

RADIATION LEVELS IN PERSPECTIVE

Protection against health risks from ionizing radiation should recognize that the persons to be protected are being bombarded with natural radiation up to one or more orders of magnitude greater than the dose in question. People travel from one location to another where **natural radiation backgrounds differ tenfold**, and may be as high as a **hundred-fold**. People generally give no consideration whatsoever to the radiation level in deciding where to go or how long to stay there. They don't consider radiation in choosing between a vinyl siding or stone facing for their home. And there is no reason that they should. In fact, a large variety of data consistently shows that **people living in high-radiation areas are as healthy, or healthier**, than those in low-radiation areas (1).

In many countries, physicians prescribe visits to "**health spas**" whose advertised **radon levels** are up to **thousands of times greater than the "safe" levels** prescribed by the US EPA, and these therapies are often subsidized by the national health insurance. Considerable documentation is available on the effects of such treatments (2), but more evaluation of this potentially huge data base would be welcome.

Although an irradiated **organism cannot distinguish** whether the radiation is of **natural** or **human** origin, there are now regulations and standards that set **permissible levels orders of magnitude lower for human-origin** material than for the very same materials from natural sources (3). Such distinctions are without any scientific justification. Hearings on radiation standards may be held in rooms in the national Capitol where natural radiation from the granite walls measures 525 mrem/year—a situation that would bring regulatory action and heavy fines in a nuclear power plant..

Some examples from the working world follow:

In 2002, there were 149,512 **workers at US nuclear power plants** who received a total collective effective whole-body radiation dose of 12,126,190 person-rem (4). This is a large number. The industry is continually pressured to reduce it. But this is an average of only **80 mrem per person**. Persons who live in areas of low natural background receive about **100 mrem/year from nature; about 8000 during their lifetime**. Others, who live where the natural background is higher, have **up to 10 times more** than this. Some places in the world have **over 100 times** this number. We make no effort to equalize or minimize this exposure, and there is no evidence that we should do so. Yet we devote extraordinary efforts to reducing the much smaller contribution from a few specific sources.

With regard to the impact of this radiation on the world population at large, page 6 paragraph 34 of Ref 5, Vol. I, estimates "the maximum collective annual dose" from 100 years of world-wide nuclear power operation at the present rate is less than **0.02 mrem per person** to the world population. This is less than **one ten-thousandth of the average natural radiation background**.

Many people work at **jobs that expose them to natural radiation** above the background. This includes air travel, underground mining, mineral processing, and exposure to radon. This exposure averages **180 mrem per year**, and is not usually regulated or controlled. By contrast, worker with **human-made radiation** sources such as uranium mining, industrial radiography, nuclear medicine and some defense activities, receive an average of **60 mrem per year** and is under continual pressure to reduce it.

In addition, Americans undergo some **15 million medical diagnostic procedures a year** involving low-dose radiation, excluding the fewer number that undergo high dose therapeutic procedures. The low-dose procedures alone give an average dose of **120 mrem/year** (5). There is no evidence that these procedures cause any detrimental radiation-induced health effects.

The **discrepancy between the treatment of natural and human-generated radiation** was first brought into focus about 1980, as the question of radon began to achieve prominence. The question was side-stepped by regulators for many years, but then, in a remarkable turn-around, the U.S. Environmental Protection Agency decided "We will regulate Nature." Overnight, the natural environment changed from a fragile and defenseless virginity they were sworn to protect, to "The Silent Killer in Your Home" (referring to radon). EPA is now aggressively pursuing natural uranium, radium and radon in water and air, and the naturally radioactive sludge brought up in oil well drilling. Although there is no evidence that these situations have caused any health effects, and a number of credible relevant surveys show the opposite, they are currently presumed guilty until proven harmless.

Overstating the risks of a radiological incident may be only tolerably overcautious in some situations, costing only delay and money. But it **distorts design and operations decisions**, and such distortions are generally harmful. For example, placing great importance on minimizing collective dose **discourages maintenance and inspection** in radiation areas, which might be important to safety (e.g. reactor head corrosion).

In connection with planning and responding to **radiological emergencies**, exaggeration of the risk can **convert a minor incident into a life-threatening panic** and change a routine cleanup to an **unwarranted economic disaster**.(6) Many existing buildings and public spaces may be "contaminated" but present no public health threat whatsoever (such as the Capitol building previously mentioned).

References

1. Frigerio, N. A., K. F. Eckerman, et al. (1973). Carcinogenic Hazard from Low-Level, Low-Rate Radiation, Part I, Rep. ANL/ES-26, Argonne Nat. Lab.
2. See "2.2.2.4 Radon Treatments" for 18 references at:
http://cnts.wpi.edu:9000/rsh/dd3/_database.jsp#2.2
3. For latest example, see ICRP Proposed Recommendations, Table S2, distributed at IRPA-11, Madrid, May 27, 2004
4. U.S. Nuclear Regulatory Commission document NUREG-0713, Vol. 24 (October 2003)
5. United Nations Scientific Committee on the Effects of Atomic Radiation UNSCEAR-2000 Report to the General Assembly with Scientific Annexes. "Sources and Effects of Ionizing Radiation" (2000)
6. See for example OpEd headlined "Radiation Chicken Little" in *Washington Post*, Sept 3, 2003.