield accident) and the Chernobyl accident.

The amount of radioactive contamination released by human activity is rather small, in global terms, but the radiation background is also rather low. Some sources claim that the Earth's background radiation level has tripled since the beginning of the twentieth century. In fact, the total amount of radioactivity released by man is inconsequential to the large quantities of radioactivity in the natural environment [2] (pdf).

Artificial radiation sources

The radiation from natural and artificial radiation sources are identical in their nature and their effects. These materials are distributed in the environment, and in our bodies, according to the chemical properties of the elements. The Nuclear Regulatory Commission, the Environmental Protection Agency, and other U.S. and international agencies, require that licensees limit radiation exposure to individual members of the public to 100 mrem (1 mSv) per year, and limit occupational radiation exposure to adults working with radioactive material to 5 rem (50 mSv) per year, and 10 rem (100 mSv) in 5 years.

The exposure for an average person is about 360 millirems/year, 80 percent of which comes from natural sources of radiation. The remaining 20 percent results from exposure to artificial radiation sources, such as medical X-rays and a small fraction from nuclear weapons tests.

Other usage

In other contexts, background radiation may simply be any radiation that is pervasive. A particular example of this is the cosmic microwave background radiation, a nearly uniform glow that fills the sky in the microwave part of the spectrum; stars, galaxies and other objects of interest in radio astronomy stand out against this background.

In a laboratory, background radiation refers to the measured value from any sources that affect an instrument when a radiation source sample is not being measured. This background rate, which must be established as a stable value by multiple measurements, usually before and after sample measurement, is subtracted from the rate measured when the sample is being measured.

Background radiation for occupational doses measured for workers is all radiation dose that is not measured by radiation dose measurement instruments in potential occupational exposure conditions. This includes both "natural background radiation" and any medical radiation doses. This value is not typically measured or known from surveys, such that variations in the total dose to individual workers is not known. This can be a significant confounding factor in assessing radiation exposure effects in a population of workers who may have significantly different natural background and medical radiation doses. This is most significant when the occupational doses are very low.

Reference:
http://www.unscear.org/unscear/en/publications/2000_1.html
[United Nations] UNSCEAR 2000 REPORT Vol. I

SOURCES AND EFFECTS OF IONIZING RADIATION

United Nations Scientific Committee on the Effects of Atomic Radiation
UNSCEAR 2000 Report to the General Assembly,with scientific annexe

Volume I: SOURCES

CONTENTS:

Report to the General Assembly
(without scientific annexes;17 pages)
Includes short overviews of the materials and conclusions contained in the scientific annexes

Scientific Annexes:

* Annex A: Dose assessment methodologies (63 pages)
* Annex B: Exposures from natural radiation sources (74 pages)
* Annex C: Exposures from man-made sources of radiation (134 pages)
* Annex D: Medical radiation exposures (203 pages)
* Annex E: Occupational radiation exposures (158 pages)