Ultra-Low Level Radiation Effects SUMMIT Carlsbad, NM

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Waste Isolation Pilot Plant, Carlsbad, NM

Elucidating answers for public benefit through science

ORION INTERNATIONAL TECHNOLOGIES

REPORT SUMMARY

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Background

The United States is projected to spend $350 billion cleaning up radioactive contamination and waste derived from nuclear activities over a period of several decades. This cost for cleaning up nuclear sites has been collected from several US Government Agency reports and is based on current ionizing radiation protection standards established by the Environmental Protection Agency (EPA). The EPA set these standards using a linear extrapolation of World War II atom bomb survivor data; however, no scientific data currently exist to verify this extrapolation. As a result, reports such as the Biological Effects of Ionizing Radiation VII (BEIR VII), acknowledge the need for more scientific data to better understand the biological effects of very low radiation doses. Such additional knowledge would enable regulatory bodies to set objective radiation cleanup standards.

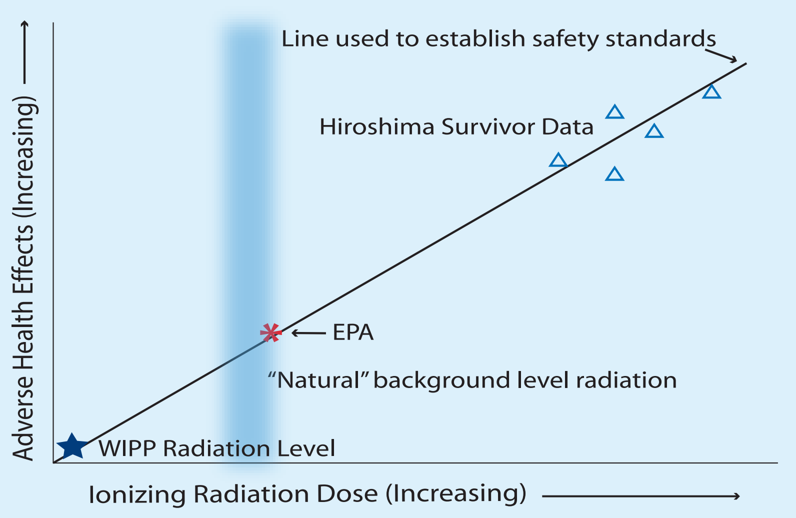

Figure 1

The difficulty in obtaining scientific data at the EPA's current ionizing radiation cleanup standards are set at a small fraction above naturally occurring background radiation levels. Studies ave been conducted using small doses of ionizing radiation, which do not incidate that rates of cancer incidence have increased. The lack of an observable increase, however, does not preclude the possibility of an unobservable effect; for example, solid tumors and leukemia have a spontaneous incidence that varies according to lifestyle and heredity. Since the possible increase in cancer incidence following irradiation is very low, large study populations are required to demonstrate statistically significant results. However, in any population there are confounding factors due to genetic and random variations that mask any possible effect of low levels of ionizing radiation. Consequently, epidemiological studies may not detect a small effect of low levels of ionizing radiation because of lack of statistical power, even if it exists..

The BEIR VII Report concluded that current scientific evidence is consistent with the Linear No-Threshold hypothesis (LNT); however, the consensus of many researchers is that the issue of detimental effects of low doses can only be resolved with a series of experiments conducted at near-zero levels of background radiation. An increase in current radiation protection dose level standards (more relaxed) as a result of creating scientifically supportable biological effects models could result in savings of hundreds of billions of dollars in cleanup costs.

To explore ways in whichthe scientific basis for low-level ionizing radiation risk could be improved, DOE funded a "Low Level Radiation Effects" (LLRE) Summit at the Waste Isolation Pilot Plant (WIPP) in Carlsbad, NM, January 16-18, 2006. The Summit was attended by 26 scientists highly regarded in the radiobiology research community and representing competing radiation effects hypotheses. The purpose of the LLRE Summit was not to decide whether one method was better or more accurate than another, but to identify the steps that must be taken to improve the science and lay the groundwork for scientifically-based radiation protection standards at low levels of exposure.

The Problem

Currently, a laboratory facility does not exist in the United States for conducing relatively large scale research at very low doses of radiation. Thus, the radiation protection standards in use for very low dose exposure are not based on scientific data but rather on a relatively simple straight line LNT hypothesis (Figure 1). Furthermore, this criterion appears to have been incorporated into the current standards by default, without supporting scientific evidence.

The uncertainty in the health effects versus radiation levels is evidenced by the fact that no data exist near zero radiation levels. This uncertainty limits fact-based discussion of

- decommissioning of existing nuclear facilities;
- long-term storage facilities for nuclear waste;
- construction of new nuclear power facilities to reduce dependence on fossil fuels;
- effects of a so-called "dirty bomb;" and
- improved acceptance of diagnostic radiology.

