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Using Decision Science to Empower Informed Choices about Health, Safety, and Environmental Risks

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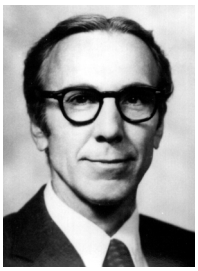
COMPENSATING GOVERNMENT WORKERS EXPOSED TO RADIATION



Arthur C. Upton, M.D.,
Environmental and Occupational Health Sciences Institute
Rutgers University

Richard Wilson, D. Phil.
Mallinckrodt Research Professor of Physics
Harvard University

"A plausible scenario if we proceed this way would be to offer government compensation to everyone in the country with any major ailment regardless of cause."

The announcement by the administration this Spring (details available at http://www.eh.doe.gov/benefits/nec/nec.html) that the US Department of Energy proposes to pay compensation to workers exposed to radiation and various chemical carcinogens raises an important societal issue. How does society compensate someone who has a disease which has a number of possible causes and for which the assignment of causation can only be expressed on a probabilistic basis?

With the exception of berylliosis, a disease caused by the toxic metal beryllium, the diseases for which the workers are being compensated are not unique to radiation exposure or chemical exposure. So diagnosis of the disease alone cannot determine what caused various diseases in the workers. Instead, the cause must be estimated in a probabilistic manner, taking into account exposure of the patient, the incidence of the disease expected from natural processes alone, and patient characteristics like age, gender, and family history.

Here is the procedure used to estimate the likelihood that radiation was the cause of the disease in question:

The Probability of Causation (POC) by a specified substance can be expressed in an equation: POC = Risk calculated from the estimated exposure to the substance, divided by risk from all causes, including the substance in question.

To establish the estimated exposure to radiation, readings are taken from a detection device, like a film badge or dosimeter, worn by the worker.

The risk can then be calculated from a dose-response relationship derived by epidemiologists who studied populations that were exposed to high levels of radiation. Many of these dose-response relationship studies were done on the surviving populations of atomic explosions in Hiroshima and Nagasaki, Japan.

Using these data, the National Cancer Institute (NCI) developed in 1986 a set of radioepidemiological tables. They show the probability (POC) that if any given person has received a radiation dose, D, at age t, and develops a cancer at age T, that radiation exposure caused the cancer.

(The chart below does not give age T. It is one in a series of charts used to calculate POC. It is offered as an illustration.)

Dose (Rems)			
100	70	50	41
10	24	9	7
7	3	1	0.7
	20	**40**	**60**

Age at Exposure

[Modified from Figure X-12 of NCI Tables]

These tables were prepared in response to Congressional mandate in the Orphan Drug Act. The purpose was to estimate POC for the 'downwinders', veterans who were exposed to an atomic bomb test as a part of their training, and citizens downwind. The individual POCs - the probability that radiation was the cause of any cancer the downwinders had - were less than 50%.

There is controversy about one critical assumption: the relationship between the dose and the response upon which these tables rely. That is, which dose-response model is used. NCI used a Linear No Threshold (LNT) model that implies a risk at any exposure above zero. But all professional groups in the field agree that for cumulative lifetime exposures below 20 Rems, there is no direct way of knowing the response because the increase of cancer incidence above the natural incidence is so small, just a few percent. We cannot even determine the sign of such an effect. In fact, some scientists believe in "hormesis", that radiation at these low levels may be beneficial. In this sense, then, the NCI tables are reasonable upper limits, 'worst case' estimates of POC while in many cases POC could be zero.

Once the POC has been calculated the science ends and society begins to decide what to do with the information. In the courts, the standard for what caused harm is “what is more likely than not”. In ordinary parlance this means that POC must be greater than 50%.

When the downwinders sought compensation, they would have faced that legal hurdle, and lost. But Congress passed a law that effectively awards compensation to any veteran downwinder in designated states with a radiogenic cancer - a cancer known to be increased by radiation - regardless of the POC. On signing this bill into law, President Reagan, to his credit, stated that neither the bill nor his signature should imply that radiation actually caused the cancers which were being compensated.

