



## Bladder Cancer and Exposure to Ionizing Radiation

**Summary:** There is strong evidence that bladder cancer may be associated with exposure to ionizing radiation. This evidence includes studies of nuclear workers. This is consistent with the National Research Council's finding that the bladder is sensitive to ionizing radiation. Bladder cancer is designated as a "specified" cancer under the Energy Employees Occupational Illness Compensation Program Act. Historically, incidence of bladder cancer has been high in both Los Alamos County and Rio Arriba County. Mortality has been very low in Los Alamos County and moderate in Rio Arriba County. Incidence means new cases of cancer, while mortality means deaths due to cancer. This indicates a need for improved treatment and prevention in Rio Arriba County.

### ***What is Bladder Cancer?***

The bladder is a hollow organ that stores urine. Bladder cancers may be named after the type of cell that is cancerous. For example, most bladder cancers begin in the transitional cells that line the bladder. This type of bladder cancer is called transitional cell carcinoma. (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 studies of bladder cancer among people exposed to ionizing radiation.

These studies found increases and possible increases in bladder 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 bladder 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 bladder 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.

- In studies performed to date there is no reported evidence of increased rates of bladder cancer in LANL workers.

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

- **Fernald, Ohio:** A possible increase in bladder cancer deaths was found in a study of 4,014 uranium processing workers who were employed between 1951 and 1989, and followed through 1989.<sup>1</sup>
- **Mallinckrodt, Missouri:** A possible increase in bladder cancer deaths was found in a study of 2,514 uranium processing workers who were employed between 1942 and 1966, and followed through 1993.<sup>2</sup>



## ***Studies of Other Nuclear Workers Worldwide***

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

- **Sellafield, England:** A possible increase in bladder cancer deaths was found in a study of 5,203 plutonium workers who were employed between 1947 and 1975, and followed through 1992, when compared to non-radiation workers.<sup>3</sup> Also, increasing rates of bladder cancer deaths were observed with increasing doses of external radiation in a study of 14,327 workers employed between 1947 and 1975, and followed through 1983. This study assumed a 15-year latent period (time after exposure for the disease to be diagnosed).<sup>4\*</sup>+
- **Registry of Nuclear Workers in the United Kingdom (U.K.):** Possible increasing rates of bladder cancer deaths were observed with increasing doses of external radiation in a study of 95,217 workers at major facilities in the U.K. nuclear industry.<sup>5</sup> +
- **Atomic Energy Authority of U.K.:** Increased deaths due to cancer of the bladder and urinary organs (excluding kidney) were observed in a study of 21,545 radiation workers who were employed between 1946 and 1979, and followed through 1986, when compared to non-radiation workers.<sup>6\*</sup>
- **Obninsk, Russia (I.P.P.E.):** A possible increase in incidence of bladder cancer was found in a study of workers who were hired before 1981, and still employed between 1991 and 1997.<sup>7</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 bladder 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:** Increasing deaths due to bladder cancer were observed with increasing doses of radiation in a study of 86,572 A-bomb survivors.<sup>8</sup>

## **Other Research and Policy Findings**

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

- **Yes.** According to the National Research Council's BEIR V Committee, "radiation can cause cancer of the bladder."<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 health effects of exposure 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 Bladder Cancer a "Specified" Cancer Under the Energy Employees Occupational Illness Compensation Program Act (EEOICPA)?***



- **Yes.** Bladder cancer is 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 Bladder Cancer?***

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

- **Tobacco.** Smoking and other tobacco use is related to bladder cancer.<sup>10,11,12</sup>
- **Occupation.** Some workers in other industries also have a higher risk of getting bladder cancer because of carcinogens in the workplace. Workers in the rubber, chemical, and leather industries are at risk. So are hairdressers, machinists, metal workers, printers, painters, textile workers, and truck drivers.
- **Infections.** Being infected with certain parasites increases the risk of bladder cancer. These parasites are common in tropical areas but not in the United States.
- **Medical Treatment.** The drugs cyclophosphamide or arsenic that are used to treat cancer and some other conditions raise the risk of bladder cancer.
- **Family history.** People with family members who have bladder cancer are more likely to get the disease.
- **Personal history of bladder cancer.** People who have had bladder cancer have an increased chance of getting the disease again.

These factors may add to any risk due to workplace exposure to ionizing radiation. The chance of getting bladder cancer goes up as people get older. Whites get bladder cancer twice as often as African Americans and Hispanics. The lowest rates are among Asians. Men are two to three times more likely than women to get bladder cancer.

## **Rates of Bladder Cancer In Exposed Counties**

### ***Los Alamos County***

There have been high rates of bladder cancer incidence reported in Los Alamos County and low rates of bladder cancer mortality.

