

## RADIATION PROTECTION

# GAO to examine low-level radiation policies

**T**HE GENERAL ACCOUNTING Office (GAO) has agreed to conduct a new study on radiation protection, a spokesperson from Sen. Pete Domenici's (R., N.M.) office told *Nuclear News* on August 5. Domenici requested the update on July 21, citing concerns about the costs of relying on the linear no threshold hypothesis (LNTH) to determine the effects of low-level radiation.

The LNTH, which is currently used to set radiation protection guidelines, assumes that cancer risk is proportional to dose, and that even a very small amount of radiation could theoretically cause cancer.

The GAO produced a report in 1994 titled "Consensus on Acceptable Radiation Risk to the Public is Lacking." According to Domenici, that report discusses radiation protection regulations, but did not question the LNTH.

*The first GAO study of low-level radiation policy since 1994 will address the linear no threshold hypothesis.*

"The linear no threshold hypothesis is now questioned by many scientists and health professionals," Domenici said. "If radiation protection standards are unnecessarily restrictive, the impact on the costs of high-level waste disposal—such as Yucca Mountain, low-level waste disposal, power plant decommissioning and decontamination, and DOE's environmental cleanup could be huge."

Domenici suggested several areas of investigation:

■ How have radiation standards changed

since 1994? Is a consensus being approached, and what has resulted from the recommendations in that report?

■ What were the bases for setting the radiation protection limits, and how is the linear no threshold hypothesis used in setting these limits?

■ If differences exist between agencies' standards, what is the impact of these differences?

■ Provide, from available data, information on the variance in background radiation between locations in the United States and around the world. Are differences in cancer rates between these locations related to differences in background radiation levels?

■ What are the costs of complying with current radiation protection regulations, and how, if at all, would these costs be affected if radiation standards were substantially relaxed?

NCRP

## New guidance issued on the application of ALARA

The National Council on Radiation Protection and Measurements (NCRP) released a position statement on June 8 titled "The Application of ALARA for Occupational Exposures." In it, the NCRP maintained its support of the linear no threshold hypothesis (LNTH) and reiterated the NCRP's philosophy "that radiation protection be based on the guiding principles of justification, dose limitation, and the reduction of dose to levels as low as reasonable achievable (the ALARA principle), economic and social factors being taken into account." However, the statement was issued as "guidance" on how to "keep exposures and the assumed associated risks to a reasonable minimum without forfeiting potentially increased benefits or incurring unreasonable costs."

*Continued*

## Isotopes & Radiation Briefs

**THE ANTITUMOR EFFECTS OF RADIATION CAN BE BOLSTERED** by first administering a drug that blocks the formation of blood vessels leading to the tumor, according to a report in the July 15 issue of *Cancer Research*. By administering an anti-VEGF (vascular endothelial growth factor) antibody prior to radiation treatments—to inhibit the growth of capillaries in the surrounding tissue that will bring nourishment to the tumor—researchers were able to reduce tumor growth in mice by 78 percent. In contrast, radiation alone produced a 43 percent reduction in tumor volume, and anti-VEGF alone achieved a 42.6 percent reduction. "These findings demonstrate that blocking the effects of VEGF enhances the tumoricidal effects of IR [ionizing radiation] in diverse tumor models of human malignancies for which IR is a major therapeutic modality," the report stated. The two treatments achieved "greater than additive effects"—better together than either treatment individually—for esophageal adenocarcinoma, squamous cell carcinoma, and glioblastoma human tumors, and also Lewis lung carcinoma, grafted onto laboratory mice.

Anti-VEGF is an angiogenesis inhibitor similar to angiostatin and endostatin (*NN*, Oct. 1998, p. 70)—two highly publicized chemicals that have successfully shrunk tumors in mice, but have yet to be tested in humans. However, unlike angiostatin and endostatin—which attack existing blood vessels—anti-VEGF antibodies seek to prevent blood vessels from even forming.

"What you're trying to do is upset the angiogenic balance," Helena J. Mauceri, one of the report's coauthors and a research associate at the University of Chicago's Department of Radiation and Cellular Oncology, told *Nuclear News*. "Tumors have the angiogenic balance on the side of angiogenesis—they're producing factors to make blood vessels grow. What you want to do is bring down that side and push up the antiangiogenic side."

