

Mechanisms for Long-term Retention of Plutonium in the Respiratory Tract: Inferences From Animal and Human Studies

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The radiation dose imparted by plutonium (Pu) to the respiratory tract, and consequently the risk from inhalation of Pu, depends on the residence time, location, and the mechanism of retention. One of the mechanisms for long term retention of Pu is 'binding,' by which a fraction of the dissolved material chemically binds to the tissue of the airway wall. The International Commission on Radiological Protection proposes a bound fraction of 0.2% for Pu, inferred from the findings of animal and human studies. A critical evaluation of these studies, along with other evidence in the literature and additional datasets from the United States Transuranium and Uranium Registries, strongly suggest that a mechanism other than chemical binding is responsible for the long-term retention of Pu in the respiratory tract. Analyses of historical animal datasets (rats and non-human primates injected with Pu) and a dataset on post-mortem retention in the respiratory tract of a wound case indicate some systemic uptake by the respiratory tract. However, this systemic uptake alone does not fully explain the observed post-mortem retention in an individual who had inhaled highly soluble Pu nitrate. A review of the literature review indicates the presence of – and a significant retention of – Pu in the scar tissues of the respiratory tract. Accordingly, an alternate model with scar-tissue compartments is proposed to explain the retention of plutonium in the respiratory tract compartments of four workers.

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