



## Breast Cancer and Exposure to Ionizing Radiation

**Summary:** There is strong evidence that breast cancer may be associated with exposure to ionizing radiation. This evidence includes studies of nuclear workers and others exposed to ionizing radiation. These findings are consistent with the National Research Council's determination that breast tissue is sensitive to ionizing radiation. Breast cancer is designated as a "specified" cancer under the Energy Employees Occupational Illness Compensation Program Act. Historically, breast cancer incidence and mortality have both been very high in Los Alamos County. Incidence and mortality in Rio Arriba County has been moderate to low among New Mexico counties. Incidence means new cases of cancer, while mortality means deaths due to cancer. A need exists for improved treatment and prevention in Los Alamos County.

### ***What is Breast Cancer?***

Breast cancer starts in the tissues of the breast. While mostly a disease of women, men can get breast cancer. When cancer arises in breast tissue and spreads (metastasizes) outside the breast, cancer cells are often found in the lymph nodes under the arm. Breast cancer cells may further spread to other parts of the body -- other lymph nodes and other organs, such as the bones, liver, or lungs. Other than skin cancer, breast cancer is the most common type of cancer among women in the United States. (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 breast cancer among people exposed to ionizing radiation.

All of these studies found increases and possible increases in breast 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 breast 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 breast cancer were observed with higher doses in some studies.

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\* Findings were statistically significant (strong evidence)

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



### **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 increase in breast cancer incidence was observed among Anglo females who were employed for at least one year between 1969 and 1978. LANL researchers who performed the study concluded it was “not likely related to the Los Alamos work environment.”<sup>16</sup> One male breast cancer case was reported.
- **Female Lab Employees Study:** A possible increase in breast cancer deaths was observed in white female radiation workers who were employed at least six months between 1943 and 1979, when compared to non-radiation workers (This study assumed a 25 year latency period).<sup>36</sup> But the researcher who conducted the study did not think it was work-related.

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

- **Oak Ridge Y-12:** A possible increase in breast cancer deaths was observed in a study of 1,073 women first employed between 1947 and 1974, and followed through 1990.<sup>24</sup>
- **Women at 10 Department of Energy (DOE) Sites:** Possible increasing rates of breast cancer deaths were observed with increasing doses of external radiation in a study of 65,984 women employed at 10 DOE facilities between start-up and 1980.<sup>37 +</sup>

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

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

- **Sellafield, England:** An increase in breast cancer deaths was found in a study of 5,203 plutonium workers who were first employed between 1947 and 1975, and followed through 1992, when compared to other radiation workers.<sup>3 \*</sup>
- **Obninsk (IPPE), Russia:** A possible increase was observed in breast cancer incidence in a study of 2,202 females who were hired before 1981 and still employed between 1991 and 1997.<sup>7</sup>

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## ***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 breast cancer among those who have been exposed to ionizing radiation. Most other research has been conducted of people exposed to atomic bombs.

- **A-Bomb:** Increasing female breast cancer deaths were observed with increasing doses of radiation.<sup>8 \*+</sup> The biggest risk of breast cancer was for those who were under 15 years old at the time of exposure.<sup>38</sup>

## **Other Research and Policy Findings**

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

- **Yes.** According to the National Research Council's BEIR V Committee, radiation-induced breast cancer has a minimum latent period of 10 years. The risk is greatest for persons less than 20 years old at the time of exposure.<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 levels of exposure.

### ***Is Breast Cancer a “Specified” Cancer Under the Energy Employees Occupational Illness Compensation Program Act (EEOICPA)?***

- **Yes.** Male and female breast cancers are “specified” cancers 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 Breast Cancer?***

In considering the cancer risk from exposure to ionizing radiation at work, it is important to understand other risk factors. The following is a list of other possible risk factors for breast cancer.

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- **Estrogen.** Evidence suggests that the longer a woman is exposed to estrogen (the estrogen hormone made by the body, taken as a drug, or delivered by a patch), the more likely she is to develop breast cancer.
- **Genetic differences.** Some people are born with differences in the cells of their bodies that may increase the risk of breast cancer.
- **Certain breast changes.** Having a diagnosis of certain unusual cell changes in breast tissue may increase a woman's risk for developing cancer.
- **Late childbearing.** Women who have their first child late (after about age 30) have a greater chance of developing breast cancer than women who have a child at a younger age.
- **Radiation therapy.** Women whose breasts were exposed to radiation during radiation therapy before age 30, especially those who were treated with radiation for Hodgkin's disease, are at an increased risk for developing breast cancer.
- **Alcohol.** Some studies suggest a slightly higher risk of breast cancer among women who drink alcohol.

These factors may add to any risk due to workplace exposure to ionizing radiation. Studies show that the risk of breast cancer increases as a woman gets older and for those with family or personal histories of breast cancer. Breast cancer occurs more often in white women than African American or Asian women. Smoking is not thought to be related to breast cancer.

## Rates of Breast Cancer In Exposed Counties

### **Los Alamos County**

There have been very high rates of breast cancer reported in Los Alamos County for breast cancer incidence and breast cancer mortality.

- Los Alamos County ranked highest in both breast cancer incidence and mortality from 1970 to 1996 of the 33 counties in New Mexico. The explanations most frequently offered are: the county population's high socioeconomic status, low birth rate, and late times of first pregnancy -- all well-documented risk factors for female breast cancer.<sup>32, 35</sup>
- In recent years, about 15 new cases of breast cancer have been diagnosed each year in Los Alamos County.<sup>13</sup>

### **Rio Arriba County**

Rates of breast cancer incidence reported in Rio Arriba County have been moderate while breast cancer mortality has been low. Rio Arriba County:

- Ranked 22<sup>nd</sup> in breast cancer incidence and
  - Ranked 29<sup>th</sup> in breast cancer mortality from 1970 to 1996 of 33 New Mexico counties.<sup>33</sup>
- The high rates of breast cancer incidence and mortality in Los Angeles County indicate that more needs to be done in Los Angeles County to prevent and treat breast cancer.

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