Compensating for COLD WAR CANCERS

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When the Energy Employees Occupational Illness Compensation Program Act (EEOICPA) became law on 30 October 2000, it was widely regarded as a landmark piece of legislation. After years of fighting workers' claims of occupational illness in court, the government had decided to acknowledge its responsibility for decades of unsafe working conditions in Cold War nuclear weapons factories. The law promised a lump sum payment of $150,000 plus medical benefits in compensation to individual workers or families of workers who had developed job-related illnesses.

However, another challenge lay ahead: how to equitably award the payments to the deserving workers. To do so, government administrators have developed a mathematical model using information about cancer risks from radiation exposure to determine which claims are likely to be job-related. However, the precise numerical results belie numerous assumptions and uncertainties, and the details of the plan have generated substantial debate.

The Equity Dilemma

Over a 50-year period from the late 1940s to the 1990s, the U.S. Department of Energy (DOE) and its contractors employed over 600,000 men and women at various sites in the production of nuclear weapons. These workers were exposed to a variety of radiation sources, including radon and X rays. The government had long denied that the working conditions could lead to disease, but that position finally changed in early 2000. Bill Richardson, energy secretary at the time, in announcing an early version of the compensation plan for workers, said that "the government is done fighting workers, and now we're going to help them."

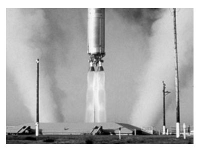
Responsibility for administering the EEOICPA's compensation program was assigned by President Clinton to the U.S. Department of Labor (DOL). Normally such duties would have been under the purview of the U.S. Department of Justice (DOJ), which oversees several other major compensation schemes including, for example, the September 11 Victim Compensation Fund, the National Vaccine Injury Compensation Program, and the Radiation Exposure Compensation Act, which compensates residents of Utah and Nevada exposed to radioactive fallout from nuclear testing. But worker advocates argued that in this case the agency had a conflict of interest because of its role in defending the government against worker claims.

Funds are appropriated for the program each year. For fiscal year 2002 the program received $597 million for benefits and $136 million for administration. But the legislation is written so that payments cannot be denied because of lack of funds in the DOL budget.

The EEOICPA provides compensation for illnesses related to three hazardous occupational exposures: radiation, beryllium, and silica. The victims of beryllium and silica exposure are relatively easy to identify, because they develop diseases specific to exposure to those agents. Beryllium is a light, highly rigid metal that withstands heat well and is used in nuclear weapons components. Some workers who were exposed to beryllium developed chronic beryllium disease, a disease of the lungs. Workers who mined tunnels in Nevada and Alaska for underground nuclear tests were exposed to silica dust, which causes chronic silicosis (nonmalignant lung disease).

But identifying the radiation victims is not so easy. The EEOICPA limits claims to victims who have developed cancer. This includes all types of cancer except chronic lymphocytic leukemia, which is not believed to be caused by radiation. But cancer is a common disease, even among those who have never gone near a nuclear weapons plant, and it is likely that many of the nuclear workers will develop cancers that are not job-related. Compensation administrators are left with a daunting challenge—how to decide who deserves to be compensated.

There is no foolproof test to determine whether a worker's lung cancer was caused by radiation or by, say, cigarette smoke. In occupational injury disputes involving cancer, administrators and courts are forced to rely on probabilities. Nicholas Ashford, a professor of technology and policy at the Massachusetts Institute of Technology, explains that, in such cases, decisions are made "not from the individual injury which is sustained, but from epidemiological evidence, which is largely statistical evidence." In other words, a doctor cannot identify the cause of a cancer by examining the patient, but information from epidemiologic studies and the patient's radiation exposure can determine whether it is likely that the cancer was caused by radiation.



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The EEOICPA requires that compensation for cancer be granted only if the disease is "at least as likely as not related to employment." This translates into a probability of 50% or greater, a cutoff that has been used in other compensation systems and in tort law. The principle here is that some individuals' cancers are more likely to be job-related than others, depending on how much radiation exposure they received, their age, and other factors. While the DOL will oversee the compensation program, the National Institute for Occupational Safety and Health (NIOSH) was charged with developing a scientifically based model to assign to each claimant a probability that his or her disease is job-related.