**MILITARY VETERANS SUBJECTED TO NASAL RADIATION** may be at increased risk of cancer, according to a report released on July 27 by the U.S. Department of Energy. **Briefs continued on next page**

### Isotopes & Radiation Briefs, *continued*

of Veterans Affairs. Although the findings are not statistically relevant due to the small sample size, the study did conclude that submariners who were treated with nasopharyngeal (NP) irradiation therapy during the 1940s, 1950s, and 1960s are at a 47 percent higher risk of death due to head and neck cancer and a 29 percent higher risk of death from all causes. “[T]his finding does suggest that WWII veterans who received NP irradiation while in submarine school may be at increased risk for deaths due to head and neck cancers,” the report concludes. Researchers studied 1214 military personnel who received the treatment and 3176 military personnel who did not.

NP irradiation therapy was used to relieve inner ear problems associated with rapid pressure changes, and is estimated to have been performed on 8000 to 20 000 military pilots, submariners, and divers. The procedure involved inserting a metal cylinder containing 50 mg of radium sulfate into the patient’s nose for up to 12 minutes, thereby shrinking lymphatic tissue to ease pressure changes in the middle ear. A typical treatment round consisted of three 12-minute procedures, and is estimated to have delivered a radiation dose of 77 centigray to the pituitary gland, 3–5 cGy to the thyroid gland, and 25 cGy to the brain. The military discontinued the NP treatments when concerns rose over its health effects and alternative treatments became available, according to the report. Although similar studies have been performed on children who have received NP therapy, this is the first follow-up study of military personnel who received the treatment.

**WORKERS EXPOSED TO BERYLLIUM AT DOE SITES** are eligible to receive benefits under a new plan announced by Energy Secretary Bill Richardson on July 15. The initiative reverses a Department of Energy policy of opposing health claims, and will provide financial assistance to DOE employees and workers at DOE sites who were employed by contractors. Chronic Beryllium Disease (CBD) can be clearly linked to defense work conducted during World War II and the Cold War, according to the DOE. Richardson said that an interagency review of other illnesses, including asbestosis, silicosis, and radiation-induced cancers, will be conducted by the National Economic Council, to determine if they, too, warrant assistance. Richardson estimated the cost of benefits to be approximately \$13 million per year, over a period of 10 years. A new beryllium rule will be instituted to reduce beryllium exposures to current workers, he said. CBD is a debilitating lung disease that may not appear until 10–15 years after exposure, and can be fatal. According to the DOE, about 20 000 workers may have been exposed to beryllium, and 500–1000 may have the disease. Benefits will include reimbursement for medical costs, compensation for lost wages, vocational rehabilitation assistance, and survivor’s benefits. A final legislative proposal was to have been developed over a period of several weeks; information on the benefits proposal is available on the Web at <[www.eh.doe.gov/benefits](http://www.eh.doe.gov/benefits)>, and general information on beryllium disease can be found at <[www.eh.doe.gov/be](http://www.eh.doe.gov/be)>.

**THE QUEST TO CREATE SUPER-HEAVY ELEMENTS IN THE LAB** continues with the news—published in the July 15 issue of the journal *Nature*—that Russian physicists at the Joint Institute for Nuclear Research in Dubna, Russia, have created element 114. One atom of the element reportedly lasted 30 seconds before disintegrating, and another lasted five seconds. Plutonium-242 targets were bombarded with calcium-48 ions to create an atom with 114 protons and 173 neutrons. If the experiment is verified, scientists could have valuable new evidence that an “island of stability” exists among super-heavy manmade elements. Most of the recently created elements disintegrate within milliseconds. If an isotope of element 114 could be created with 184 neutrons, it may be truly stable, scientists theorize, because no more neutrons could fit within the atom. Physicist Albert Ghiorso, of Lawrence Berkeley National Laboratory, was quoted in the press as being skeptical of the ability of the Russian equipment to pinpoint single atoms. Scientists at LBNL recently created elements 116 and 118 (*NN*, Aug. 1999, p. 118).

**AN INNOVATIVE DOSE CALCULATION SYSTEM** for planning radiation cancer treatments has been licensed for commercialization by Lawrence Livermore National Laboratory, the system’s developer. PEREGRINE, a three-dimensional Monte Carlo–based dose calculation system designed specifically for radiation therapy planning, has been licensed to NOMOS Corporation for commercial development, the company announced on July 22. Unlike other dose calculation methods that approximate dose distributions in the patient based on water phantom measurements, PEREGRINE can accurately model absorbed dose by simulating the paths of trillions of radiation particles entering the body. “It used to be that Monte Carlo dose calculations would take days on a supercomputer to produce an accurate result,” said Ralph Patterson, a program manager at LLNL. “With PEREGRINE, results are available in minutes using computer components commonly found in desktop PCs.” To account for individual anatomy and disease, the system employs information from computed tomography scans to tailor radiation dose calculations for each patient.

