

# POPULATION EXPOSURE TO RADIATION: NATURAL AND MAN-MADE

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## 1. Radiation in the environment

Environmental radiation can be detected with great sensitivity. With modern instrumentation and calibration techniques the exposure level can be quantitatively measured to a precision of better than five per cent, even at the extremely low levels of natural background. By proper use of spectroscopic techniques, it is also practical to distinguish between particular natural and man-made sources [27].

Only during the past two decades has the radiation environment of mankind been surveyed extensively [1], [60], [61], primarily to monitor fallout from weapons tests. Considerable data were available more than 40 years ago, but those studies were directed toward an understanding of cosmic rays, rather than environmental exposures [36]. Summaries and bibliography can be found in the annexes of [11], [22].

Numerous studies have been made of the biological effects of radiation. The scope can be appreciated by examining the UNSCEAR reports (for example, see bibliography in [60] pp. 67-83, 108-117, and 183-206). Although laboratory experiments have been limited to plants and animals, several groups of humans, inadvertently exposed, have also been studied. With rare exception, the observations have been based on exposures which were extremely large and at high rates by comparison with environmental levels. No data exist which give dose response curves at such low doses. To be conservative, all standards setting bodies *assume* that the high level, high rate, dose response curves extrapolate linearly to zero dose, that is, that no threshold exists below which radiation is harmless. However, it must be emphasized that the nonthreshold, linear response is an *assumption* and not a scientific fact. A major objective of a statistical study would be to obtain better information on the shape of the low dose response curve.

Despite the sensitivity and precision for measurement of radiation, and despite the extensive knowledge of biological effects, the health hazards associated with environmental radiation are difficult, if not impossible, to evaluate.

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