Models and Assumptions

The centerpiece of the NIOSH final rule on the probability of causation in radiation workers, which was promulgated on 2 May 2002, is a computer program known as the Interactive Radio-Epidemiological Program (IREP). The IREP was originally developed by the National Cancer Institute (NCI) to aid the Department of Veterans Affairs in adjudicating claims of atomic veterans (U.S. veterans exposed to radiation from a nuclear blast in World War II or during nuclear bomb tests during the Cold War), but NIOSH made some modifications in adapting it for the nuclear workers.

While the NIOSH–IREP model contains some highly technical bells and whistles, the basic calculation relies on one crucial piece of data: for any given radiation dose, how much does it increase a worker's risk of developing a particular type of cancer? The program contains a large database of cancer risk estimates for different types of cancer based on type of radiation, dose, sex, history of smoking, age at exposure, and age at which the cancer was diagnosed. However, these estimates of low-level radiation risk have been the subject of ongoing scientific controversy.

The NCI group that developed the original IREP model, led by radiation statistician Charles Land, primarily relied upon studies of 82,000 Japanese atomic bomb survivors, the richest data source available, to generate the risk model. However, some scientists have questioned the application of the Japanese survivor studies to American nuclear workers. While the Japanese at Hiroshima and Nagasaki were exposed to a single intense blast of radiation, the nuclear workers were exposed to smaller doses, sometimes over a period of decades, which, some experts say, could result in different biologic effects. Says epidemiologist David Richardson of the School of Public Health at the University of North Carolina at Chapel Hill (UNC), "The question is whether [the cancer risk values] are valid, and the validity is partly a question of extrapolating from a bomb blast to chronic exposures. That's probably the main source of uncertainty."

Richardson argues that the risk model should also incorporate findings from studies in U.S. nuclear workers. In a study published in the August 1999 issue of *EHP*, Richardson and UNC colleague Steve Wing studied 14,000 Cold War workers at Oak Ridge National Laboratory and found substantially higher cancer risks at low-level exposures than would have been predicted based on data from the atomic bomb survivors study. (Wing published an earlier paper on this same topic with similar results in the 20 March 1991 issue of the *Journal of the American Medical Association*.)

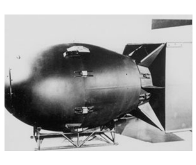
But results from other worker studies have been inconsistent. Other scientists maintain that because most workers are exposed to very low levels of radiation, it is difficult to distinguish between a small adverse effect and no effect at all. "The worker studies have a lot less information than the survivor studies," says statistician Daniel Stram of the University of Southern California.

Most radiation scientists do agree, however, that the same radiation dose has a different effect when it is given over a longer time interval. Says John Boice, scientific director of the International Epidemiology Institute and a member of the International Commission on Radiological Protection, "There's a wealth of animal and cellular and biological data that indicate that if you spread the dose over time, the effect is less." This is because human DNA is able to repair small amounts of damage.

In predicting risks for long-term exposures, major radiation protection organizations such as the National Council on Radiation Protection and Measurements, a nongovernmental group of radiation and health experts, recommend using a correction factor called a dose rate effectiveness factor (DREF). This factor represents how much the effectiveness of a dose of radiation decreases when it is given over a long time period (as a slower dose rate). A higher DREF number means that exposure over a longer time will be much less effective than the same exposure over a short time. The council (as well as other radiation protection authorities) suggests that the correct number to be used here is somewhere between 2 and 10, but they settled on 2 as the most prudent choice because it assumes the highest risk. Yet the appropriate value of this correction factor is uncertain. William Beckner, executive director of the council, says, "That number is based on a scientific judgment; it's not based on scientific data that it is a number of two."

NIOSH has adopted the recommended correction factor in their risk valuation model, though the agency has received criticism from both sides of the debate for doing so. Richardson and Wing maintain that their worker studies contradict the theory that a dose given over a longer time is less effective, and suggest that no correction is necessary. At the other extreme, Harvard physics professor and radiation expert Richard Wilson advocates for an even stronger correction factor. "Whoever chose the dose rate [effectiveness] factors was an extreme pessimist," he says.

