



National Institute for Occupational Safety and Health Announcement of Findings Occupational Energy Research Program

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WORKPLACE
SAFETY AND HEALTH

NIOSH Multi-Site Leukemia Study

Why was this study done?

Previous studies suggest exposure to high doses of ionizing radiation may cause leukemia. However, it is still uncertain if low doses of ionizing radiation, which are common in some workplaces, may also cause leukemia.

Leukemia is a type of cancer, an illness that starts in blood-forming tissue such as bone marrow. Leukemia causes large numbers of abnormal blood cells to be produced. The cancer cells interfere with the body's production of healthy cells, making the body unable to fight off infections.

Leukemia is either chronic (slowly progressing) or acute (rapidly progressing).

There are many types of leukemia. The four **main** types are:

- Acute lymphocytic leukemia
- Acute myeloid leukemia
- Chronic lymphocytic leukemia
- Chronic myeloid leukemia

Who did this study?

The National Institute for Occupational Safety and Health (NIOSH) is a federal research agency that works to improve the health and safety of workers. NIOSH researchers looked at a group of nuclear workers to see if being exposed to low doses of ionizing radiation in the workplace may or may not be linked with fatal leukemia (death caused from leukemia).

What nuclear facilities were involved in this study?

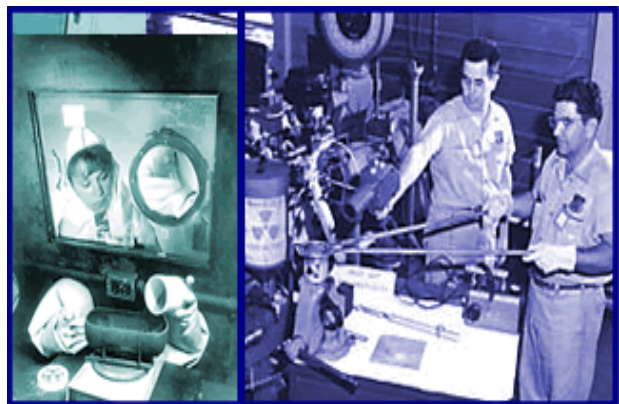
Five U.S. nuclear facilities were involved:

- Hanford Site
- Los Alamos National Laboratory (including Zia workers)
- Oak Ridge National Laboratory
- Portsmouth Naval Shipyard
- Savannah River Site

Between the 1940s and 1990s, a total of 94,517 workers were monitored for radiation exposure at these facilities. Using death certificates, we found 257 of these workers died from a type of leukemia.

Who was included in the study?

Because this study focused on fatal leukemia we wanted to learn more about the workers who died from leukemia by comparing them to workers who did not die from leukemia.



This study included 249 of the 257 workers who died from leukemia (eight workers were not included because it was not clear what type of leukemia they died from). These 249 workers died from different types of leukemia (see graph 1).

We compared the 249 workers to a sample of 995 workers from these sites who did not die from leukemia and were the same age as the workers who had died from leukemia.

How was the study done?

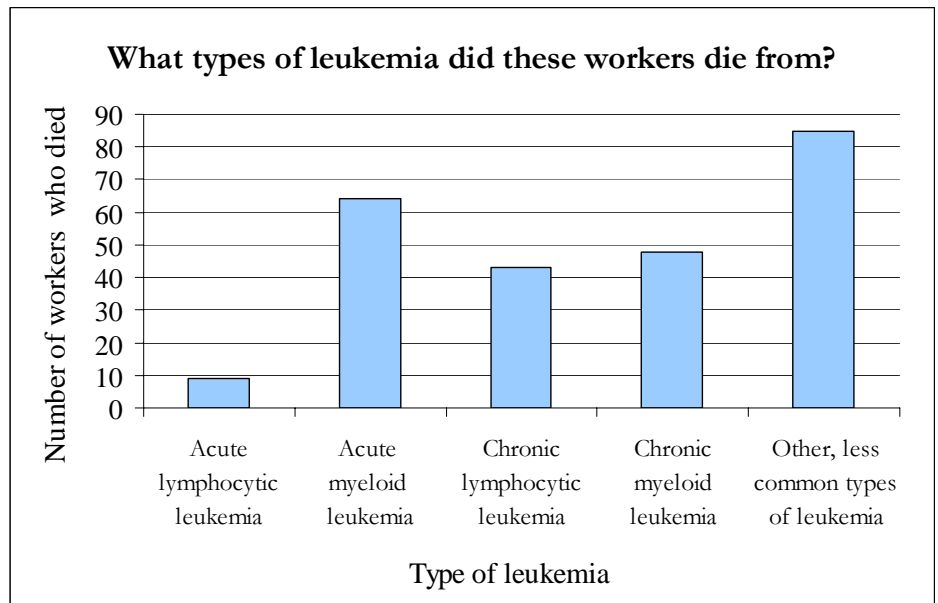
Using information and records gathered from the study sites, we estimated radiation doses for the 249 workers who died from leukemia. Radiation doses were also estimated for the comparison group of 995 workers who did not die from leukemia.

