

## **The Mayak Worker Dosimetry System (MWDS-2013): Plutonium Dissolution in the Lungs—An Analysis of Mayak Workers**

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Lung doses resulting from inhalation of plutonium aerosols are highly dependent on the assumed rate of particle clearance, which occurs by two competing processes: (1) particle transport clearance to the alimentary tract and to the thoracic lymph nodes and (2) clearance to systemic tissues, which occurs by dissolution of particles in lung fluid followed by uptake to blood, which is a process collectively known as absorption. Unbiased and accurate estimates of the values of lung absorption parameters are required to obtain reliable estimates of lung dose, particularly those inferred from urine bioassay. Parameter values governing the rate of absorption are best estimated from data, such as autopsy measurements of plutonium in the lungs and systemic tissues, which directly relate to the exposed workers of interest. However, because the mathematical models that determine clearance from the lungs and systemic tissues are complex and consist of many parameters, estimates of model parameter values are subject to significant uncertainties. With this in mind, this paper uses a Bayesian approach to estimate one of the most important dissolution parameters: the slow rate of dissolution. This is estimated for both plutonium nitrate and plutonium oxide bearing aerosols in the lungs of former workers of the Mayak Production Association. A value of  $2.6 \times 10^{-4} \text{ d}^{-1}$  is estimated for plutonium nitrates, and  $4.7 \times 10^{-5} \text{ d}^{-1}$  for plutonium oxides.

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