- Los Alamos County ranked fifth highest in bladder cancer incidence and very low in mortality (32<sup>nd</sup>) from 1970 to 1996 of the 33 counties in New Mexico. This is evidence of early detection and successful treatment.
- In recent years, about three to four new cases of bladder cancer has been diagnosed each year in Los Alamos County.<sup>13,14</sup>

### ***Rio Arriba County***

Rates of bladder cancer incidence reported in Rio Arriba County have been moderate and rates for bladder cancer mortality have been very high.

- Rio Arriba County ranked 20th in bladder cancer incidence from 1970 to 1996 of the 33 counties in New Mexico.
- Rio Arriba County ranked third highest in bladder cancer mortality from 1970 to 1996 of the 33 counties in New Mexico.<sup>33</sup>



Rio Arriba County's ranking for bladder cancer mortality is much worse than its ranking for bladder cancer incidence. This means that the rates of diagnosis and treatment may be low relative to the number who actually have the disease. This is a strong indication of a "health disparity" compared to Los Alamos County, where bladder cancer cases do better. More needs to be done in Rio Arriba County to detect and treat bladder cancer early.<sup>15</sup>

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- <sup>1</sup> Ritz B. Radiation exposure and cancer mortality in uranium processing workers. *Epidemiology* 1999; 10(5):531-538.
  - <sup>2</sup> Dupree-Ellis EA, Watchkins JP, Ingle JN, Phillips J. External radiation exposure and mortality in a cohort of uranium processing workers. *American Journal of Epidemiology* 2000;152(1):91-95.
  - <sup>3</sup> Omar RZ, Barber JA, Smith PG. Cancer mortality and morbidity among plutonium workers at the Sellafield plant of British Nuclear Fuels. *British Journal of Cancer* 1999; 79(7/8):1288-1301.
  - <sup>4</sup> Smith PG, Douglas AJ. Mortality of workers at the Sellafield plant of British Nuclear Fuels. *British Medical Journal* 1986;293:845-854.
  - <sup>5</sup> Kendall GM, Muirhead CR, MacGibbon BH, O'Hagan JA, Conquest AJ, Goodill AA, et al. Mortality and occupational exposure to radiation: first analysis of the National Registry for Radiation Workers. *British Medical Journal* 1992;304:220-225.
  - <sup>6</sup> Fraser P, Carpenter L, Maconochie N, Higgins C, Booth M, Beral V. Cancer mortality and morbidity in employees of the United Kingdom Atomic Energy Authority, 1946-1986. *British Journal of Cancer* 1993;67:615-624.
  - <sup>7</sup> Ivanov VK, Tsyb AF, Rastopchin EM, Gorsky AI, Maksyutov MA, Vayzer VI, et al. Cancer incidence among nuclear workers in Russia based on data from the Institute on Physics and Power Engineering: a preliminary analysis. *Radiation Research* 2001;155:801-808.
  - <sup>8</sup> Pierce DA, Shimizu Y, Preston DL, Vaeth M, Mabuchi K. Studies of the mortality of atomic bomb survivors. Report 12, part 1. Cancer: 1950-1980. *Radiation Research* 1996;146:1-27.
  - <sup>9</sup> Committee on the Biological Effects of Ionizing Radiation. *Health Effects of Exposure to Low Levels of Ionizing Radiation; BEIR V*. Washington, D.C.: National Academy Press; 1990.
  - <sup>10</sup> Wald NJ, Hackshaw AK. Cigarette smoking: an epidemiological overview. *British Medical Bulletin* 1996;52(1):3-11.
  - <sup>11</sup> Shopland DR. Tobacco use and its contribution to early cancer mortality with a special emphasis on cigarette smoking. *Environmental Health Perspectives* 1995;103(S8):131-141.
  - <sup>12</sup> Anon. Cigarette smoking-attributable mortality and years of potential life lost - United States, 1990. *Morbidity and Mortality Weekly Report* 1993;42(33):645-649.
  - <sup>13</sup> New Mexico Department of Health. Steering Committee Data; Appendix E, Table N. Cancer Cases; Los Alamos Residents 1970-1990; Site by Year of Diagnosis. Los Alamos Cancer Rate Study. Santa Fe, NM, 1992;1.
  - <sup>14</sup> Athas WF, Key CR, Sewell M, Voorhees R. Cancer Trends in Los Alamos County, 1973-1997. In: Fuller Lodge; July 14, 1999; Los Alamos, NM; 1999. p. 27.
  - <sup>15</sup> Galke WA, Johnson ER, Tietjen GL. Mortality in an ethnically diverse radiation exposed occupational cohort. unpublished draft. Los Alamos, NM: Los Alamos Scientific Laboratory; 1992 November 24.
  - <sup>33</sup> Athas WF. *Cancer in New Mexico 1970-1996: Changing Patterns and Emerging Trends*. Santa Fe, NM: New Mexico Department of Health, 1998.



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

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