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FOR IMMEDIATE RELEASE

Low Levels of Ionizing Radiation May Cause Harm

WASHINGTON -- A preponderance of scientific evidence shows that even low doses of ionizing radiation, such as gamma rays and X-rays, are likely to pose some risk of adverse health effects, says a new report from the National Academies' National Research Council.

The report's focus is low-dose, low-LET -- "linear energy transfer" -- ionizing radiation that is energetic enough to break biomolecular bonds. In living organisms, such radiation can cause DNA damage that eventually leads to cancers. However, more research is needed to determine whether low doses of radiation may also cause other health problems, such as heart disease and stroke, which are now seen with high doses of low-LET radiation.

The study committee defined low doses as those ranging from nearly zero to about 100 millisievert (mSv) -- units that measure radiation energy deposited in living tissue. The radiation dose from a chest X-ray is about 0.1 mSv. In the United States, people are exposed on average to about 3 mSv of natural "background" radiation annually.

The committee's report develops the most up-to-date and comprehensive risk estimates for cancer and other health effects from exposure to low-level ionizing radiation. In general, the report supports previously reported risk estimates for solid cancer and leukemia, but the availability of new and more extensive data have strengthened confidence in these estimates.

Specifically, the committee's thorough review of available biological and biophysical data supports a "linear, no-threshold" (LNT) risk model, which says that the smallest dose of low-level ionizing radiation has the potential to cause an increase in health risks to humans. In the past, some researchers have argued that the LNT model exaggerates adverse health effects, while others have said that it underestimates the harm. The preponderance of evidence supports the LNT model, this new report says.

"The scientific research base shows that there is no threshold of exposure below which low levels of ionizing radiation can be demonstrated to be harmless or beneficial," said committee chair Richard R. Monson, associate dean for professional education and professor of epidemiology, Harvard School of Public Health, Boston. "The health risks – particularly the development of solid cancers in organs – rise proportionally with exposure. At low doses of radiation, the risk of inducing solid cancers is very small. As the overall lifetime exposure increases, so does the risk." The report is the seventh in a series on the biological effects of ionizing radiation.

Assessing Health Risks

The committee's risk models for exposure to low-level ionizing radiation were based on a sex and age distribution similar to that of the entire U.S. population, and refer to the risk that an individual would face over his or her life span. These models predict that about one out of 100 people would likely develop solid cancer or leukemia from an exposure of 0.1 Sv (100 mSv). About 42 additional people in the same group would be expected to develop solid cancer or leukemia from other causes. Roughly half of these cancers would result in death. These particular estimates are uncertain, however, because of limitations in the data used to develop risk models.

Survivors of atomic bombings in Hiroshima and Nagasaki, Japan, were the primary sources of data for estimating risks of most solid cancers and leukemia from exposure to ionizing radiation. The committee's review included an examination of updated cancer-incidence data from tumor registries of the survivors, and of research data on solid cancer deaths -- which is now more abundant because the number of deaths available for analysis has nearly doubled since the Research Council published its previous report on this topic in 1990. The committee combined this information with data on people who had been medically exposed to radiation to estimate risks of breast cancer in women and thyroid cancer. Data from additional medical studies and from studies of people exposed to radiation through their occupations also were evaluated and found to be compatible with the committee's statistical models. Follow-up studies should continue for the indefinite future, the report says.

Adverse hereditary health effects that could be attributed to radiation have not been found in studies of children whose parents were exposed to radiation from the atomic bombs. However, studies of mice and other organisms have produced extensive data showing that radiation-induced cell mutations in sperm and eggs can be passed on to offspring, the report says. There is no reason to believe that such mutations could not also be passed on to human offspring. The failure to observe such effects in Hiroshima and Nagasaki probably reflects an insufficiently large survivor population.

Follow-up studies of people who receive computed tomography (CT) scans, especially children, should be conducted, the report adds. Also needed are studies of infants who are exposed to diagnostic radiation because catheters have been placed in their hearts, as well as infants who receive multiple X-rays to monitor pulmonary development. CT scans, often referred to as whole body scans, result in higher doses of radiation than typically experienced with conventional X-rays.

Sources of Ionizing Radiation

People are exposed to natural background ionizing radiation from the universe, the ground, and basic activities such as eating, drinking, and breathing. These sources account for about 82 percent of human exposure.

Nationwide, man-made radiation comprises 18 percent of human exposure. In this overall category, medical X-rays and nuclear medicine account for about 79 percent, the report says. Elements in consumer products -- such as tobacco, tap water, and building materials -- account for another 16 percent. Occupational exposure, fallout, and the use of nuclear fuel constitute roughly 5 percent of the man-made component nationwide.

Factors that could increase exposure include greater use of radiation for medical purposes, working around radioactive materials, and smoking tobacco. Living at low altitudes, where there is less cosmic radiation, and living and working on the upper floors of buildings, where there is less radon gas -- a primary source of natural ionizing radiation -- are factors that could decrease exposure.

The report was sponsored by the U.S. departments of Defense, Energy, and Homeland Security, the U.S. Nuclear Regulatory Commission, and the U.S. Environmental Protection Agency. The National Research Council is the principal operating arm of the National Academy of Sciences and the National Academy of Engineering. It is a private, nonprofit institution that provides science and technology advice under a congressional charter. A committee roster follows.

Copies of **Health Risks from Exposure to Low Levels of Ionizing Radiation (BEIR VII - Phase 2)** will be available this summer from the National Academies Press; tel. 202-334-3313 or 1-800-624-6242 or on the Internet at **http://www.nap.edu**. Reporters may obtain a copy from the Office of News and Public Information (contacts listed above).

[This news release and report are available at **http://national-academies.org**]

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