

Reanalysis of Radiation and Mesothelioma in the U.S. Transuranium and Uranium Registries

Joey Y. Zhou¹, Stacey L. McComish², Sergei Y. Tolmachev²

¹*U.S. Department of Energy*; ²*United States Transuranium and Uranium Registries*

It has been noted for years that there is an excess of mesothelioma deaths among the Registrants of the U.S. Transuranium and Uranium Registries (USTUR). The previous analyses to link the excess of mesothelioma to radiation were done inappropriately in part due to the small number of mesothelioma cases and the use of the U.S. general population as a comparison group. The reanalysis applied an internally matched case control approach to evaluate the cluster of mesothelioma cases in association with cumulative external radiation exposures. First, all causes of USTUR Registrants' deaths were classified into four groups: mesothelioma cases (Meso), lung cancers (LC), other cancers (OC), and non-cancers (NC). Second, for each case of mesothelioma, controls were identified in the LC (2 ~ 3 controls per case), OC (2 ~ 5 controls per case), and NC (2 ~ 5 controls per case) groups matching gender (male), race (white), years of employment (± 2.5 years), first hire (± 5 years), birth year (± 5), and age at death (± 5 years). Third, a paired t-test (one sided) was used to examine whether there were statistically significant differences in cumulative external radiation doses between cases in the Meso group and respective controls in the LC, OC, and NC groups. In practice, a permutation paired t-test (PPTT) was developed to run the significance tests based on a large number of paired t-tests. For each paired t-test, one control for each case was randomly selected from multiple (2 ~ 5 controls per case) matching controls. This procedure was repeated at least 5,000 times, and the percentage of statistically significant ($p < 0.05$) paired t-tests was counted. Inference was reached based on whether or not 5% or more of PPTTs were statistically significant. PPTTs were not significant for Meso vs. LC, and Meso vs. OC; PPTTs were significant, however, for Meso vs. NC with larger than 9.0% of significant paired t-tests. A follow-up conditional logistic regression for the Meso and NC groups showed a non-statistically significant odd ratio (OR) of 1.001 (95% CI: 0.997 ~ 1.006) between cumulative external radiation doses and mesothelioma. The internally matched case control analysis suggested that the excess of mesothelioma deaths among USTUR Registrants was not associated with cumulative external radiation exposures.

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