Nevertheless, there is broad agreement on one point—the uncertainties in the NIOSH–IREP model are numerous and substantial. The model actually provides a range of possible values to reflect this uncertainty, and the EEOICPA requires that administrators use the value most favorable to the worker. Says Larry Elliott, director of the NIOSH Office of Compensation Analysis and Support, "We give the benefit of the doubt to the claimant, using science to the fullest extent possible in doing so."



The Politics of Compensation

Land insists that the model works exactly as intended. "If you are not compensated," he says, "it must be just about impossible not to have had a probability of causation less than fifty percent. It's an extremely generous standard of proof."

But worker advocates maintain that inequities persist. For instance, the NIOSH–IREP model treats smokers differently than nonsmokers when considering claims for lung cancer, imposing more stringent requirements for compensation. Knut Ringen is a consultant who provided public comment to NIOSH on the proposed compensation rule on behalf of the Center to Protect Workers' Rights, part of the AFL-CIO based in Silver Spring, Maryland. He is concerned that because 80% of the workers were smokers, very few will be eligible for compensation for lung cancer. "On one level this makes sense, but it leads to a totally absurd result," he says. "A smoker has to have up to thirty times the exposure in order to get the same compensation as a nonsmoker. We think that's just plain wrong."

Ultimately, some critics would like to see the burden of proof rest on the government, not on the worker. For example, physicist Marvin Resnikoff of Waste Management Associates, a New York City consulting company that provides dose estimates and other technical information on behalf of workers in litigation, opposes the requirement for exposure estimation. "They shift the burden on the workers to determine what these levels are," he says. "The presumption should be that there was stuff in the air and that the workers were exposed."

Indeed, the greatest uncertainty in adjudicating claims comes not from the scientific debate about radiation risks but from the lack of adequate records of worker exposures. Record-keeping practices for radiation safety were woefully deficient at many sites, particularly for intermittent and temporary workers such as those doing construction and maintenance work. NIOSH will do the work of dose reconstruction itself, based on DOE records and interviews with workers, according to a second final rule released at the same time. Exposures will have to be estimated based on job descriptions and measurements from comparable work settings. However, in some cases, the records may be so poor as to prevent any realistic estimation.

James Melius, a member of the Advisory Board on Radiation and Worker Health, which provides oversight of NIOSH's rule making under the EEOICPA, maintains that missing records pose a major challenge. Administrators will be forced to strike a balance between scientific accuracy and expedience, he says: "How far do you go in trying to find dose information or to reconstruct? I think that is a key issue. It may cost more just to do that than to award compensation."

The EEOICPA does provide for exceptions when exposure records are especially poor. The law singles out workers at a few notorious sites, including the gaseous diffusion plants at Paducah (Kentucky), Portsmouth (Ohio), and Oak Ridge (Tennessee) as "special exposure cohorts." Workers in this group simply have to show that they worked in an exposed job for at least 250 days. Under the EEOICPA, additions to the special exposure cohorts can be created for groups of workers where the radiation dose cannot be determined "with sufficient accuracy." NIOSH is still working on developing guidelines by which it will make these determinations.

The Advisory Board on Radiation and Worker Health will be a key player in all of this. The board provides independent advice to NIOSH with members reflecting "a balance of scientific, medical, and worker perspectives." Currently, though, the 12-member advisory board includes only one worker as well as one labor union physician. In February, advisory board chairman Paul Ziemer wrote to Department of Health and Human Services secretary Tommy Thompson asking that this imbalance be rectified, but so far no other workers have been added. The next advisory board meeting, to be held in Denver on 1–2 July 2002, will be the first held outside Washington, D.C., and board members hope that this will allow more input from former workers.

So far about $200 million has been paid out, mostly to uranium miners and members of the special exposure cohorts. About 4,000 cancer claims are currently awaiting assessment by the NIOSH–IREP model, after which they will forwarded to the DOL for a final decision. While the NIOSH rule prescribing the compensation model is now final, it allows for revisions to the NIOSH–IREP model under the oversight of the advisory board. Thus, disputes over the modeling assumptions are likely to continue.

However, Stram is quick to point out that, despite scientific differences, a lot is known about how to calculate radiation risks. "We probably know more about radiation than we do about any other exposure," he says. "Despite all of the uncertainties, we know that there is a bound on the risks." That may be small compensation to workers who fail the probability test and are left with the legacy of cancer.

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