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Assessments of plutonium exposure and uptake are most commonly assessed using urinalysis based on alpha-spectrometric measurements of $^{239+240}$Pu. These measurements fail to meet basic performance criteria for radiobioassay and internal dosimetry as established under the United States Department of Energy (DOE), Code of Federal Regulations, Part 835 (10 CFR 835). Many internal dosimetry programs exploit a clause in the regulations which tolerates non-compliance through existence of a 'technological shortfall'. Accelerator Mass Spectrometry (AMS) and other competing '*atom counting*' technologies provide much improved detection sensitivities for long-lived radionuclides such as ^{239}Pu and ^{240}Pu. The Center for Accelerator Mass Spectrometry (CAMS) heavy element measurement system at the Lawrence Livermore National Laboratory (LLNL) is considered to be the *cutting edge* technology for this stated purpose, and vastly improves on the capabilities essential for monitoring compliance with the standards for occupational safety and risk management at LLNL and elsewhere within the DOE complex.

Under routine operating conditions, the AMS system background at CAMS is equivalent to about ~0.1 μBq of ^{239}Pu and ~0.3 μBq of ^{240}Pu, far exceeding the requirements of the United States Department of Energy (DOE) regulation stated in *10 CFR 835* for *in-vitro* bioassay monitoring of plutonium isotopes. In recent years, we have utilized this new measurement capability as part of a radiological surveillance monitoring program at former nuclear test sites in the Marshall Islands. High quality plutonium bioassay data developed under program appear to re-define the baseline for urinary excretion of plutonium from people living in the Northern Hemisphere, and challenges previous assumptions about residual systemic burdens of plutonium acquired from previous exposures to world-wide fallout contamination. We will present an overview of AMS applications at LLNL as well as some interesting findings on age-related trends in urinary excretion of plutonium at the sub-μBq level from baseline cohort populations in the Marshall Islands.

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