



Does Exposure to Plutonium Affect Workers' Longevity?

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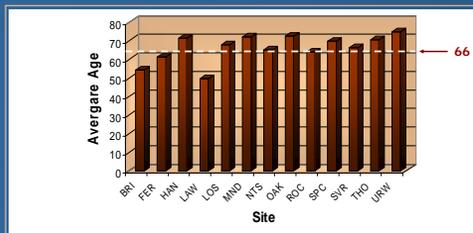


INTRODUCTION

Transuranic radionuclides such as plutonium are of great importance when considering internal exposures. If they are taken into the body via inhalation, ingestion or wounds, they may not be excreted for decades while they deliver dose to the surrounding tissues mainly by emitting alpha particles (1).

The most important facilities at which exposure to transuranic materials may have occurred include Hanford, WA; Savannah River, GA; Rocky Flats, CO; and the Nevada Test Site in the United States and Mayak and Semipalatinsk in the former Soviet Union (1).

Considering the fact that the health effects of exposure to radionuclides such as plutonium is still unclear (2), in particular for low doses, a retrospective cohort study has been designed to apply the United States Transuranium and Uranium Registries (USTUR) information to find whether or not there is any potential health consequence due to exposure to actinide elements based on the actual human experiences.



Average Age of Death among USTUR Registrants

During the past fourteen years, the death rates for the USTUR registrants have been significantly lower than expected from U.S. general life table data. Over this period, Registrant longevity has exceeded 'life table' expectation by an average of 10.4 years (20).

ROLE OF THE NATIONAL REGISTRIES

Some of the main challenges in epidemiological investigations of low-dose populations include: accurate dose information in particular for internal exposures, and sufficient periods of follow-up (4, 16, 17). National Registries play an important role in this regard (4). The United States Transuranium and Uranium Registries (USTUR) maintains the organ samples of the volunteer donors exposed to actinide elements during their work (mostly as a result of accidents), their exposure histories, autopsy reports, radionuclide contents of major body organs, etc. The USTUR provides a unique opportunity for the comprehensive collection of scientific data tracing the human experience of accidental exposures to plutonium, americium and uranium over the history of U.S. nuclear materials production (18, 19).

UNITED STATES TRANSURANICUM AND URANIUM REGISTRIES

The USTUR program started in 1968 as the "U. S. Plutonium Registry" at the Hanford Atomic Products Operation in Richland, Washington. It was then merged with the Uranium Registry and operated by the Hanford Environmental Health Foundation. Since 1992, the USTUR has been operated for the U. S. Department of Energy (DOE) Office and Health Studies, by Washington State University in Richland (19).

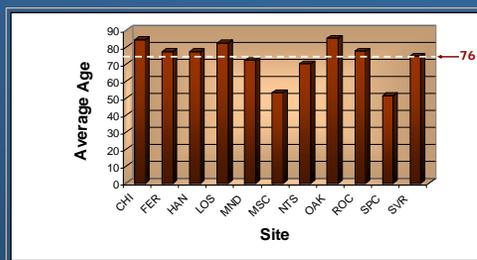
More than 60% of the living USTUR registrants have exceeded 75 year life spans by an average of 7 years.

BACKGROUND AND SIGNIFICANCE

Association between exposure to high-levels of ionizing radiation and development of cancer has already been well documented, mainly from atomic bomb survivors; therapeutic medical exposures; and nuclear accidents. However, extrapolation of radiation cancer risks from high doses to low doses and low dose rates results in considerable uncertainties (3-6). Since 2004, three reports on the effects of low-level radiation have been released but with divergence in their conclusions (7-9).

When investigating the relationship between low-level exposures and cancer incidents, studies of nuclear workers have provided useful information (4, 10). In fact, radiation worker studies have been considered as the most informative epidemiological studies conducted on low-dose population (11).

Various methods and designs have already been used for conducting initial and follow-up studies on nuclear workers or people living near nuclear power plants. They were most frequently cohort studies of cancer mortality rates. Although previous epidemiological studies on nuclear workers have made important contributions to this challenging problem, there are still controversies among their results and it is not clear that there is any health effect due to exposure to transuranic radionuclides such as plutonium (2-6, 10, 12-18). Continued effort is clearly necessary.



Average Age among Living USTUR Registrants

THE MAIN QUESTIONS

- 1- Does exposure to plutonium affect workers' longevity?
- 2- Is there any association between occupational exposures to radionuclides such as plutonium and cancer mortality?

Because of the "Healthy Worker Effect", a formal cohort study needs to be conducted to compare the longevity of the USTUR's plutonium-exposed registrants with that of matched 'non-plutonium exposed' workers drawn from DOE's Comprehensive Epidemiologic Data Resource (CEDR) database.

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