

Uranium exposure limits in dispute

A new dispute has arisen between epidemiologists and health physicists over the interpretation of data on the health effects of low levels of ionizing radiation, the subject of a recent report from the National Academy of Sciences (*Nature* 7 August p. 550).

This time the disagreement centres on whether current exposure limits to the radioactive gas radon and its decay products may present an unnecessarily high risk of lung cancer to the 7,000 uranium miners currently employed in the United States.

And the precise shape of the low-level dose-response curve has been given a new significance by growing concern about the possible health risk to the general public from radon-emitting building materials, since radon's precursor, radium-226, is a trace element contained in most rocks and soil.

In the light of epidemiological evidence on occupational exposures that has been accumulated since the current standards were set in 1971, the National Institute of Occupational Safety and Health (NIOSH) has suggested to the Department of Labor that permitted exposure limits for uranium miners should be significantly reduced.

However, the International Council for Radiological Protection (ICRP) argues that no change is needed. In a set of new recommendations currently being circulated to its members, the ICRP says that on the basis of dosimetric techniques applied to models of the lung, the current exposure limits appear to be adequate.

Mining companies — already facing a tight economic squeeze because of a virtual collapse in the international market for uranium ore — are using the ICRP's arguments to press the department not to reduce the limits. A move to reduce the limits could mean that mining companies would have to install expensive ventilation equipment.

Research in the 1950s and 1960s confirmed an abnormally high incidence of lung cancer among uranium miners. The cause was identified as radon and its alpha-emitting decay products — known as radon daughters — which become attached to air particles and can lodge in miners' lungs. The Department of the Interior introduced in 1971 an exposure limit of 4 working level months (WLM) a year, with a ceiling airborne concentration not to exceed 1.0 WL. (One working level (WL) is defined as a radon daughter concentration in one litre of air resulting in the emission of 1.3×10^5 MeV of potential alpha energy).

Since then, evidence from epidemiological studies in Canada, Sweden, Czechoslovakia and the United States, suggests, according to a report put together by a NIOSH study group, that the full effects of radon exposure may have been

underestimated, and that "there appears to be no margin of safety associated with the present standard".

The working group point out that triggering doses may be substantially lower than the cumulative doses associated with a particular incidence of lung cancer, since the radiation absorbed after the triggering dose may have been biologically redundant. In addition, the contribution of smoking to lung cancer among miners may have been overestimated in previous work. Some studies appear to show a higher rate of lung cancer among miners who do not smoke than among those who do — perhaps because cigarette smoking creates a thicker layer of mucus which may provide some protection against alpha emissions.

In submitting the report to the Department of Labor's Mine Safety and Health Administration (MSHA) Dr Anthony Robbins, Director of NIOSH, says that the apparent excess risk of lung cancer among those who might accumulate 120 WLM over a working lifetime — perhaps twice previous estimates — was a cause for major public health concern.

"On the basis of the study group's report, we feel that the present MSHA standard of 4 WLM per year does not provide an adequate degree of protection for underground miners exposed to radiation when it is evaluated over their exposure lifetime," Dr Robbins says.

NIOSH officials met with MSHA at the beginning of this month, and agreed that there is enough scientific evidence to support a possible revision of the regulation.

The department has already been petitioned to reduce permitted exposure levels by Ralph Nader's Health Resources Group and the Oil Chemical and Atomic Workers, a labour union to which many of the uranium miners belong. The two organizations are demanding that the maximum allowed radiation be reduced from 4 to 0.7 WLM per year.

However, the department is being urged by the industry to take into account the ICRP regulations suggesting little need for change. The ICRP proposals, agreed in draft form at a meeting of the commission in Brighton, UK earlier this year, describe two different ways of estimating what might be considered a safe exposure level.

Using epidemiological techniques based essentially on the same data as those analysed by the NIOSH working group, ICRP suggest that a safe limit would be between 2 and 10 WLM per year.

However, the ICRP also makes estimates based on a dosimetric analysis of the expected effect on the lung of a given amount of radiation, and in particular to that region of the lung particularly susceptible to alpha emission.

The latter approach, according to the ICRP, leads to a recommended exposure limit of 5–8 WLM per year based on a regular lung dose, or 9–14 WLM per year based on a mean lung dose. And given the variability in the epidemiological data, ICRP suggests that a figure of 5 WLM should be used as the basis for regulation — adding that for uranium miners already exposed to additional gamma radiation, this limit would tend to be reduced by 20 per cent for radon daughters alone, bringing it in line with the current US standard.

Ironically this conclusion is somewhat in conflict with the judgement of the National Academy of Sciences' Committee on the Biological Effects of Ionizing Radiation (BEIR), which last month moved closer to ICRP's position that for a different type of low level radiation (that resulting from X rays and gamma rays) a linear dose-response model may overstate the dangers.

In its comments on the dangers from alpha emission and other sources of high-LET (linear energy transfer) radiation, however, the BEIR committee drew heavily on the epidemiological studies of uranium miners and others to conclude that "the application of the linear hypothesis is less likely to lead to overestimates of risk and may, in fact, lead to underestimates".

David Dickson

High-altitude research

Reflated hopes

A threat to halt the launching of large scientific balloons from two sites in Australia may yet be averted if a proposal to update equipment and share running costs is accepted by the five countries which regularly use them. The continuation of the facilities is particularly important for astronomers from Australia, the United States, Britain, Germany and Japan who want to send balloon-borne payloads to high altitudes to study X-ray and UV sources in the Southern Hemisphere near the Galactic Centre.

The Australian government has threatened to close the facilities at Mildura, Victoria and Alice Springs in the Northern Territory because it says that it is heavily subsidizing foreign astronomers whose governments do not pay an economic fee. The United States is the only country that currently contributes to running costs: it pays a third, Australia making up the remaining two thirds. Other users of the facility currently pay about £10,000–11,000 for a launch and nothing towards basic running costs.