

Reevaluation of USTUR Plutonium Wound Case 0262 Using Bayesian Methodology and New Data

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Skin penetration by radionuclide contaminants serves as a route of entry into the body and may pose a serious health risk to humans depending on the magnitude of intake. The United States Transuranium and Uranium Registry whole body Case 0262 was involved in a wound intake of plutonium at the Hanford Site. The registrant died about 33 years later. Results were initially reported in 2007 regarding the deposition and retention of plutonium in various tissues, including the wound site. However in 2009, an additional (previously unrecorded) sample of the wound tissue was located in the National Human Radiobiological Tissue Repository. The new sample was analyzed using inductively coupled plasma-mass spectrometry (ICP-MS), and the results were used to calibrate the measurement of emitted ²³⁹Pu x-rays from the original wound tissue sample made in 2007. In the present study, the analysis of ²³⁹Pu absorption rates from the wound and axillary lymph node from the initial study is repeated using the additional wound activity data and ICPMS calibration. This new analysis is carried out using the Weighted Likelihood Monte Carlo Sampling (WeLMoS) method and code, which applies Bayesian inference to calculate the posterior probability distribution of intake and wound absorption parameters directly from the observed data and the assumed biokinetic model structure. The resulting central estimates of empirical wound absorption parameters and their associated uncertainties are here compared with the empirical values recommended in NCRP Report No. 156 for plutonium and with the maximum likelihood point estimates derived in the initial study from the Case 0262 data available at the time.

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