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Pancreatic Cancer and Exposure to Ionizing Radiation

Summary: Some evidence has been recorded of a possible connection between cancers of the pancreas and exposure to ionizing radiation. This possible connection is supported by evidence from studies conducted at Los Alamos National Laboratory and other studies of nuclear workers at other sites who have been exposed to ionizing radiation. The National Research Council's, on the other hand, has determined that the pancreas is relatively insensitive to ionizing radiation. Pancreatic cancers are designated as "specified" cancers under the Energy Employees Occupational Illness Compensation Program Act. Historically, incidence of pancreatic cancer in Los Alamos County is in the middle of New Mexico county rates. Incidence in Rio Arriba County is among the ten highest county rates. Incidence means new cases of cancer, while mortality means deaths due to cancer.

What is Pancreatic Cancer?

The pancreas is a gland located between the stomach and the spine (backbone). The pancreas makes certain hormones and pancreatic juices. These juices contain enzymes that help digest food. The pancreas releases the juices into a system of ducts leading to the common bile duct. Most pancreatic cancers begin in the ducts that carry pancreatic juices. Cancer of the pancreas may be called pancreatic cancer or carcinoma of the pancreas. (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 pancreatic cancer among people exposed to ionizing radiation.

These studies found increases and possible increases in pancreatic 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. All were mortality studies of pancreatic cancer death as a health outcome. Incidence studies that look at new cases of cancer can track health more quickly and accurately

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.

- **Female Lab Employees Study:** An increase in pancreatic cancer deaths was found in women who were employed at the Lab from 1943 to 1981, assuming a 25-year latent period.* But this was based on only one case, who had a cumulative dose of 690 mrem (a measure of

* Findings were statistically significant (strong evidence)

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



radiation dose). The researcher who conducted the study felt it was “highly unlikely that her radiation exposure contributed to the development of pancreatic cancer.”³⁶

- **Zia Study (unpublished)**: Possible increasing rates of pancreatic cancer deaths were observed with increasing doses of external radiation in males employed between 1946 and 1978.¹⁵

Studies of Other Nuclear Workers in the United States

The next most relevant evidence comes from studies done on workers in similar occupations facing the same types of exposures. Below are studies that observed pancreatic cancer in possible connection with certain exposures among nuclear workers in the United States.

- **Hanford**: Dr. Thomas Mancuso (University of Pittsburgh) discovered an increased rate of death due to pancreatic cancer in a study of 35,000 white males employed between 1943 and 1972.⁵¹ In a follow-up study through 1989, there were increasing rates of death due to pancreatic cancer with increasing doses of external radiation in workers who were employed for at least six months from 1945 to 1986.⁺ But the researchers who conducted the study did not interpret it as evidence of an effect.⁴⁹
- **Mallinckrodt, St. Louis, Missouri**: Possible increased rates of pancreatic cancer deaths were found in a study of 2,514 men who were employed in uranium processing between 1942 and 1966, and then followed through 1993.²
- **Oak Ridge Y-12**: A possible increase in pancreatic cancer deaths was found in a study of 8,116 men and women who were employed between 1947 and 1972, and then followed through 1990.²⁴
- **Savannah River Site**: A possible increase in pancreatic cancer deaths was observed in white male hourly and long-term (15+ years) workers who were employed before 1955.⁴⁴
- **West Chicago (Kerr-McGee) Thorium Plant**: An increase in pancreatic cancer deaths was found in a study of 1,446 men who were first employed between 1955 and 1969, and then followed through 1976.^{*} Rates were highest in workers with at least one year in a dusty job.⁴⁵

* Findings were statistically significant (strong evidence)

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



Studies of Other Nuclear Workers World-Wide

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

- **Sellafield, England:** Compared to non-radiation workers, a possible increase in pancreatic cancer deaths was seen in a study of 5,203 plutonium workers who were employed between 1947 and 1975, and then followed through 1992. A possible increase in the incidence of pancreatic cancer was found in plutonium workers who were employed between 1971 and 1986, and then followed through 1992.³

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 pancreatic 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 pancreatic cancer in A-bomb survivors.

Other Research and Policy Findings

Is the Pancreas Sensitive to Radiation?

- According to the National Research Council's BEIR V committee, the pancreas is "relatively insensitive" to radiation.⁹ This was published before some of the nuclear worker studies cited above.

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

Yes. Pancreatic cancer is a "specified" cancer under the EEOICPA consideration of Special Exposure Cohorts (except if cirrhosis or hepatitis B is indicated).

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



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 Pancreatic 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 pancreatic cancer.

- **Tobacco.** Smoking is related to pancreatic cancer.^{10, 12}
- **Diabetes.** Pancreatic cancer occurs more often in people who have diabetes
- **Family history.** The risk for developing pancreatic cancer triples if a person's mother, father, sister, or brother had the disease. Also, a family history of colon or ovarian cancer increases the risk of pancreatic cancer
- **Disease of the pancreas.** Chronic pancreatitis is a painful condition of the pancreas. Some evidence suggests that chronic pancreatitis may increase the risk of pancreatic cancer.

These factors may add to any risk due to workplace exposure to ionizing radiation. The likelihood of developing pancreatic cancer increases with age. African Americans are more likely than Asians, Hispanics, or whites to get pancreatic cancer. More men than women are diagnosed with pancreatic cancer

Rates of Pancreatic Cancer In Exposed Counties

Los Alamos County

Rates of cancer of the pancreas incidence was moderate in Los Alamos County.

- Incidence of pancreatic cancer ranked in the middle (17th) of the 33 counties in New Mexico, from 1970 to 1996.³³
- In recent years there have been about two cases per year in the county.^{13, 14}

Rio Arriba County

Rates of cancer of the pancreas incidence was high in Rio Arriba County. Rio Arriba County:

- Ranked 6th among the 33 counties in New Mexico for the incidence of pancreatic cancer, from 1970 to 1996.³³
- In recent years there have been about four cases per year in the county.

* Findings were statistically significant (strong evidence)

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