The Mayak Worker Dosimetry System (MWDS-2013): Estimation of Plutonium Skeletal Burden from Limited Autopsy Bone Samples from Mayak PA Workers

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The method to estimate total skeleton plutonium burden of former Mayak Production Association (MPA) workers from limited bone samples obtained at autopsy is described. From two to nine bone samples were obtained at autopsies conducted from the mid-1950s to 2013. Plutonium was measured using alpha-radiometry up to 2000 and later by alpha-spectrometry. The method was validated using data from whole-body donations from the United States Transuranium and Uranium Registries (USTUR). The developed algorithm overestimated the USTUR values from 20 to 40%, that is quite acceptable for conservative estimation. Late-in-life liver diseases known to redistribute plutonium between liver and skeleton were not associated with significant differences in plutonium deposition among sampled bones, except for the pelvis. Sources of uncertainties are discussed and future studies will address the reduction of these uncertainties. This algorithm can be used to obtain data in support of the development of biokinetic, dosimetric and risk models for humans exposed to plutonium.