

Inhalation of Soluble Plutonium: 53-year Follow-up of Manhattan Project Worker

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This whole-body tissue donor to the United States Transuranium and Uranium Registries was occupationally exposed to plutonium nitrate-dioxide mixture via chronic inhalation. This individual was involved in the Manhattan Project operations and later participated in medical follow-up studies. Soft tissues and bones collected at autopsy were analyzed for ²³⁸Pu, ²³⁹⁺²⁴⁰Pu, and ²⁴¹Am. Fifty-three years post-intake, 700±2 Bq of ²³⁹⁺²⁴⁰Pu were still retained in the skeleton, 661±11 Bq in the liver, and 282±3 Bq in the respiratory tract. Bioassay measurements and organ activities at the time of death were used to estimate the intake and radiation doses using the TAURUS internal dosimetry software. For this individual, an ICRP Publication 130 Human Respiratory Tract Model with case-specific particle size of 0.3 µm, ICRP Publication 100 Human Alimentary Tract Model, and ICRP Publication 141 Plutonium Systemic Model adequately described long-term plutonium retention and excretion. The total cumulative ²³⁹⁺²⁴⁰Pu intake of 31,716 Bq was estimated, of which 24,853 Bq (78.4%) were contributed by inhalation of plutonium nitrate and 6,863 Bq (21.6%) of plutonium dioxide. The committed equivalent doses to the red bone marrow, bone surface, liver, lungs, and brain were 0.71 Sv, 6.5 Sv, 8.3 Sv, 3.8 Sv, and 0.068 Sv, respectively. The committed effective dose was 1.22 Sv.

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