



NUCLEAR INFORMATION AND RESOURCE SERVICE

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Questions and Answers on Radiation

Q1. What is ionizing radiation?

A1.

Ionizing radiation is energy that is given off by unstable atoms as they decay.

In a nuclear power reactor core, radioactive uranium atoms split into smaller radioactive atoms (like cesium, strontium, iodines) which give off alpha, beta and gamma radiation. These particles and waves have sufficient energy to cause damage to DNA and cells if they get into the environment and our bodies.

Q2. How is radiation measured?

A2.

Radiation is detected with specialized instruments, such as geiger counters. Different instruments detect the different types of radiation. They count the radioactive emissions (particles and rays from the nucleus of the atom).

1 emission per second is a becquerel (Bq)

37 billion emissions per second equal one Curie (Ci). 1 Ci= 37 Billion Bq

Radiation DOSES are somewhat complicated *calculations* based on assumptions about the amount, type of radiation, the angle of exposure. Although the effects are different depending on the body mass and gender of the individual exposed, this is not incorporated into the dose calculation.

The units used are Sieverts (Sv) and Rems (r).

A thousandth of a Sievert is a millisievert (mSv);

A thousandth of a Rem is a millirem (mr).

A thousandth of a mSv is a microSievert (uSv);

A thousandth of a millirem is a microrem (ur).

1 Sievert = 100 rems

10 microSieverts = 1 millirem

(For more radioactive unit conversions see <http://www.nirs.org/fukushima/crisis.htm> under 'more information.')

Q3. IS there a safe level of radiation?

A3.

No, there is no safe level of radiation. Every exposure to ionizing radiation increases our risk of cancer. Radiation causes other health problems such as ischemic heart disease, reduced immunity, birth defects and mutations.

Even natural background radiation has health risks, and in some places steps can be taken to minimize exposure, for example to radon.

Children are many times more vulnerable to radiation, as are elders. A National Academy of Sciences report (BEIR-3) found that women are 50% more likely than men to suffer cancer from radiation.

Q4. What are “normal” levels of radiation?

A4.

Background levels of radiation vary depending on elevation, location, time, rock formations. For years background has been approximately 80 millirems/year at sea level, not including radon. Government and industry charts estimate that we receive 360 millirems per year including about half of that from radon. Those charts attribute about 60 millirems per year from naturally occurring radiation from the earth and sun.

The US Environmental Protection Agency (in 40 CFR 90) limits members of the public to 25 millirems a year from a nuclear power facility. The US Nuclear Regulatory Commission allows 100 millirems per year. (These are *legal levels*, not “safe levels.”)

We list these for comparison to the millirem numbers that are being estimated from the failing nuclear power reactors and their accompanying irradiated fuel pools.

Q5. How does nuclear power radiation differ from natural background?

A5. The uranium in nuclear power reactors splits to make “fission products” and absorbs neutrons to form “transuranics” that are very biologically active. Some of the radioactive elements formed decay very rapidly (in a few minutes, hours, days); some take hundreds to millions of years. The persistent elements bioaccumulate in the food chain. They give external doses but also can concentrate in bones, muscles and other organs and irradiate from within for as long as they remain radioactive and lodged in the body. The radiation from the sun and from the rocks exposes us from outside. It does not concentrate inside. Radon gas occurs naturally and it can be breathed into the body. Medical radioactivity is generally very short lasting and gives a specific benefit to the patient.

For more on radiation see Chapter 2 of *Out of Control – On Purpose: Dispersal of Radioactive Waste into Landfills and Consumer Products*.

<http://www.nirs.org/radwaste/outofcontrol/outofcontrolreport.pdf>

More factsheets on radiation are at <http://www.nirs.org/radiation/radiationhome.htm>