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Prostrate Cancer and Exposure to Ionizing Radiation

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Prostate Cancer and Exposure to Ionizing Radiation

Summary: Evidence has been recorded of an connection between cancers of the prostate and exposure to ionizing radiation. This connection is supported by evidence from studies of nuclear workers in England who have been exposed to ionizing radiation. The National Research Council's, on the other hand, has determined that the prostate is relatively insensitive to ionizing radiation. Prostate cancer is not designated as a "specified" cancer under the Energy Employees Occupational Illness Compensation Program Act. Historically, prostate cancer incidence has been high for Los Alamos County while prostate cancer mortality has been low compared to other counties in the state. Prostate cancer incidence and mortality rates in Rio Arriba County were among the top third of New Mexico counties. Incidence means new cases of cancer, while mortality means deaths due to cancer.

What is Prostate Cancer?

The prostate is a gland in a man's reproductive system. The prostate is about the size of a walnut. It is located below the bladder. Cancer of the prostate occurs when cells of the prostate become abnormal and reproduce without control. Tumors of the prostate that are not cancer are common. (National Cancer Institute)

Findings of Human Health Research Studies

Human health research studies compare the patterns of disease among groups of people with different amounts of exposure to a suspected risk factor. Below are results reported from such studies of prostate cancer among people exposed to ionizing radiation.

All of these studies found increases and possible increases in prostate cancer among certain groups of exposed workers. Statistically significant is a term used to mean that the connection between the health outcome and the exposure was strong enough that it was unlikely to be due to chance. An asterisk (*) was placed by statistically significant findings. The research included incidence studies, which look at new cases of cancer. These can track health more quickly and accurately than mortality studies of deaths due to cancer.

Studies of Los Alamos National Laboratory (LANL) Workers

Research conducted of LANL workers provides the most direct evidence about possible relationships between a health problem and workplace exposures at LANL.

- In studies performed to date, no reported evidence of increased rates of prostate cancer in LANL employees.

***** *Findings were statistically significant (strong evidence)*

+ *Evidence of a dose-response relationship (strongest evidence)*

Studies of Other Nuclear Workers in the United States

The next most relevant evidence comes from studies of workers in similar occupations with the same types of exposures. Listed below are studies that looked at prostate cancer and workplace exposures among nuclear workers in other parts of the United States.

- **Fernald, Ohio:** A possible increase in prostate cancer deaths was found in a study of 4,014 males who were employed between 1951 and 1989, and then followed through 1989. [1]

- **Lawrence Livermore, California:** A possible increased incidence of prostate cancer was seen in men employed between 1969 and 1980. [22]

- **Mallinckrodt, St. Louis, Missouri:** A possible increase in prostate cancer deaths was found in a study of 2,514 males employed in uranium processing between 1942 and 1966, followed-up through 1993. [2]

- **Oak Ridge:** A possible increase in prostate cancer deaths was found in a study of 8,375 males who were employed for at least 30 days between 1943 and 1972, and then followed through 1977. [50] Similar findings in 3,763 workers who were monitored for internal contamination, followed through 1984. [57]

- **Oak Ridge Y-12:** A possible increase in prostate cancer deaths was seen in a study of 7,043 males employed between 1947 and 1990, and then followed through 1990. [24]

- **Rocky Flats, Colorado:** A possible increase in prostate cancer deaths was found in a study of 5,413 males who were employed for at least two years between 1952 and 1979, and then followed through 1979. [28]

- **Savannah River Site**: A possible increase in prostate cancer deaths was seen among salaried employees and in white males employed before 1955. [44]

Studies of Other Nuclear Workers World-Wide

Below are studies of nuclear workers outside of the United States that looked at prostate cancer in connection with radiation exposures.