We noted if any of these workers smoked or were exposed to other possible cancer-causing agents in the workplace, including benzene and carbon tetrachloride.

We compared the radiation doses of workers who died of leukemia to the radiation doses of the comparison group. From this, we were able to examine the possible link between fatal leukemia and the amount of radiation exposure in the workplace. This is called the “dose-response” relation.

What did the study find?

- The death rate for chronic myeloid, acute lymphocytic, acute myeloid and the other, less common types of leukemia combined was slightly higher in workers exposed to more than one rem of radiation total during their employment at one of these sites compared to workers who received lower doses.



Graph 1: Types of leukemia the 249 workers died from.

- No increase in death rate for the chronic lymphocytic type of leukemia was seen among these workers.
- On average, workers with fatal leukemia were exposed to a total of three rems of radiation during their employment at one of these sites.
- The dose response relation in our study was similar to earlier studies of radiation-exposed populations.

What does this mean?

After taking into account smoking and exposure to benzene and carbon tetrachloride, we found the risk of some types of leukemia was slightly higher in workers exposed to more than one rem of radiation.

One way this can be explained is by comparing two groups of men in the U.S.: one group not exposed to radiation and a second group exposed to three rems of radiation (the average total exposure in the workers with fatal leukemia). The normal lifetime chance of dying from leukemia in the first group is 71 men out of 10,000. The lifetime chance of dying from leukemia in

the second group is 77 men out of 10,000.

If you were exposed to this level it does not mean you will get leukemia. It is important to remember that our study looked at these workers as a group, and therefore cannot predict the future health of any one person.

What were the limitations?

Because methods to record radiation exposure have improved over time, it is likely exposure estimates are more accurate for later years compared to those from the 1940's. When we looked at workers with the same amount of radiation exposure, we found workers hired after 1952 seemed to have a higher chance of leukemia than workers hired earlier.

Also, this study only included workers who died from leukemia. Workers who currently have, or did not die from leukemia were not included because information on cancer illness was not available in all states until recently.

What should you do?

Average radiation exposures are generally lower in workers today compared to 40 years ago because of improved technology and changes in work practices. If you currently work with radioactive materials or non-radioactive hazardous materials, contact your health and safety representative if you have any questions about your exposure or how to best protect yourself.

Additional Information

Information on the types, symptoms, and treatment of leukemia

The American Cancer Society at www.cancer.org or call 1-800-227-2345

The National Cancer Institute at www.cancer.gov or call 1-800-4-CANCER

Building Trades National Medical Screening Program

This program is designed to identify health problems caused by hazardous substances workers may have been exposed to while working on a Department of Energy site. For more information, visit www.btmed.org or call 1-800-866-9663.

Compensation Program for Civilian Nuclear Weapons Workers

If you have developed an illness you think might be related to exposure from working at a Department of Energy (DOE) site or a DOE contractor facility, you could be eligible for benefits under the Energy Employees Occupational Illness Compensation Program Act of 2000 (EEOICPA).

EEOICPA, administered by the Department of Labor, provides compensation and medical benefits for certain civilian nuclear weapons workers (and their survivors) who may have developed certain work-related illnesses, including cancer. NOTE: Not all DOE workers will be eligible for this compensation.

The NIOSH Office of Compensation Analysis and Support (OCAS) helps the Department of Labor (DOL) by reconstructing radiation doses for certain claimants who have developed cancer.

For more information about EEOICPA, visit www.cdc.gov/niosh/ocas or www.dol.gov/esa/regs/compliance/owcp/eoicp/main.htm.

Centers for Disease Control and Prevention (CDC)

CDC is the federal agency that works to promote health and quality of life by preventing and controlling disease, injury, and disability. For more information, visit www.cdc.gov or call 1-800-CDC-INFO.

National Institute for Occupational Safety and Health (NIOSH)

NIOSH is the federal agency within CDC that is responsible for conducting research and making recommendations for the prevention of work-related injury and illness. For more information, visit www.cdc.gov/niosh.

Study Information

This study was done by the NIOSH Occupational Energy Research Program (OERP) and was funded by the Department of Energy (DOE). For more information about the OERP or to obtain an electronic copy of this worker notification, visit: www.cdc.gov/niosh/oerp/ or call 1-800-CDC-INFO

Study Publications

Schubauer-Berigan MK, et al. Risk of chronic myeloid and acute leukemia mortality following exposure to ionizing radiation among workers at four U.S. nuclear weapons facilities and a nuclear naval shipyard. *Radiation Research*. 2007; 167:222-232.

Download from:

www.cdc.gov/niosh/oerp/pdfs/RadiatRes167222-232.pdf

Schubauer-Berigan MK, et al. Chronic lymphocytic leukaemia and radiation: findings among workers at five US nuclear facilities and a review of the recent literature. *British Journal of Haematology*. 2007; 139:799-808.

