The United States Transuranium and Uranium Registries: What the Human Data Have Shown

Ronald L. Kathren and John J. Russell

Washington State University, 2710 University Drive, Richland, Washington 99352

Postmortem studies of tissues obtained at autopsy from volunteer donors with known intakes of transuranics have shown that contrary to the commonly accepted models base primarily on animals studies, plutonium and americium have different biokinetics and appreciable deposition in the soft tissues of the body as well as the established skeleton and liver depots. While the ICRP model and biokinetic parameters for plutonium are reasonably consistent with the human tissue observations, the clearance half time of americium in the liver was found to be only about 2.5 years, considerably shorter than put forth by the ICRP. Plutonium was shown to concentrate in human placenta, possibly indicative of the placenta serving as a biological filter. Measurement of plutonium, americium and uranium in the lungs and associated lymph nodes of occupationally exposed persons revealed clear differences between smokers and nonsmokers, indicative of impaired clearance and a higher lung dose in smokers. Studies of tissues obtained at autopsy from a person with a massive accidental intake of americium were consistent with observations of biokinetics in other cases with smaller intakes. A small but clear diminution of all blood cell lines was observed soon after intake, possibly with some subsequent recovery, and with further diminution towards the end of life. The hematological effect and changes in bone remodeling including bone hyperplasia are likely attributable to the massive dose of 360 Sv to the bone and 10,400 Sv to the bone surfaces.

There was no evidence of radiation-associated malignancy and although the individual suffered cataracts, the dose to the eyes was below the catarogenic dose. A study of the causes of death among the first 260 donors to the USTUR revealed no excess causes of death attributable to radiation exposure. An excess number of brain tumor deaths were observed, but these all occurred at a single work site and are thought to be attributable to other causes. Studies of whole body Thorotrast donors to the USTUR indicate that commonly accepted risk coefficients for alpha induction of bone sarcoma might be too high while those for leukemia are a factor of six too low. Future cytogenetic studies utilizing these unique materials and techniques such as fluorescent in situ hybridization hold promise of determining with a high degree of confidence the presence or absence of low-level radiation effects as well as identifying specific genetic factors involved in radiation carcinogenesis.

USTUR-0158-00