Until Wednesday April 12th 2000, the Department of Energy resisted compensation for workers with low POCs and whose exposures had been within allowable workplace standards. DOE was implicitly sticking by the “more likely than not” rule. Assistant Secretary David Michaels stated that the compensation decisions should be science-based. A DOE official said at a news conference that the agency would calculate POC and stick by it to determine compensation. Yet the numbers of people the DOE said should be compensated are far larger than would be compensated if the POC standard were maintained

Since then, Sen. Fred Thompson (R-TN), supported by DOE and the rest of the administration, introduced an amendment to the Defense Appropriations Act. While maintaining the POC procedure in general, the amendment would empower DOE to specify an exposure cohort, a group of persons such as those working on national defense in specific defense laboratories. These people would be compensated as would be the downwinders, regardless of POC.

This procedure is similar to the “heart laws” that apply in many fire and police departments. These laws compensate any policeman or fireman who develops heart trouble: it is simply assumed that it is work related. But now that it has been realized that cigarette smoking is a far larger cause of heart attacks than fighting fires or felons, these laws are often being modified so that they only apply to firemen and policemen who don’t smoke.

The government’s solution for compensating workers and residents exposed to radiation replaces one problem - public sympathy for cancer victims who have helped to defend the country - with another – excessive largesse.

Consider one example that highlights the dangers of using this non-science based approach to compensating victims of pollution. To produce electricity for the DOE facilities at Portsmouth and Paducah in the Ohio Valley, DOE relied on a contractor with inadequate pollution control. The site is in the location identified as having the largest increase in death from respiratory diseases in the Harvard “Six Cities” study of air pollution. Many scientists believe that the air pollution contributes to increased deaths, and that a linear dose response relation is at least as likely for air pollution as it is for radiation-induced cancers.

Should the workers, who had compensation for the risk of exposure to air pollution in the form of their pay, be

Harvard Center for Risk Analysis
Harvard School of Public Health
718 Huntington Avenue
Boston, Massachusetts
02115-5924
617 432-4497
www.hcra.harvard.edu

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PEER REVIEWERS:

GEORGE GRAY, PH.D.

KAREN KUNTZ, SC.D.

compensated for respiratory illnesses? The public had no compensation. Should they be paid too, if they got sick? If the millions of the public who were exposed are compensated the same way the DOE is proposing to compensate radiation workers, it would break the federal bank.

When the calculated POC is close to 50% it is fairly well determined from actual data. When it is 0.1% it depends very much on theory. At what point should we cut off compensation? If there is no clear procedure, no clear scientific standard, compensation decisions on all sorts of exposures will be arbitrary and capricious and subject to endless legal wrangling, as well as enormously expensive. A plausible scenario if we proceed this way would be to offer government compensation to everyone in the country with any major ailment regardless of cause.

We therefore urge scientists who are concerned with public policy to make their views known. Our suggestion, made several times by many people in the last 15 years, is to decide on a sum for compensation for the disease in question (perhaps $500,000) and then pay a fraction of this equal to $500,000 X POC (POC is always less than 1) with perhaps a “de minimis” cut off at some suitable figure. Although the exposure is usually less well known for substances or agents other than radiation, the same principles could apply to compensation for any substance or agent.

We also urge a peer review of the work of the panel whose work formed the basis of the new DOE policy. Those panels did not include any of the well-known experts on the effects of radiation on people. That may be appropriate for a “new look” at the data. But now that their report has been presented, the “elder statesmen” in the field have a right and duty to apply their extensive experience to see whether the new proposals make sense. And the government has an obligation to the public to call on this expertise.

On April 12th the DOE started a procedure that has extraordinary ramifications. Scientists and others concerned with public policy in these matters must act quickly to ensure that these ramifications are fully understood and a consistent procedure for handling these matters, hopefully based upon good science, replaces the present haphazard approach.