



## Testicular Cancer and Exposure to Ionizing Radiation

**Summary:** Evidence varies on whether there may be an connection between testicular cancer and exposure to ionizing radiation. This connection is supported by some 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 testis are relatively insensitive to ionizing radiation. Testicular cancer is not designated as a "specified" cancer under the Energy Employees Occupational Illness Compensation Program Act. Historically, testicular cancer incidence has been very high for Los Alamos County while mortality was very low compared to other counties. Incidence in Rio Arriba County was in the top third of New Mexico county rates.

### ***What is Testicular Cancer?***

Testicular cancer is a disease in which cells become cancerous in one or both testicles. The testicles (also called testes or gonads) are a pair of male sex glands. They produce and store sperm, and are also the body's main source of male hormones. (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 testicular cancer among people exposed to ionizing radiation.

These studies found increases and possible increases in testicular cancer among certain groups of exposed individuals, in some cases followed over time. 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. Adding to the strength of the findings is that increasing rates of testicular cancer were observed with higher doses in some studies.

### ***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.

- **UC & Zia Employees:** A possible increased incidence of testicular cancer was found in Anglo males employed for at least one year between 1969 and 1978. This finding was just based on three cases.<sup>16</sup>

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\* 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 testicular cancer and workplace exposures among nuclear workers in other parts of the United States.

- **Lawrence Livermore, California:** A possible increased incidence of testicular cancer was found in men employed between 1969 and 1980.<sup>22</sup>
- **U.S. Transuranics Registry:** Plutonium is retained in the testis longer than in other soft tissues.<sup>78</sup>

### ***Studies of Other Nuclear Workers World-Wide***

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

- **Nuclear Workers in England:** Increase in deaths due to cancer of the testis was found in a study of 40,761 men who were ever monitored for tritium.<sup>29\*</sup>
- **Atomic Energy Authority of the U.K.:** A possible increase in deaths from cancer of the testis was found in a study of men who were employed between 1946 and 1979, and then followed through 1986. Most of the cases accounting for the excess occurred at the Harwell facility.<sup>6</sup>
- **Canadian Radiation Workers:** Increasing incidence of cancer of the testis was seen with increasing doses of radiation in a study of 95,643 men exposed between 1951 and 1988.<sup>\*+</sup> The researchers who conducted the study wrote “the result needs to be interpreted with caution.”<sup>47</sup>

### ***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 testicular 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 testicular cancer in A-bomb survivors.

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\* Findings were statistically significant (strong evidence)

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



## Other Research and Policy Findings

### ***Is the Testis Sensitive to Radiation?***

- According to the National Research Council's BEIR V committee, "the human testis is relatively insensitive to the carcinogenic effects of radiation."<sup>9</sup>

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

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

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 Testicular 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 testicular cancer.

- **Development of the testis.** Men who have had a testicle that did not move down into the scrotum are at greater risk for developing the disease. This is true even if surgery is performed place the testicle in the scrotum
- **Genetics.** Men with Klinefelter's syndrome (a sex chromosome disorder that may be characterized by low levels of male hormones, sterility, breast enlargement, and small testes) are at greater risk of developing testicular cancer.
- **Cancer history.** Men who have a history of testicular cancer are at increased risk of redeveloping the cancer

These factors may add to any risk due to workplace exposure to ionizing radiation. Smoking is not related to testicular cancer.

## Rates of Testicular Cancer in Exposed Counties

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\* Findings were statistically significant (strong evidence)

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



### **Los Alamos County**

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

- Ranked highest in the incidence of testicular cancer among the 33 counties in New Mexico from 1970 to 1996.
- There were no deaths due to testicular cancer, however. This is evidence of earlier detection and successful treatment of testicular cancer in Los Alamos County, compared to other counties in New Mexico.
- In recent years, about one to two cases have occurred annually in the county.<sup>14, 78</sup> There was a consistent increase in incidence between 1984 and 1997.<sup>79</sup>

### **Rio Arriba County**

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

- Ranked 10<sup>th</sup> highest in incidence among the 33 counties in New Mexico from 1970 to 1996.
- During this time, there were three deaths due to testicular cancer.<sup>33</sup>

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\* Findings were statistically significant (strong evidence)

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