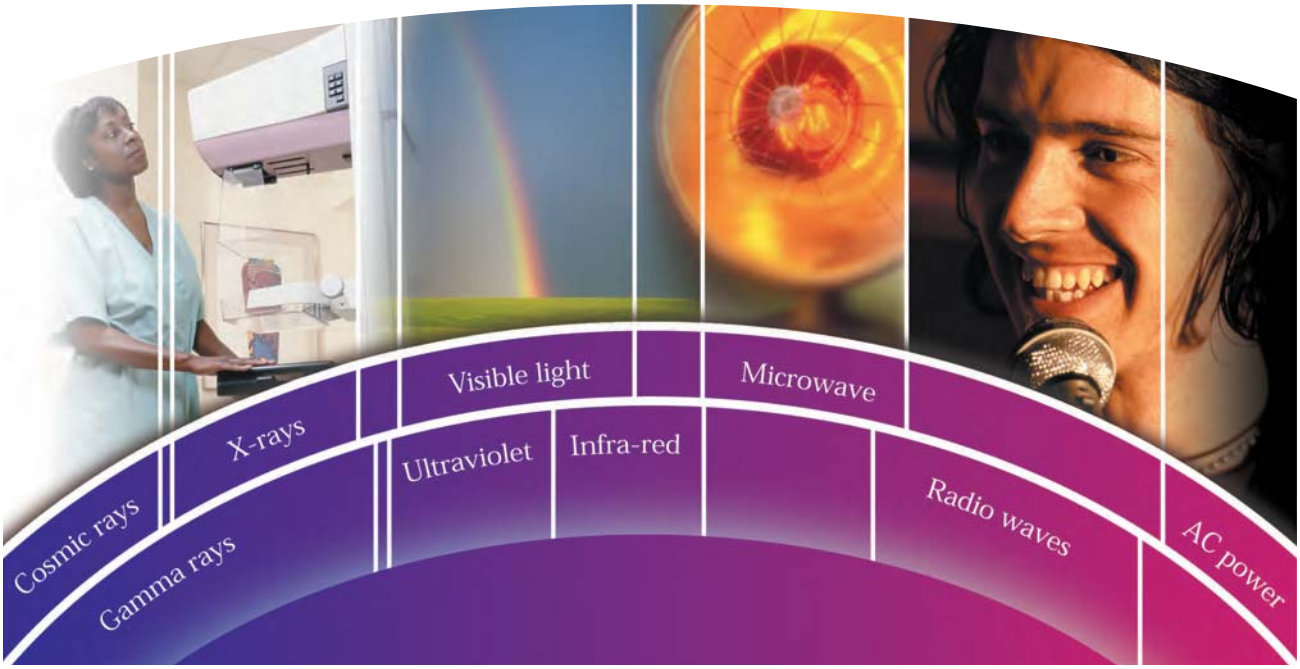
NUCLEAR *facts*

Does radiation come only from nuclear power plants?

NO. MOST OF THE RADIATION TO WHICH WE ARE EXPOSED COMES FROM NATURAL SOURCES.

Radiation is all around us, it is unavoidable. The amount of radiation from natural sources varies considerably around the world with some groups receiving many times the average amount with no observable effect.

Radiation is energy that travels through space in the form of waves or atomic particles that give up all or some of their energy on contact with matter. "Ionizing radiation" is radiation which has sufficient energy to produce ions when it interacts with matter. This includes alpha and beta particles, gamma and X-rays and high-energy neutrons. Non-ionizing radiation includes heat, visible light, microwaves, radio waves and others.



Ionizing radiation

The various kinds of ionizing radiation are:

- X-rays are used in diagnostic medicine; X-rays are similar to light rays but they have the power to penetrate flesh, bone and metal;
- Gamma rays, which are similar to X-rays, are also used in medicine for the treatment of cancer; they usually have greater penetrating power than X-rays;
- Cosmic rays take the form of energetic particles that bombard the Earth from outer space. They are more intense above the Earth's protective atmosphere. For example, passengers flying at a high altitude are exposed to more radiation than people standing on the surface of the Earth;
- Alpha particles are positively charged particles that are emitted naturally from such elements as uranium, radium and some man-made elements. Alpha particles have such low penetrating power that they can be stopped by a sheet of paper or by our skin. However, if these particles are swallowed or breathed into the human body they can do more damage than other types of radiation;
- Beta particles are fast-moving electrons; they are smaller than alpha particles and some can penetrate a centimetre of water and human flesh, but a sheet of aluminum several millimetres thick can stop them; and
- Neutrons are highly penetrating particles released when atoms collide with other highly energetic particles, or during fission, when atoms are split in a nuclear reactor. A shield of water and thick concrete around the nuclear reactor core provides protection from these particles.

Accurate measurement of radiation is easy

Techniques developed over the years since the discovery of X-rays in 1895 enable the measurement of very small amounts of radiation – many times lower than the level of radiation that exists from natural sources. The dose of radiation is expressed as sieverts (Sv) and takes into account the effect of the radiation on humans. An exposure to one sievert produces the same biological effect, regardless of the type of radiation involved. Low levels of radiation are measured in one-thousandths of a sievert, or millisieverts (mSv).

Radiation is a fact of life

We live in a "sea" of radiation – from space, from our planet, and, to a much smaller degree, from various man-made sources. **Table 1** gives typical amounts of radiation Canadians receive from natural sources.

A promising and growing application of ionizing radiation is the preservation of food. It can be used to prevent e-coli and salmonella in meats; control the ripening of fruits and vegetables to extend their shelf life; and to inhibit sprouting in root crops such as potatoes and onions.

Carefully monitored and controlled, ionizing radiation is a gift of nature that can be safely used to our great benefit.

See also the Web site of the United Nations Scientific Committee on the Effects of Atomic Radiation www.unscear.org

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Table 1.

Typical radiation doses from natural sources (mSv/yr)

Source	Average	Range
Cosmic radiation	0.40	0.3 to 1.0
External terrestrial	0.48	0.3 to 0.6
Inhalation (radon)	1.2	0.2 to 10.0
Ingestion	0.3	0.2 to 0.8
Total	2.4	1.0 to 10

There are also many man-made sources of ionizing radiation, the largest being X-rays and radioisotopes used in medical diagnostics. Others include: radiation sources used in industry for such purposes as radiography and sterilization of medical instruments; the remaining fall out from nuclear weapons testing from the 1950s to 1970s; nuclear power plants. High radiation doses are given deliberately for the treatment of cancer but these are not considered here. **Table 2** gives some typical doses from these sources.

Table 2.

Typical radiation doses from man-made sources (mSv/yr)

Source	Average	Range
Medical diagnosis*	0.4	0.04 to 1.0
Nuclear bomb testing	0.005	0.004 to 0.006
Nuclear power	0.0002	0.0001 to 0.02

* The dose from various medical diagnostic procedures varies considerably. A chest X-ray will give about 0.14 mSv while a lower gastrointestinal tract examination gives about 6.4 mSv.

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