

# HEALTH BULLETIN

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## Job Factors, Radiation, and Cancer Mortality at Oak Ridge National Laboratory: Followup Through 1984

A study published in the March 20, 1991, issue of the Journal of the American Medical Association (JAMA 265:1397-1402) examined the causes of death among white men who worked at the Oak Ridge National Laboratory (ORNL) between 1943 and 1972. The authors compared death rates for the calendar period 1943 to 1984 among workers exposed externally to ionizing radiation with those among workers who had no recorded exposure. The cancer death rate increased with total radiation dose, but this relationship was not observed for any specific type of cancer. The death rate for leukemia among ORNL workers was higher than that for U.S. white men, but this excess was not related to radiation exposure.

Additional analyses of death rates among the same ORNL workers, will be published in the February 1993 issue of the American Journal of Industrial Medicine. These analyses focus on other factors that might influence death rates to see whether accounting for these factors would change the statistical relationship between cancer and radiation exposure. These include: length of employment in specific job categories, factors related to time of hire (for example, men hired during World War II may have been less healthy than men drafted for military service, or may have had exposure to higher levels of radiation than men hired later in time), and exposures to substances such as beryllium, lead, and mercury.

The study population consisted of 8,318 white men. One thousand four hundred and ninety of these men died between 1943 and 1984. Death rates for cancer were calculated for men employed in 15 broad job categories that were assumed to have similar occupational exposures. The death rate for cancer rose with length of employment in six of the categories: radioisotopes production, chemical operations, physics, engineering (construction), engineering (hazards), and "unknown" jobs. Further statistical analyses suggested that measured external radiation exposure might account for this finding in two of the job categories (radioisotopes production and chemical operations). Accounting for potential exposure to lead, mercury, or beryllium did not change the relationship between cancer and radiation exposure. The cancer death rate among workers hired during World War II was similar to that among men hired later.

There were several limitations in the study methods that should be considered in interpreting the results. Most important, results were shown only for all types of cancer combined. The term "cancer" comprises many diseases that have different causes. Broad job categories were used as a substitute for exposure. Individual exposure levels for specific substances like beryllium, lead, and mercury were not determined. Each worker had an average of 1.5 jobs during his career, thus, any individual worker could have been included in more than one category. One of the most important risk factors associated with cancer (lung cancer, in particular), cigarette smoking, was not considered. Because about half of all deaths from cancer are lung cancer, it would be important to consider smoking as a factor.

This study is one of many that has looked at the mortality experience of ORNL workers, and radiation exposed workers in general.

*Epidemiologic Note:*

*In evaluating whether there is a cause and effect relationship between an exposure (or risk factor) and a disease, researchers carefully consider the following questions:*

*How strong is the relationship between the disease and the exposure? The larger the difference between the rate of disease in an exposed population compared to that in an unexposed population, the more likely the disease is caused by the exposure.*

*Was the relationship statistically significant? If there were more cases of the disease than would be expected due to chance alone, the relationship is more likely to be causal.*

*Does the rate of disease increase consistently with increasing level of exposure? If the relationship is a causal one, we might expect to see higher rates of disease among people who had higher levels of exposure or who were exposed for a longer time.*

*Did the exposure occur a sufficient amount of time before the disease developed to have been able to cause the disease? Some diseases, like certain forms of cancer, take many years to develop, and to cause the disease the exposure must occur many years earlier.*

*Do similar studies of different populations having the same exposure show similar results? If the same relationship is seen in many studies, then it is likely that the relationship is causal. If the results of studies are different, then it is difficult to make any interpretations regarding cause.*

*Are the results consistent with what we know about human biology and disease natural history? If the results are consistent, then it is more likely that the relationship is causal.*

*Finally, researchers consider the design and limitations of the study. Are there any weaknesses in the methodology that may influence the conclusions? Have other factors that may also be related to the disease of interest been considered? How accurate are the measurements of the exposure and of the occurrence of the disease?*

This Health Bulletin is one in a series of routine publications issued by the Office of Health to share data from health studies throughout the DOE complex. The authors' conclusions do not necessarily reflect those of the Department. For more information contact: Dr. Terry L. Thomas, Director, Health Coordination and Communication Division, Office of Epidemiology and Health Surveillance, U.S. Department of Energy, Washington, D.C. 20585; Telephone (301) 903-5328.