



Colorectal Cancer and Exposure to Ionizing Radiation

Summary: Strong evidence has been recorded of a possible connection between colon cancer and some evidence of rectal cancer have been found in studies of exposure to ionizing radiation. This evidence is based upon studies of nuclear workers and others exposed to ionizing radiation. These findings are consistent with the National Research Council's determination that tissues of the colon and rectum may be sensitive to ionizing radiation. Colon cancer, but not rectal cancer is designated as a "specified" cancer under the Energy Employees Occupational Illness Compensation Program Act. Historically, colorectal cancer incidence and mortality have been very high in Los Alamos County and moderate in Rio Arriba County 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 Colorectal Cancer?

Together, the colon and rectum form a long, muscular tube called the large intestine (also called the large bowel). Cancer that begins in the colon is called colon cancer, and cancer that begins in the rectum is called rectal cancer. Cancers affecting either of these organs may also be called colorectal cancer. (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 colorectal cancer among people exposed to ionizing radiation.

All these studies found increases and possible increases in colon and rectal 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 colon and/or rectal cancers 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.

* Findings were statistically significant (strong evidence)

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



- **UC & Zia Employees:** A possible increase in colon cancer incidence was observed among Anglo males who were employed for at least one year between 1969 and 1978.⁽¹⁶⁾

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 colorectal cancer and workplace exposures among nuclear workers in other parts of the United States.

- **Lawrence Livermore, California:** Increased incidence of rectal cancer was found in females who were employed between 1969 and 1980.^{* 22}
- **Mound, Ohio:** Increased deaths due to rectal cancer were observed in workers who were hired during World War II.^{43 *}
- **Mallinckrodt, St. Louis, Missouri:** A possible increase in deaths due to colon cancer and rectal cancer were seen in a study of 2,514 uranium processing workers who were employed between 1942 and 1966, and followed through the year 1993.²
- **Savannah River Site:** A possible increase in deaths due to rectal cancer was found in a study of 6,687 hourly workers who were employed between 1952 and 1981 for at least 90 consecutive days.⁴⁴
- **West Chicago (Kerr-McGee) Thorium Plant:** A possible increase in deaths due to rectal cancer was found in a study of 1,352 men who were first employed between 1940 and 1954, and followed through 1975.⁴⁵

Studies of Other Nuclear Workers World-Wide

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

- **Atomic Energy of Canada:** A possible increase in deaths due to rectal cancer was found in a study of 8,977 men who were employed between 1947 and 1985.⁴⁶
- **Canadian Radiation Workers:** Increased incidence of colon cancer in males, and rectal cancer in males and females, was observed with increasing doses of external radiation in a study of 191,300 workers employed between 1951 and 1988.^{47 *+}
- **Sellafield, England:** A possible increase in incidence of rectal cancer was found in a study of 5,203 plutonium workers employed between 1947 and 1975.³

* Findings were statistically significant (strong evidence)

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



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 colorectal 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 colon cancer deaths with increasing doses of radiation in a study of 86,572 A-bomb survivors^{8,*+}

Other Research and Policy Findings

Are the Colon and Rectum Radiation-Sensitive Organs?

- **Yes.** According to the National Research Council's BEIR V committee, "the risks of cancer of the colon and cancer of the rectum can be increased by intensive irradiation in humans..."⁹

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.

Are Colon and Rectal Cancers "Specified" Cancers Under the Energy Employees Occupational Illness Compensation Program Act (EEOICPA)?

- **Yes,** colon cancer is a "specified" cancer while
- **No,** rectal 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 Colorectal 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 colorectal cancer.

- **Diet.** Colorectal cancer seems to be associated with diets that are high in fat and calories and low in fiber.
- **Polyyps.** Polyyps are non-cancerous growths on the inner wall of the colon and rectum. Some types of polyyps increase a person's risk of developing colorectal cancer.

* Findings were statistically significant (strong evidence)

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



- ? **Certain diseases.** Those who have been diagnosed with the rare condition of the colon, Ulcerative colitis, are at increased risk of developing colorectal cancer. Women with a history of cancer of the ovary, uterus, or breast have a somewhat increased chance of developing colorectal cancer.
- ? **Smoking.** There is some evidence that rectal cancer is related to smoking. But the evidence for rectal cancer is not strong or consistent.⁴¹

These factors may add to any risk due to workplace exposure to ionizing radiation. Those who have had family members with colorectal cancer are at higher risk.

Rates of Colorectal Cancer In Exposed Counties

Los Alamos County

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

- Los Alamos County ranked 3rd highest in colorectal cancer incidence and 5th highest in colorectal cancer mortality from 1970 to 1996 of the in New Mexico.
- In recent years, about 7 new cases of colorectal cancer have been diagnosed each year in Los Alamos County.^{13,}

Rio Arriba County

Rates of colorectal cancer reported in Rio Arriba County have been moderate, among the middle of New Mexico counties, for cancer incidence and mortality.

- Rio Arriba County ranked 14th in colorectal cancer incidence and¹³
- Rio Arriba County ranked 19th in colorectal cancer mortality from 1970 to 1996 of the in New Mexico.¹³

The high rates of colorectal cancer incidence and mortality in Los Angeles County indicate that more needs to be done in Los Angeles County to prevent and treat colorectal cancer.

* Findings were statistically significant (strong evidence)

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