

Modeling Pu Decorporation Therapy Following Occupational Exposure

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High levels of exposure to actinides can cause severe health effects. Individuals with significant internal contamination typically undergo treatment with chelating agents to accelerate urinary excretion and thus decrease radiation dose to sensitive tissues. The US Transuranium and Uranium Registries (USTUR) studies actinide biokinetics and tissue dosimetry by following up occupationally exposed workers. These studies are fundamental to improving the reliability of, and confidence in, radiation dose and risk assessment methods.

By linking radiation exposure history, bioassay results, and medical data with post-mortem measurements of actinides in the human body, we aim to develop and parameterize a biokinetic model for plutonium decorporation therapy. USTUR Case 0785 was selected for this study. This individual was exposed to plutonium via inhalation and wounds due to an explosion at his workplace, and underwent chelation treatment. Worksite personnel estimated his systemic deposition at 7,400 Bq. Bioassay and tissue analysis data from this case were evaluated using IMBA Professional Plus[®] software. The proposed model will be tested for various exposure scenarios.

The ²³⁹Pu whole-body activity at the time of death, estimated from tissue radiochemical analysis, was 2,777 Bq. Of these, 69.7% was deposited in the skeleton, 21.7% in the liver, and 6.5% in the respiratory tract. The results confirmed that internal deposition of plutonium was caused by inhalation and wound intake, and provided additional information on material solubility type. This information will be used for modeling decorporation therapy. The results of this project are important to further optimization of actinides decorporation treatment.

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