

rems and mrems

In view of the discussions
about the effect of nuclear power
on the environment,
these notes on sources of radiation and the
amounts received by
man may be of assistance.
They are extracted from
"Nuclear Energy and the Environment"
produced by the Agency as an
addendum to its
annual report to the Economic and
Social Council of the United Nations,
1969—70.
Copies of the booklet are available on request.

Natural sources

Man has always been subjected to natural radiation; his body contains natural radioactivity and when two men meet they are in effect irradiating each other. Indeed natural radiation induces mutations, one of the main factors that causes the evolution of living species. But excessive radiation injures human tissue, can cause cancers and genetic damage.

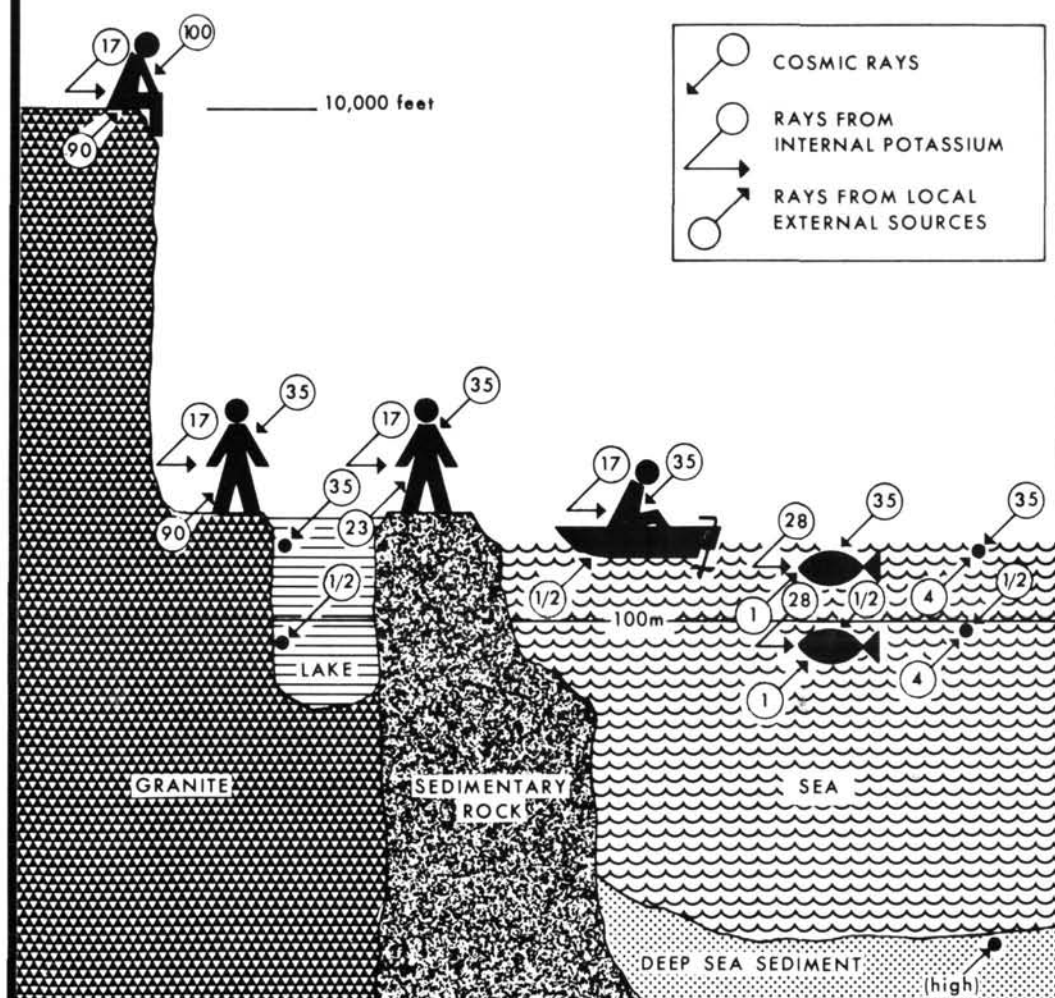
Natural radiation induces cosmic radiation; there are also naturally occurring radionuclides in the ground, air, sea, plants and animals, as well as in the human body. The levels of natural background radiation differ greatly in various parts of the world. The doses received from the ground differ considerably from place to place depending on the composition of the soil.

Man-made sources

In addition to natural sources of radiation man is exposed to sources of radiation he himself has created. Man-made sources of radiation include the fall-out from nuclear bomb testing, radioactivity released in the course of nuclear power production, and ionizing radiation used for various medical and industrial purposes.

natural radiation

Information from "The Effects of Atomic Radiation on Oceanography and Fisheries" NAS-NRC Pub 551/1957



TOTAL NATURAL DOSES (mrad/year) —

Man over granite		Man over sedimentary rock	Man over sea	Large fish in sea		Micro-organism in sea	
10,000	m.s.l.	75	52	at surf.	100m	at surf.	100m
207	142			64	30	39	5

— A mrad is one thousandth of a rad, the unit for indicating absorbed energy in tissues.

Nuclear weapons testing is the major source of man-made radioactive contamination of the environment (besides adding psychologically to the anxiety of many people about other applications of the atom). The United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) periodically produces and up-dates reports on the levels of radioactive contamination throughout the world and the contribution that fall-out makes to such contamination. Since the conclusion of the partial Test-Ban Treaty in 1963, these levels have been decreasing.

Medical sources

Ionizing radiation is now one of the most valuable tools for research, diagnosis and treatment. The table given here indicates that medical exposures, although many times larger than exposures resulting from all other peaceful uses of nuclear energy put together, are still only a quarter of the amounts received from natural radioactivity.

Average yearly dose to the population

(information taken from the Report of UNSCEAR, 1962)

	Genetically significant dose (mrem)
Natural radiation	125
Medial exposure:	
Diagnostic	30
Therapeutic	5
Occupational and miscellaneous exposure including all peaceful uses of atomic energy except medical	2

One mrem is one-thousandth of a rem, the unit of ionizing radiation giving the same biological effect as that due to one roentgen of X-rays (thus Roentgen Equivalent, Man)

The International Commission on Radiation Protection (ICRP) has set a recommendation for the genetic dose to the population as a whole over a period of thirty years with respects to exposures other than by naural radiation and by medical treatment. This must not exceed 5000 mrem over the period. Generally this means that all exposures except those from natural background and medical applications should not contribute on average more than 170 mrem per year. Present exposure is only about one quarter per cent of this figure.

The ICRP has also recommended dose limits for the individual members of the public to guard against harmful effects. Whether the individual dose limit or the genetic dose is overriding depends on many factors which are beyond the scope of this discussion and it is enough to say that the number of people exposed is a very significant factor. However, the highest degree of exposure to people living in the vicinity of a reactor is only a few tenths of the dose limits permitted.