The NCRP has promoted the principle of ALARA with the organization’s dose limit recommendations, because “the NCRP wished to emphasize that adherence only to dose limits was not sufficient.” The NCRP has noticed, however, that “in some instances, the application of the ALARA principle has been inappropriately exaggerated so that the use of radiation has, at times, been unnecessarily restricted and beneficial outcomes forfeited.” The ALARA principle recommends that economic and social factors be balanced with radiation protection, said the NCRP, but, in short, “sound judgment is essential in its proper application.”

The NCRP recommends that to prevent unnecessary efforts and to focus attention on higher exposures, “the procedures and documentation required to implement the ALARA principle be less formally applied as the annual dose to an individual is reduced farther and farther below the occupational limit.”

A footnote to the statement explained that “The assumption, for radiation protection purposes, that ‘the risk of stochastic effects is proportional to dose without threshold throughout the range of the dose and dose rates of importance in routine radiation protection’ (NCRP, 1993) has led some to the belief that even the lowest exposures are unduly hazardous.”

Copies of the statement are available from NCRP Publications, phone 301/657-2652, or from NCRP’s Web site, at <[www.ncrp.com](http://www.ncrp.com)>.

### ISOTOPE DATING

#### New technique permits analysis of older rocks

Scientists have often plied layers of rock with their most sophisticated tools, hoping to date them and discover the secrets of evolution and life on earth. The earliest rocks, however, from the Precambrian era (the first 3.5 billion years of earth’s existence), have been hard to date. They contain few fossils, which can help to date rock layers, and they are made up of particles from older rocks. Geologists at the University of Western Australia, in Nedlands, Australia, however, have now developed a technique to reduce the uncertainties involved in dating such rocks, according to a report published in the July 2 issue of *Science*.

They were able to use the mineral xenotime that had crystallized in the small spaces between grains of rock shortly after the sediment that forms the rock was deposited. That xenotime contains uranium, which slowly decays to lead. By freeing the lead from the xenotime crystals, the researchers were able to make it accessible for examination. Using established dating techniques based on the decay pattern of uranium, they were able to reduce the uncertainty surrounding the rock’s age from almost a billion years to 14 million years.

The researchers used a mass spectrometer dubbed SHRIMP II (sensitive high-resolution ion microprobe) to measure and analyze the lead-206 and -207 isotopes contained in the

xenotime crystals. The research was conducted on sedimentary rock made up of coarse crystals and rock fragments, known as siliclastic rock. If the technique proves useful with other rocks, it could help scientists pinpoint when prehistoric life forms first appeared on earth.

NRC

## **New rules proposed for general licensees**

The Nuclear Regulatory Commission has moved to amend its regulations covering users and distributors of radioactive material in industrial measuring, gauging, and controlling devices by publishing a proposed rule in the July 30 *Federal Register*. According to the NRC, the rules are meant to ensure that the devices are properly used and disposed of, and to reduce the chance of accidental radiation exposure or contamination.

Included in the proposal is a plan to institute an annual registration program, and a requirement that purchasers of equipment containing radioactive materials be given additional information by suppliers, detailing the requirements for ownership of the equipment. The devices contain heavy shielding to permit operation by workers without radiation training. If the equipment is not disposed of properly, however, and falls into the hands of someone who is not aware of the radioactivity, accidental exposures or contamination can result.

Owners of machines containing radioactive material that have been built with inherent safety features and approved by the NRC are known as general licensees. The NRC has not regularly contacted general licensees in the past, but the proposed rule would require general licensees to register with the NRC and pay \$420 annually. Only those general licensees having equipment "with quantities of certain radioactive materials posing a higher risk to public safety or property damage if the device were lost than would other generally licensed devices" would be included, according to the NRC. The majority of those devices are used in industrial applications measuring thickness, density, or chemical composition in industries such as petrochemical and steel manufacturing. About 5100 general licensees will be affected by the proposed rule.

Regulations on the sale of equipment containing radioactive materials would also be strengthened under the proposed rule, and the NRC plans to increase civil penalties for the loss or improper disposal of a device. A one-year amnesty period will go into effect after the rule is finalized.

Interested parties can submit comments until October 13, 1999, to: Secretary of the Commission, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555-0001, Attn.: Rulemakings and Adjudications Staff. Comments can also be submitted on the NRC's interactive rulemaking site, which can be found on the Web at <[www.nrc.gov](http://www.nrc.gov)>. **NW**