# Radiation Causes Cancer Among Nuclear Workers

**INCIDENT**

The evidence from a study conducted from International Nuclear Workers Study (INWORKS) suggests the following: “a positive association between ionizing radiation exposure and death from solid cancer, all cancer, and all cancer excluding leukemia among more than 300,000 nuclear workers.”

**NEED TO KNOW**

Although previous studies suggested exposure to high doses of ionizing radiation may cause solid cancer, it was unclear if prolonged low doses of ionizing radiation, which are common in some workplaces, also cause solid cancer.

**BUSINESS / REGULATIONS**

**INWORKS STUDY**

A group of nuclear workers were tracked over time to find out how long workers lived and what their causes of death were. Using the Radiation Dosimetry Information that had been collected by personal badge dosimeters in the workplace, we estimated a worker’s excess relative rate, or ERR (that is, the relative rate minus 1) of death from cancer. The relative rate compares the mortality rate in an exposed group to the mortality rate (for the same cause) in an unexposed group. For example, an ERR of 0.5 means that the cancer rate among exposed people was 50% higher than the rate among without exposure. The methodology of the study had four steps.

1. **The following was assembled.**

Employment records were used to identify 308,297 workers from France, the United Kingdom and the United States of America who worked in the nuclear industry for at least one year and were monitored for radiation exposure. The period of risk observation (sometimes referred to as follow-up) varied by country. The French, British, and American worker subgroups were followed between 1968-2004, 1946-2001, and 1944-2005, respectively.

2. **Each worker’s potential job-related exposures were evaluated.**

Ionizing radiation received in the workplace was our exposure of interest. Historical records maintained by dose registries, governments, and employers were thoroughly searched for information on the radiation dose for each worker. Recorded doses were adjusted to account for measurement practices that differed by exposure location and

time period. Colon dose was preferred for comparison of findings to other studies.

3. **Death information was obtained.**

We used national death databases and other record sources in each country to determine if a worker was alive or deceased and, if deceased, his or her underlying cause of death. We studied deaths from all cancer, as well as deaths from cancer excluding leukemia, and solid cancer (cancer excluding leukemia and lymphoma).

4. **The relationship between radiation dose and these cancers was examined.**

Using standard methods of statistical modeling, we assessed the dose-response relation between ionizing radiation exposure and each cancer outcome of interest. For consistency with other studies, the estimated risk was reported as an ERR per gray (Gy) of radiation exposure. However, typical occupational exposures are far less than that amount.

**Limitations of the study findings**

**Study limitations**

There are a number of limitations including incomplete or imperfect information on radiation doses and other risk factors, such as, asbestos exposure and tobacco use. But the impact from these limitations is believed to be small and unlikely to change study conclusions.

**Takeaways:**

Exposure to ionizing radiation cannot be avoided completely. According to the National Council on Radiation Protection & Measurements, on average persons in the U.S. receive an effective dose of about 6.0 mSv, or 0.006 Sieverts (Sv) each year from natural and man-made radiation sources.

The link between ionizing radiation exposure and some cancers is well known. However, much of this knowledge comes from studies of acutely exposed people, such as Japanese atomic bomb survivors and radiation therapy patients. Questions remain about using information from these studies to describe risks under much different **(usually much lower)** exposure conditions, such as those experienced by nuclear workers.

**This study supports previous findings and strengthens the evidence of a relationship between cancer and ionizing radiation. This relationship is observed not only at high doses following acute exposure, but also from prolonged, low exposures found in the workplace.**

**STATISTICS**

As stated, prior, among more than 300,000 nuclear workers the following was determined.

- The rate of death from cancer increased with radiation dose.
- The risk of solid cancer increased by about 5% per 100 millisieverts (mSv) (10 rem).
- The average dose of the group of workers in the study was 21 mSv (2.1 rem).
- Within the group of workers about 2 in every 200 deaths from cancer (other than leukemia) were due to their workplace radiation exposure.
- Among the members who received at least 5 mSv of radiation dose in the workplace out of every 200 deaths from cancer other than leukemia, about 5 were due to their workplace radiation exposure.

**PREVENTION**

Ionizing radiation is deadly if not properly controlled and monitored. Use the following three step prevention protocol to avoid possible disaster and prevent damages.

1. **HAZARD IDENTIFICATION**

- The employer must identify all sources of ionizing.
- The employer must monitor all workers who may be exposed to ionizing radiation using a dosimeter, which is worm as a badge attached to clothing. At monthly intervals the dosimeter must be sent to a laboratory where the radiation exposure can be read.
- The employer will need to employ someone with the relevant expertise to oversee and monitor the regulation of a dosimeter operation.
- Talk to members of your work group about the hazards of radiation and their control, and any effects they may be experiencing on a regular basis.
- Investigate any past incidents.

2. **RISK ASSESSMENT**

- Ensure the employer assesses results of monitoring – keep a check on results.
- Ensure your employer has an effective incident reporting procedure in place to record actual and potential exposure to radiation and unsafe conditions.

3. **RISK ELIMINATION/REDUCTION**

Ensure your employer controls the risk of radiation following the preferred order of control methods:

- Takes all measures possible to avoid exposure.
- Isolates all sources of radiation by shielding, containment or remote handling.
- Maintains all radiation generating equipment in good order to minimize radiation emitted and prevent any “leakages”
- Implements engineering controls to reduce radiation levels.
- Develop safe practices work practices and procedures, and ensures they are followed.
- Provides suitable protective clothing and administrative controls, including job rotation and rest breaks, to limit the amount of time employees are exposed, where engineering controls are unavailable or ineffective to reduce exposure levels.
- Provides adequate information and training on any radiation hazards in the workplace. Training should include information on the sources of the radiation, the health effects, the control procedures in place and how they are monitored, safe work practices, personal protective equipment (PPE), emergency procedures and radiation monitoring programs where appropriate.
- Maintain all controls implemented.
- Develop back up option emergency procedures in the case of control measures failure.