- **Atomic Energy of Canada:** A possible increase in prostate cancer deaths was found in a study of 8,977 men who were employed between 1956 and 1985. [46]

- **Atomic Weapons Establishment of the U.K.:** An increase in prostate cancer deaths was found in a study of 9,389 workers who were monitored for radiation while employed between 1951 and 1982, and then followed through 1982.* A possible increase in prostate cancer deaths was found in an analysis of the 3,742 workers who were monitored for internal radionuclides (This study assumed a 10 year latent period). [53]

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- **Sellafield, England:** An increase in prostate cancer deaths was found in a study of radiation workers who were employed between 1947 and 1975, and then followed to 1992, when compared to non-radiation workers.* Also, an increase in deaths due to benign prostatic hyperplasia (BPH) was found in plutonium workers employed between 1947 and 1975, when compared to other radiation workers.[3] *

- **Atomic Energy Authority of the U.K.:** Risk of prostate cancer increased in men who were internally contaminated by tritium, chromium-51, iron-59, cobalt-60 or zinc-65.* Risk increased with length of time working in contaminated areas and increasing levels of contamination.[76] *+ A scientist commenting on this study pointed out that zinc-65 localizes in the prostate gland.[letters to BMJ re: Rooney #37, #44]

Studies of Other Ionizing Radiation Exposures

Studies among other groups of people who were not nuclear workers can also be significant as evidence of possible increases in prostate cancer among those who have been exposed to ionizing radiation. Most other research has been conducted of people exposed to atomic bombs.

- **Atomic Bomb Survivors:** In studies performed to date there is no reported evidence of increased rates of prostate cancer in A-bomb survivors.

Other Research and Policy Findings

Is the Prostate Sensitive to Radiation?

- According to the National Research Council's BEIR V committee, "the sensitivity of the prostate to the induction of cancer by irradiation appears to be comparatively low."(9) However, this was written before the British nuclear worker studies (above) were published.

The National Research Council advises the U.S. government on scientific matters. Their Committee on Biological Effects of Exposure to Ionizing Radiations (BEIR) V reviewed sensitivity of parts of the body to radiation. Their findings are based mostly on studies of cancer among atomic bomb survivors, as well as on some of the available information on the biology of the body, animal studies, and other evidence. The greatest risk is at high exposure levels.

Is Prostate Cancer a "Specified" Cancer Under the Energy Employees Occupational Illness Compensation Program Act (EEOICPA)?

- **No.** Prostate cancer is not a "specified" cancer under the EEOICPA consideration of Special Exposure Cohorts.

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Policy makers have identified certain types of cancer among energy employees at nuclear facilities, including those employed at Los Alamos National Laboratory, as being potentially related to occupational exposures under the EEOICPA.

What Are Other Risk Factors for Prostate Cancer?

In considering the risks of occupational exposure to ionizing radiation, it is important to understand other risk factors. Below is a list of other possible risk factors for prostate cancer.

- **Family History.** A man's risk for developing prostate cancer is higher if his family has a history of developing prostate cancer
- **Diet.** Some evidence suggests that a diet high in animal fat may increase the risk of prostate cancer and a diet high in fruits and vegetables may decrease the risk

These factors may add to any risk due to workplace exposure to ionizing radiation. Risk increases with age. This disease is much more common in African American men than in white men, but less common in Asian and American Indian men. Smoking is not related to prostate cancer.

Rates of Prostate Cancer In Exposed Counties

Los Alamos County

Rates of prostate cancer incidence was very high in Los Alamos County, while mortality was very low. Los Alamos County:

- Ranked highest in incidence of prostate cancer and
- Ranked 23rd in mortality among 33 counties in New Mexico from 1970 to 1996.

This is evidence of earlier detection and successful treatment of prostate cancer in Los Alamos County, compared to other counties. In recent years, about 20 cases have occurred annually.[13]

Rio Arriba County

Rates of prostate cancer incidence and mortality for Rio Arriba County were in the top third of counties. The county:

- Ranked 10th in incidence and
- Ranked 8th in mortality for prostate cancer among the 33 counties in New Mexico from 1970 to 1996. [33]

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+ *Evidence of a dose-response relationship (strongest evidence)*