The current radiation protection standards, which are based on the LNT hypothesis, influence the cost to clean up radiation sites in the United States. These costs, as shown in Figure 2, would be significantly reduced if a scientific studies determined that a relaxed standard would not increase the estimate of potentially adverse effects of radiation on people or the environment. Similarly, scientifically-based standards will have significant impact on the cost of each of the five bulleted points listed above.

The Solution

Over the last few years, national and international scientific "consensus" groups have studied the LNT but have not reached an agreement on its validity. The community tends to default to the LNT because there is a tendency to remain conservative until science unequivocally justifies another model. The "Bridging Radiation Policy and Science" report states that:

"While regulatory decision-making was designed to protect the public health, in some ways it has become punitive and burdensome. The idea that any exposure to radiation may be harmful has led to public anxiety and to enormous economic expenditures that are disproportionate to the actual radiation risks involved. In the United States and some other countries, regulatory compliance costs are steadily growing, while desired public health benefits from added regulation are increasingly difficult to measure."

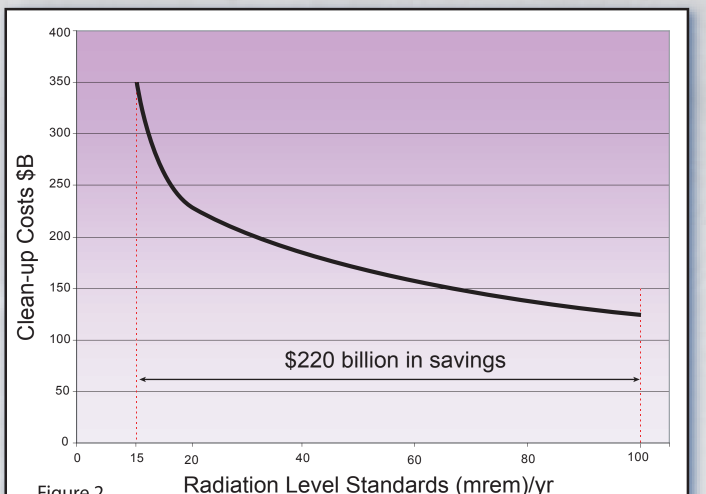

Figure 2

The Waste Isolation Pilot Plant (WIPP) in Carlsbad, New Mexico, provides the only site in the United States where a research facility could be established with virtually all background radiation eliminated. This site will allow scientific experiments to be conducted that, for the first time, produce a broad set of data on the biological significance at the lowest levels of radiation exposure. Data from experiments conducted in this ultra-low level radiation environment will lead to improved scientific models from which radiation standards can be promulgated.

LLRE Summit Results

- 92% of the attendees agreed that in order to establish a scientific basis for radiation protection standards at low doses, a research environment is needed that allows for ultra-low dose experiments
- Due to the existence of "noisy" background radiation from naturally occurring sources, ultra-low dose radiation experiments cannot be conducted effectively on the Earth's surface
- The ideal test environment has zero to negligible levels of radiation
- The principal environments with ultra-low levels of natural radiation, suitable for ultra-low dose experiments without adding extensive additional shielding are underground salt mines
- 96% of the attendees agreed that WIPP is the ideal location to conduct these experiments
- Existing infrastructure at WIPP will assist development and minimize the construction cost of the proposed facility

Recommendations

WIPP is the world's first underground repository licensed to safely and permanently dispose of transuranic radioactive waste resulting from the research and production of nuclear weapons. Located in southeastern New Mexico, project facilities include disposal rooms mined 2,150 ft underground in a salt formation that has been stable for more than 200 million years.

The consensus of the participants of the LLRE Summit is that a laboratory facility be established at the WIPP, which will attempt to resolve the radiation protection standard question. Since the radiation levels in the underground salt beds are about 7% of the radiation background on the surface, WIPP is an ideal experimental site for ultra-low level radiation research. Simple shielding will reduce the radiation level at the WIPP site to near zero.

The goal of this facility would be to establish a scientifically-based standard that offers optimal protection of the public against the possibility detrimental health effects of radiation while potentially realizing a savings to the United States of more than $200 billion in cleanup costs alone. Initial costs for creating an ultra-low level radiation effects facility at WIPP and operating it as a research laboratory for five years of are estimated to be approximately $150 million.

Conclusion

Establishing an improved scientific basis for setting an ionizing radiation standard has the potential to save more than $200 billion in the cleanup of radiation sites nationwide. Countless other billions of dollars could be saved in other areas affected by radiation standards (Figure 2). For example, knowledge about the low-dose effects of radiation may help to remove the stigma that currently restricts greater use of nuclear energy. More information on the effects of radiation levels will give policy makers and the general public a more realistic view of the consequence of nuclear events, accidents or terrorist activities (dirty bombs). Currently, no facility exists in the US that provides the necessary environment for conducting the required ultra-low level radiation experiments proposed in this report. Funding an ultra-low level radiation facility at WIPP will ultimately generate data crucial to understanding ultra-low level radiation effects on biological systems and provide a scientific basis for setting radiation protection standards.

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