

The Mayak Worker Dosimetry System (MWDS-2013): Plutonium Binding in the Lungs - an Analysis of Mayak Workers

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Estimates of plutonium lung doses from urine bioassay are highly dependent on the rate of absorption from the lungs to blood assumed for the inhaled aerosol. Absorption occurs by dissolution of particles in lung fluid followed by uptake to blood. The latter may occur either rapidly or dissolved ions may first become temporarily bound within airway tissue. The presence of long-term binding can greatly increase lung doses, particularly if it occurs in the bronchial and bronchiolar regions. Analyses of autopsy data from Beagle dogs and USTUR Case 0269, obtained following exposure to plutonium nitrate, suggest that a small fraction of 0.2–1.1 and 0.4–0.7%, respectively, of plutonium becomes permanently bound within the lungs. The present work performs a further analysis using autopsy data of former plutonium workers of the Mayak Production Association to determine values of the bound fraction that are supported by these data. The results suggest a bound fraction value of 0–0.3%. The results also indicate that the Mayak worker population median values of the particle transport clearance parameters from the alveolar-interstitial region are largely consistent with expected values, but suggest the rate from the alveolar region to the interstitium may be lower than initially thought.

USTUR-0425A-16