

# Asbestos

## **The Only Known Cause Of Mesothelioma Is Asbestos — Not!**

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# Commentary

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## The Only Known Cause Of Mesothelioma Is Asbestos — Not!

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“The only known cause of mesothelioma is asbestos.” For the past 30 years, this statement has been the mantra in asbestos litigation, effectively repeated by plaintiffs’ counsel and their experts at every trial. Science and medicine offer another explanation for the development of mesothelioma that may affect a growing number of cases. What is this other potential cause of mesothelioma? The answer is radiation exposure, which comes from a number of modern applications including medical treatment, nuclear or other workplace exposures and, perhaps, even from natural or environmental exposures.

The number of persons historically exposed to significant amounts of radiation through various sources and those likely to be exposed in the future, is rapidly increasing; and, as expected, the number of mesothelioma cases involving a radiation exposure component is similarly on the rise. With perhaps as much as 40 % of the population of aging baby boomers expected to contract one type of cancer or another (National Research Council, Committee to Assess Health Risks of Exposure to Low Levels of Ionizing Radiation. 2006. *Health Risks From Exposure to Low Levels of Ionizing Radiation, BEIR*

VII, Phase 2, pgs 7-8, and Figure PS-4), the number of people undertaking therapeutic radiation treatment is only going to increase, as is the risk that those people will suffer “2nd tumors” including mesothelioma as a result of radiation treatment. Additionally, there are over 100 fully licensed commercial nuclear power generating units in the US, and the September 6, 2007 issue of *The Economist* reports that this number of reactors is expected to increase by roughly a third. A growing body of knowledge indicates that workers at nuclear facilities, and even people living down wind from former nuclear test sites are at increased risk for any number of cancers, including mesothelioma. For decades, sailors and shipyard workers have worked with nuclear power plants in the many warships that make up the United States “Nuclear Navy” with the concomitant risk of radiation exposure.

Because radiation is a universal carcinogen capable of causing every form of solid tumor cancer, the relevant scientific and medical literature tends to focus on cancer types that account for the largest numbers of reported malignancies, such as lung cancer and colon cancer. Mesothelioma, which has a relatively rare incidence even in persons exposed to asbestos or radiation, has not received as much direct attention. In fact, under the International Classification of Diseases that was in effect in 1999, ICD-9, mesothelioma did not even have its own ICD code, rather it was included in other generic cancer categories including “other respiratory cancers,” or even simply “other cancers.”

However, the literature suggesting a link between radiation exposure and cancers actually dates back

for several decades. Early published studies described individuals who had exposure as uranium miners and suffered an increased risk of cancers of the lung (Waggoner, JK, Archer, VE et al, *Radiation as the Cause of Lung Cancer Among Uranium Miners*, New England Journal of Medicine, Vol. 273: pgs 181 – 188, 1965; Archer, VE, Saccomano, G and Jones, JH, *Frequency of Different Histologic Types of Bronchogenic Carcinoma as Related to Radiation Exposure*, Cancer, Vol. 34, pgs 2056 – 2060, 1974).

Early animal studies investigated the possible link between radiation exposures, carcinogenicity in general, and induction of mesothelioma in particular (Sanders, GL, and Jackson, TA, *Induction of Mesotheliomas and Sarcomas from "Hot Spots" of <sup>239</sup>PuO<sub>2</sub> Activity*, Health Physics, Vol. 22, pgs 755-759, 1972), and other researchers reported upon human mesotheliomas apparently related to therapeutic radiation therapy (Babcock, TL, Powell, DH et al, *Radiation-Induced Peritoneal Mesothelioma*, Journal of Surgical Oncology, Vol. 8: pages 369-372, 1976). Indeed, as early as 1959, with the expansion of the US Navy's nuclear powered fleet, the Joint Committee on Atomic Energy of the US Congress convened hearings on Employee Radiation Hazards and Workmen's Compensation Problems with the support of the Industrial Union of Marine and Shipbuilding Workers of America.

