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The Usefulness of Accelerator Mass Spectrometry in Retrospective Dosimetry Studies

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In 2001 Lawrence Livermore National Laboratory initiated a Laboratory Directed Research and Development project to evaluate the application of accelerator mass spectrometry to analyze ^{239}Pu in archived bioassay samples collected for routine occupational worker monitoring. This project successfully applied accelerator mass spectrometry (AMS) to recover previously inaccessible information concerning short- and long-term urinary excretion patterns of ^{239}Pu for a set of eleven personnel, who were periodically monitored at LLNL via urine sampling over multiple decades. AMS analysis was performed on residue that was removed from archived alpha spectrometry discs that were originally generated as an end product of processing routinely collected urine samples. AMS methods are substantially more sensitive (50- to 300-fold) than alpha spectrometry and it was possible to reconstruct detailed patterns of historical ^{239}Pu excretion and compare these patterns with known or potential intake situations in the work environment. The sensitivity of the technique is sufficient to detect low-level exposures 20 or more years post exposure. Results of this research facilitate application of ultra-sensitive Pu-detection technology to occupational safety, nuclear security goals, and retrospective dosimetry. This presentation will review the methods and results of the study and will present some of the observed excretion patterns relative to known exposure and sample processing issues.

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