

Study of the Association Between Exposure to Transuranic Radionuclides and Cancer Death

Naz A. Fallahian¹

¹*Idaho State University, Department of Physics, Pocatello, ID*

An exploratory epidemiological study has been conducted on 319 deceased nuclear workers, who had recorded intakes and histories of employment for at least one year during the time period from 1943 to 1995, at different facilities including the United States Department of Energy (DOE) sites, and thorium and uranium mining and milling plants. These workers voluntarily agreed to donate their organs or whole body to the United States Transuranium and Uranium Registries (USTUR) for scientific research purposes. The majority of this population was involved in documented radiological incidents during their careers. Many were exposed to transuranic radionuclides primarily via inhalation or puncture wounds. The purpose of this study was to find the level of dose that was received by the USTUR registrants following accidents and subsequent to mitigating actions, and to investigate whether or not there is any association between exposure to these transuranic radionuclides and cancer deaths. The external and internal dose assessments were performed using occupational radiation exposure histories and postmortem concentrations of transuranic radionuclides in critical organs, respectively. Statistical data analyses were performed to identify whether or not the USTUR registrants can be categorized as a 'low-dose' population and to investigate the potential correlation between exposure to transuranic radionuclides and causes of death within this population due to cancers of the lungs and liver as well as cancers of all sites, while controlling for the effects of other confounders. Based on the statistical tests performed, the USTUR registrants can be categorized as a low-dose population in terms of their occupational external exposures. However, when considering their total effective dose equivalents from both external penetrating radiation and internal exposure to transuranic radionuclides, they can not be categorized as a low-dose population with a 95% confidence level ($\alpha = 0.05$). No association was found between exposure to transuranic radionuclides and causes of death due to cancer development ($\alpha = 0.05$). However, statistically significant associations were found between the cause of death due to any type of cancer and exposure to benzene or toluene (odds ratio = 5.71; 95% CI: 1.04 to 31.34), as well as smoking habits (odds ratio = 5.41; 95% CI: 1.42 to 20.67), and rate of cigarette smoking (odds ratio = 2.70; 95% CI: 1.37 to 5.30). Lung cancer deaths were found to be related to exposure to chlorinated solvents (odds ratio = 10.85; 95%CI: 1.02 to 115.16), and the duration of exposure to these materials (odds ratio = 1.12; 95%CI: 1.01 to 1.24).

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