

# NUCLEAR MONITOR

*A Publication of World Information Service on Energy (WISE) and the Nuclear Information & Resource Service (NIRS), incorporating the former WISE News Communiqué*

#620--North American Edition

December 24, 2004

## ICRP SHOULD RECOMMEND MORE PROTECTIVE RADIATION STANDARDS

This is the third article in NIRS' series on Draft Recommendations of the International Commission on Radiological Protection (ICRP-2005) and reviews the history behind radiation protection standards and CERRIE Majority and Minority Reports criticizing ICRP assumptions.

**(620.5661) NIRS** - In 2001, the British Environment Minister established the Committee Examining Radiation Risks of Internal Emitters (CERRIE, pronounced "cherry"), to review recent radiation research and adequacy of public and worker standards. The committee was comprised of representatives of the nuclear industry, the radioactive recycling industry and nuclear critics.

Some of the Committee grew dissatisfied and produced a Minority Report. Both the CERRIE Majority and Minority Reports were published in October 2004 and address many of the issues raised in the Draft ICRP-2005. Following a brief history of radiation standards below is a summary of some of the relevant conclusions of the CERRIE Reports, especially as they pertain to ICRP's recommendations.

### Historical Context

In 1895, Wilhelm Roentgen identified ionizing radiation, x-rays, and their significance for scientific research and, later, for medical purposes. During the following fifty years, uses of radioactive materials proliferated, often with little understanding of the harmful effects on biological organisms. Doses in the tens of rem (hundreds of milliSieverts, mSv) were tolerated, legally, without realization of the potential injuries that appeared two or more decades later.

Following the splitting of the atom during World War II, the Manhattan Project's race to develop an atomic bomb, and the bombing of

Hiroshima and Nagasaki, adverse impacts of radiation exposures became a serious medical — and political — issue. In the U.S. in the early 1950s, the National Council on Radiation Protection and Measurements (NCRP), a private, nuclear advocacy, advisory body, undertook a review of data on both external doses (received by Japanese survivors and collected by the Atomic Bomb Casualty Commission) and internal exposures from ingestion and inhalation.

Dr. Karl Z. Morgan, chair of the NCRP internal dose subcommittee, found determination of the internal distributions and organ impacts far more complicated than anticipated. As U.S. commitment to Cold War weaponry grew, the NCRP was pressed to submit recommendations to the government but did not permit completion of the more difficult analysis on the internal effects of radioactive materials that lingered in the body.

At that time, the concern was genetic impacts, rather than cancers. In 1958, the NCRP recommended an annual dose limit of five rem (50 mSv) for workers, assumed to be acceptable because it was equivalent to dose limits for radium. For the public, dose levels one-tenth as great (0.5 rem, 500 mrem; or 5 mSv) were deemed safe enough (by the nuclear advocates). The U.S. Federal Radiation Council published guidance in 1960, as public concerns about atmospheric bomb test fallout and commercial uses of nuclear energy grew. The public exposure

limit was reduced to 100 mrem/yr (1 mSv), and questions arose about the assumption of a "safe threshold" of radiation exposure. In 1990, the U.S. National Research Council Committee on the Biological Effects of Ionizing Radiation (BEIR V) accepted the linear no threshold hypothesis of the relationship of dose to response (LNT). (See *WISE News Communiqué* 326-327.3261 "Beir-V Report Reassesses Radiation Risks")

Now the ICRP proposes to reduce radiation protection in several ways (see *WISE/NIRS Nuclear Monitor* #618 and #619), even though recent research indicates worse health effects from protracted, internal, low dose exposures. The CERRIE Reports address some aspects of the current understanding of radiation-related risk.

### CERRIE

The Committee Examining Radiation Risks of Internal Emitters (CERRIE) was tasked to consider present risk models for radiation and health that apply to exposure to radiation from internal radionuclides in light of recent studies, and to identify any further research that maybe needed. The CERRIE Majority Report recommends important and necessary

further research and elucidates certain shortcomings of ICRP. However, the final report was published under threat and fear of litigation for allegation of factual misstatements. As a result, full representation of views was not

allowed in the report and there were very few subjects on which the committee members actually reached consensus. A subgroup of the Committee produced the CERRIE Minority Report 2004.

### **Biological Evidence:**

#### **Conclusions and Further Research Needed**

While a consensus eluded the CERRIE committee in a number of scientific areas, many of their recommendations for further research are sound, necessary, and immediately relevant to protection of humans from radiation exposure.

- In general, the committee did not find evidence for threshold doses of radiation and the Committee rejected hormesis (the claim that a little radiation is good for you).

- CERRIE recommended more study on both genomic instability (damage from radiation shows up in its descendants after a cell has repaired and reproduced) and bystander effects (cells untouched by radiation show damage as if they were hit). Both effects see more damage at low doses.

- The mechanisms for genomic instability, bystander effect and mini satellite mutations (a specific type) may explain effects seen at low doses that were not expected and are not found at higher doses. In addition, these phenomena may vary with each individual and could raise ethical questions of radiation exposure. The committee did not arrive at any consensus on this topic.

- The CERRIE committee recognized that, while it is preferable to have studies peer-reviewed and published, there is a tendency within this system to reject evidence that does not conform to existing paradigms. - CERRIE also recognized that data protection is making research more difficult to execute.

- CERRIE recommended more integration of data collected since 1990 into ICRP recommendations, and further study of microdosimetry, cancer mechanisms and germline mini-satellite mutations.

- There is evidence that Sr-90 may preferentially bind to chromosomes

rather than evenly distribute in cells and may also prefer cellular DNA. The committee strongly recommends more research on this and other radionuclides that show unexpected properties, such as tritium and auger emitters, for which they say ICRP has underestimated risk.

