

AUSTRALIAN NUCLEAR FORUM

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Background Radiation (Adopted 8/8/02, Revised 13/9/12)

Mankind has evolved in a world continuously bombarded by cosmic rays from outer space and has been exposed to radiation from radioactive substances in the air we breath, the water we drink, the food we eat and consequently even our own bodies. Collectively this radiation is called "natural background radiation." In addition modern life has also contributed to the total through the use of various medical procedures, some industrial applications, high altitude flying, and past bomb tests.

The radiation doses received by people from natural background vary markedly depending on local geologies, altitude, latitude and exposure to indoor radon gas. The world average annual dose is about 2.4 mSv ("milli-Sieverts") but this can range from 1 to over 200 (ref. UN Scientific Committee on the Effects of Atomic Radiation, 2000 Report). The table below shows the radiation doses for 10 European countries (Australian doses are comparable). Included is a 0.35 mSv/y contribution from radioactive isotopes normally in the body including K-40 (half-life 1.3 billion years), plus about 90µg of uranium plus C-14, H-3 and Po-210.

Two locations with the highest recorded natural background levels are Kerala in India and Ramsar in Iran. The dose rates in Kerala vary from 15 to 30 mSv/y due to local thorium-containing monazite sands. Ramsar dose rates range from 10 to 260 mSv/y mostly due to radium dissolved in the local waters. Interestingly there is little or no evidence that this has had any adverse effect on the health of local residents.

Natural Radiation Dose, mSv/y

COUNTRY	RADON	COSMIC & EXTERNAL	TOTAL*
Finland	6.26	1.01	7.62
France	4.00	0.95	5.3
Germany	2.33	0.8	3.48
Greece	3.44	0.89	4.68
Ireland	2.89	0.78	4.02
Italy	2.73	0.99	4.07
Netherlands	1.35	0.69	2.39
Sweden	4.73	1.12	6.2
Switzerland	3.13	1.05	4.53
UK	1.01	0.66	2.02

Reference: "Electricity Generation Alternatives for Australia," J. Brough and J. Fredsall, ANF Discussion Paper, 31/5/01.

The UNSCEAR report also shows data on additional doses received in occupations involving natural and man-made sources of radiation.

Occupational Radiation Doses

Source/Practice	Number Monitored	Ave. mSv/y Additional
Nuclear fuel cycle	800	1.8
Industrial uses of rad	700	0.5
Medical	2320	0.3
Air travel (crew)	250	3.0
Mining (non-coal)	760	2.7
Coal mining	3910	0.7

Current radiation protection standards assume that all radiation doses are proportionately harmful, e.g. people who naturally receive 15 mSv/y at Kerala in India should show over 6 times more harmful effects than the world average. That this is not evident indicates that the standards are too conservative. The assumption of proportionality is probably an over-simplification of the true situation since it can be expected from an evolutionary viewpoint that humans are adapted to a range of radiation dose as they are to many other environmental factors (e.g. temperature). Appropriate revision of the standards awaits further investigation.