### Radiotherapy Can Cause Mesothelioma

Certainly Case Reports alone, even when combined with animal studies, are not enough to demonstrate a causal link. What experts and the courts call for as the determinative factor are properly conducted epidemiological studies (Reference Guide on Scientific Evidence, 2nd ed., Federal Judicial Center, 2000, at pgs 474-475, 480; and see *Casey v. Ohio Medical Products* (N. D. Cal 1995) 877 F. Supp 1380, 1385). Such epidemiological studies certainly exist in regards to therapeutic radiation and have been published in peer-reviewed periodicals. In *Second Cancers Among 40576 Testicular Cancer Patients: Focus on Long-term Survivors* (Travis, TL, Fossa, S et al, Journal of the National Cancer Institute, Vol. 97: pgs 1354-1365, 2005), *The Risk of Secondary Malignancies Over 30 Years After the Treatment of Non-Hodgkin Lymphoma* (Tward, JD, Wendland, MM et al, Cancer, Vol. 107: pgs 106-115, 2006) and *Therapeutic Radiation for Lymphoma — Risk of Malignant Mesothelioma* (Teta, MJ, Lau, E et al, Cancer, Vol. 109: pgs 1432-1438) the authors each calculate a statistically

significant increased risk of contracting mesothelioma after therapeutic radiation. These authors have concluded that ample evidence exists to demonstrate such a link and, when pressed, virtually all experts will agree that therapeutic radiation is now conclusively linked as a cause of mesothelioma.

### Radiation Workers At Increased Mesothelioma Risk

The dose of radiation administered during therapeutic radiation is enormous, or "ultra high" dose as described in the relevant literature. So, the next question is whether occupational exposures that tend to be 1 to 2 orders of magnitude lower than radiotherapy doses are still sufficiently potent to cause mesothelioma. As mentioned above, the literature in this area tends to focus on all cancers and does not typically call out a rare tumor such as mesothelioma. Notwithstanding the lack of a concerted focus on mesothelioma, the radiation worker epidemiological literature still does support the proposition that occupational radiation dose can cause mesothelioma and statistically increases an individual's risk of developing mesothelioma. As with therapeutic radiation, case reports can be found from 25 years ago suggesting a link between lower level radiation dose and mesothelioma. In *Features of Asbestos-Exposed and Unexposed Mesothelioma* (Hirsch, A, Brochard, P, et al. American Journal of Industrial Medicine, Vol. 3: pgs. 413-422, 1982), Dr. Hirsch and co-authors described a case of an individual with no known asbestos exposure who developed mesothelioma after receiving periodic CT scans over the course of a couple decades for a total of less than 100 mSv (an estimated 8.5 REM or 85 mSv) of total radiation exposure. And, in *An Autopsy Case of Peritoneal Mesothelioma in a Radiation Technologist* (Horie, A., Hiraoka, K, et al., Acta Pathologica Japan, Vol. 40: pgs 57-62, 1990), Dr. Horie and colleagues described a case of mesothelioma in a radiation technologist who was estimated to have received up to 400 or 500 mSv (40 to 50 Rad) of total radiation. These exposure levels are relatively low when compared to the 15,000 to 60,000 mSv of radiation received during therapeutic radiation treatment.

Again, the animal studies that demonstrate development of mesothelioma in rats, mice and even dogs, provide evidence that radiation exposure causes mesothelioma. Relevant animal studies include those performed at the direction of Roger McClellan for the Lovelace Inhalation Toxicology Research Project

where mesotheliomas were found in dogs exposed to radiation, but none in the controls or non-exposed dogs. Moreover, *in vivo* and *in vitro* studies show how radiation impacts cells and causes genetic damage including generation of free oxygen radicals and aneuploidy or uneven chromosomal division. Further, large-scale epidemiological studies have been performed on nuclear or atomic workers, and even shipyard workers. In *Cancer Risks in Low-Level Radiation in U. S. Shipyard Workers* (Matanoski, GM, Tonascia, JA et al, Journal of Radiation Research — J-STAGE Advance Publication August 10, 2007) a long-term study of shipyard workers undertaken by the Navy and the Department of Energy is reported. The reported findings are virtually identical to those found in studies in the UK (See Atkinson, WD, Law DV, et al., *Mortality of Employees of the United Kingdom Atomic Energy Authority, 1946-1997*, Journal of Occupational and Environmental Medicine, vol. 61, pgs 577-585, 2004) and the International Agency for Research on Cancer (IARC) in its 15-country study following nuclear industry workers around the world (Cardis, E, Vrijheid, M et al, *The 15-Country Collaborative Study of Cancer Risk among Radiation Workers in the Nuclear Industry: Estimates of Radiation-Related Cancer Risks*, Radiation Research, Vol. 167: pgs 396-416, 2007). All of these studies find statistically significant increased incidence of mesothelioma in the radiation workers.