- Indeed, the actual concepts of absorbed dose become questionable, and sometimes meaningless, when considering interactions at the cellular and molecular levels.

- CERRIE recommended more use of direct measure of damage to exposed people, called biodosimetric measurement, although this has limitations.

- ICRP dosimetric models need to account for insufficient modeling of damage to cells and molecules, particularly for short-range radiation.

- CERRIE recognized that effective dose (a calculation of radiation exposure) says nothing about the way in which the radiation dose is received, or what organ is most exposed or for how long. Therefore, the ICRP risk estimates present an incomplete picture of radiation damage.

#### **Epidemiological study: further study and conclusions**

The committee investigated bomb test health data, data from reprocessing sites such as Sellafield, and nuclear industry workers and their children, and health studies after the Chernobyl explosion in Europe and the Former Soviet Union.

In general, the committee concluded that low-level intake of radionuclides leads to some increased risk of adverse health effects as a result of the internal irradiation of organs and tissues. There was some dissent on this. Some members felt that risk models are quite accurate while others thought that current risk models may well underestimate risks from intakes of certain radionuclides, but by modest amounts, while two members felt risks are substantially underestimated.

- CERRIE concluded that an increase in infant leukemia was prevalent in populations exposed to Chernobyl nuclear fallout. The committee was divided as to whether or not current risk estimates would have correctly

predicted or underestimated the incidence.

- For childhood leukemia, the committee concluded that official risk estimates did not underestimate incidence. Two members strongly dissented partially due to data mixing which can dilute evidence of disease.

- ICRP needs to recognize the uncertainties involved with dose and risk estimates. The committee hopes this would lead to identification of situations where the precautionary approach might be appropriate.

CERRIE and its Dissenters agreed that ICRP's risks might be underestimated. The disagreement is over the magnitude or mechanism of that under-estimate.

#### **CERRIE Minority Report**

Two scientists on the panel, Dr. Chris Busby and Mr. Richard Bramhall, and one of the Secretariat, Dr. Paul Dorfman, produced the CERRIE Minority Report as the Majority Report did not reflect their views. One important concern is that epidemio-logical studies have inherent flaws that make the final, peer-reviewed reports biased.

The minority disagrees strongly with the main report's conclusions that risk models are fairly accurate. The dissenters raise concerns about epidemiological methods used in studies referenced for this conclusion. Using the example of infant leukemia in Greece after the Chernobyl explosion, Busby et al said that studies are often discounted when they find that the highest cancer rates are not associated with the highest doses. The authors argue that rather than discount this observation, which fails to fit any favored theories such as LNT, science should let the actual disease incidence findings guide them to investigate why these cases may be different from the theoretical model.

The argument between the deductive and inductive methods is something that CERRIE alludes to briefly and then discounts by saying this discussion was not within the remit or expertise of the committee. However, choosing one of these methods over the other could very well result in entirely different interpretations of the same data.

Choosing to use one logic method over the other is fundamental to scientific investigation and understanding of that investigation.

The minority report concludes that there could be errors of magnitude in the current risk assessments due to energy deposition at the cellular level. The authors then examined studies, which were reviewed by CERRIE, offering different interpretations of data and conclusions, often adding more complete background and contextual information than was offered in the first report. The minority identifies issues such as inappropriate data mixing, limiting assumptions about the linear-no-threshold theory, and problems with recording human disease.

In a number of cases, including health studies on weapons testing and in coastal areas, Busby et al recommend further study since the Committee disbanded before being able to complete these assessments. Further, the minority said that CERRIE majority under-reported on important discussions in some cases.

The minority members sum up their view: "We are in broad agreement with elements of the main report's (CERRIE) discussion on genomic instability and the bystander effect

but we dissociate ourselves from any suggestion that they may indicate that current standards are too stringent. This is because we believe that there exists sufficient epidemiological evidence to demonstrate deleterious health-effects from radioactive pollution."

Busby et al conclude that in the short term, the evidence of harm and the scientific insecurity of the ICRP methodology are sufficient to trigger application of the Precautionary Principle in respect of releases of radioactivity. Long-term research is needed on the implications of these mechanisms for radiation risks, from both internal and external radiation.

Considering the conclusions reached by both the CERRIE Report and the CERRIE Minority Report, research must be continued and, in the interim, existing standards must not be weakened. Precaution demands, instead, that standards need to be all the more restrictive, and that radioactive materials and wastes already deregulated should be brought under control.

**Contact:** Cindy Folkers at cindyf@nirs.org and Judith Johnsrud atjohnsrud@uplink.net Tel:+1202-238-0002 or + 1814-237-3900

### Public participation

The deadline for public comment is **30 December 2004** (Note: Time zone at ICRP in Sweden is ahead of North and South America).

ICRP prefers comments uploaded onto its website at [www.icrp.org](http://www.icrp.org), full link is <http://www.icrp.org/remissvar/listcomments.asp>

ICRP will accept comments by e-mail to [Jack.Valentin@ssi.se](mailto:Jack.Valentin@ssi.se) OR [scient.secretary@icrp.org](mailto:scient.secretary@icrp.org) but prefer posting on the website to allow other to view.

Draft ICRP 2005 is at [www.icrp.org/docs/2005\\_recs\\_CONSULTATION\\_Draft1apdf](http://www.icrp.org/docs/2005_recs_CONSULTATION_Draft1apdf)

Please comment to ICRP by the deadline. To view the CERRIE Report (discussed in article) visit [www.cerrie.org](http://www.cerrie.org) and to see the executive summary and order the CERRIE Minority Report go to <http://llrc.org>.