From Deposition to Detection: the USTUR Approach to Measurement Quality

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The United States Transuranium and Uranium Registries (USTUR) is a U.S. Department of Energy funded research program at the Washington State University that studies deposition, biokinetics, and dosimetry of actinides such as plutonium, americium, and uranium. Other radionuclides of interest for analysis at the USTUR include ^{226}Ra, ^{232}Th, ^{237}Np, and ^{244}Cm. The USTUR radiochemical laboratory analyzes human tissues from deceased former nuclear workers who have donated selected organs/tissues or entire bodies to the Registries. Plutonium and americium are radiochemically separated from digested tissues, electrodeposited onto a planchet, and measured by alpha spectrometry. Each sample is counted for 150,000 s with an associated background measurement of 300,000 s. This presentation is part of the development of Measurement Quality Objectives (MQOs) for the USTUR's Radiochemistry Program. It specifically addresses the minimum detectable activity (MDA) and the development of a measurement sensitivity MQO associated with the anticipated activity of a sample (i.e., expected activity on a planchet). Using this concept, the Registries characterizes its alpha spectrometry counting system based on an assumed actinide uptake of 74 Bq, 50 years prior to measurement, considering factors associated with the exposure scenario such as the chemical and physical form of the radioactive material, primary radionuclide, and route of intake. The resulting summary table highlights areas of technological limitations, prompting a subsequent discussion on potential measurement alternatives. Current radiochemical analysis procedures are more than adequate to detect activities of ^{239}Pu and ^{241}Am in the lungs, liver, and skeleton for most of the Registrants.

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