The concern about radiation exposures is at such a level that the federal government has enacted statutes authorizing compensation to people who have contracted cancer from workplace exposures. In the *Energy Employees Occupational Illness Compensation Program Act* (42 USC Section 7384 *et seq.*), the government has established a framework for receiving and evaluating claims from energy industry employees to seek compensation when they have contracted cancers potentially related to their workplace exposures. As stated in the Act:

Over the past 20 years, more than two dozen scientific findings have emerged that indicate that certain of such employees are experiencing increased risks of dying from cancer and non-malignant diseases. Several of these studies have also established a correlation between excess diseases and exposure to radiation and beryllium.

The cancers for which claims can be made include mesothelioma — both pleural and peritoneal.

This statutory scheme is supported by scientific investigation commissioned by the federal government and administered by the National Cancer Institute, National Institute of Health, Department of Labor and the National Institute for Occupational Safety and Health or NIOSH. The National Institute of Occupational Safety and Health conducted a comprehensive study of more than 65,000 civilian employees of the Idaho National Engineering and Environmental Laboratory, a sprawling facility in rural Idaho that houses or has housed prototype US Navy nuclear power plants and various test reactors. An analysis of the data forthcoming from that research demonstrates an increased risk of mesothelioma even for those workers who do not fall within a broad definition of “Asbestos Workers” that includes persons who were substantially likely to have worked with asbestos-containing materials (*An Epidemiologic Study of Mortality and Radiation-Related Risk of Cancer Among Workers at the Idaho National Engineering and Environmental Laboratory, a U. S. Department of Energy Facility*, HHS (NIOSH) Publication No. 2005-131). The results reported from this project and others demonstrate that cause for concern exists.

### **Background Radiation Causes All Solid Tumor Cancers**

Finally, we must consider if environmental exposures can cause cancers such as mesothelioma. Again, the federal government believes so. In the *Radiation Exposure Compensation Act* (42 USC 2210 *et seq.*) Congress states when discussing downwind exposures from nuclear test sites that “the health of individuals who were exposed to radiation in these tests was put at risk to serve the national security interests of the United States. . .” Research commissioned by the federal government provides the scientific underpinning for this conclusion.

The Committee on the Biological Effects of Ionizing Radiation, referred to by its acronym of “BEIR” and organized under the authority of the National Research Council has evaluated the effects of radiation exposures for years. The latest publication by the BEIR group, known as BEIR VII Phase 2, focuses on low dose radiation exposure, which they define as lifetime background level radiation dose or doses below 100 milliSieverts (mSv). The conclusion of the BEIR group is that even these very low, background radiation levels can cause every form of solid tumor cancer in man.

Mesothelioma is not separately addressed, presumably because it is such a rare cancer that there was no apparent reason for such focus. However, there is no reasonable medical or scientific explanation to support a conclusion that mesothelioma is the only solid tumor cancer that low dose radiation exposure does not cause. Particularly where low dose radiation exposure is strongly linked to lung cancer, other respiratory cancers and cancers in abdominal organs, it would appear nonsensical to believe that somehow radiation skips through or around the lining of the lung (pleura) and abdomen (peritoneum) to only cause cancer in the organs but not in the lining of these organs. The "Linear-No Threshold model" (LNT) that the plaintiffs' bar relies upon in low dose exposure asbestos cases to argue that "there is no known safe dose of asbestos", should and does apply even more convincingly to low dose radiation exposure cases. Numerous regulatory agencies, including OSHA, NIOSH and the EPA (See Federal Register, Vol. 44, No. 202: pg 60063 for a discussion of this model) have adopted such a model for evaluating low dose asbestos exposure situations. In BEIR VII, Ph. 2, the National Research Council in discussing low dose radiation exposures has stated:

A comprehensive review of available biological and biophysical data supports a "linear-no-threshold" (LNT) risk model — that the risk of cancer proceeds in a linear fashion at lower doses without a threshold and that the smallest dose has the potential to cause a small increase risk in humans.

In conclusion, it would seem appropriate in all mesothelioma, and perhaps lung cancer and other cancer cases as well, to explore the plaintiff's possible exposures to radiation in the work place and from therapeutic and environmental sources. Has your plaintiff served in the "Nuclear Navy"? Did he work at any one of the many shipyards constructing, maintaining and overhauling nuclear powered ships (Puget Sound Naval Shipyard, Mare Island Naval Shipyard, Portsmouth Naval Shipyard and the Electric Boat Shipyard come to mind immediately.)? Has your plaintiff previously received radiation therapy? Did he work in a nuclear power plant, or even live in the vicinity of a potential radiation exposure source? Perhaps plaintiffs' counsel will no longer be able to credibly argue, "There is only one known cause of mesothelioma in man." ■

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*edited by Bryan Redding*

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