UCRL-ABS-234225

LAWRENCE LIVERMORE NATIONAL LABORATORY

Improved Methodology for Assessing Workplace Uranium Intakes Based on Accelerator Mass Spectrometric Measurements of Uranium-236 (^{236}U)

T.F. Hamilton

T.A. Brown

A.R. Wood-zika

S.J. Tumey

R.E. Martinelli

S.R. Kehl

Wm.G. Mansfield

(Abstract submission, Health Physics Society 41st Midyear Topical Meeting, Oakland, January 27-28, 2008)

September 2007

This work was performed under the auspices of the U.S. Department of Energy by the University of California, Lawrence Livermore National Laboratory under Contract W-7405-Eng-48.

Improved Methodology for Assessing Workplace Uranium Intakes Based on Accelerator Mass Spectrometric Measurements of Uranium-236 (^{236}U)

T.F. Hamilton, T.A. Brown, A. R. Wood-Zika, S.J. Tumey, R.E. Martinelli, and Wm. G. Mansfield

Lawrence Livermore National Laboratory (LLNL), PO Box 808,
Livermore, CA 94551-0808 U.S.A

Heavy-element accelerator mass spectrometry (AMS) provides a highly sensitive, accurate, and robust technique for measuring actinide elements at ultra-low concentrations. The development of heavy element AMS at the Lawrence Livermore National Laboratory (LLNL) has centered on plutonium and uranium isotope applications in human health and exposure, long-term environmental stewardship, and source-term characterization. These studies have shown that AMS has a sufficiently high abundance sensitivity to measure low abundance isotopes in the presence of mass "m−1" and "m+1" ions generated from principal isotopes of the element of interest. In many cases, the isotopic signature ratios of the low-abundance isotopes provide more sensitive and accurate *fingerprint* information for assessing sources of contamination in either the workplace or the environment. This is especially true of uranium where the high abundance isotopes associated with an anthropogenic source will be rapidly diluted by the natural uranium background. Uranium-236 (^{236}U) (half-life = 2.34×10^7 years) does occur in nature but at ultra-low concentrations. ^{236}U is also produced in nuclear reactors from neutron capture on uranium-235 (^{235}U) and may enter the workplace as reprocessed uranium containing elevated levels of ^{236}U. Consequently, industrial sources of uranium including materials used in nuclear weapons production potentially carry signature ratios of $^{236}U/^{238}U$ or $^{236}U/^{235}U$ that are distinguishable from natural background sources of uranium. Here we report on the results of initial studies showing the presence of ^{236}U in bioassay samples collected from LLNL workers potentially exposed to uranium. Advances in ^{236}U detection and measurement clearly provide a basis for improving on methodologies used to assess workplace intakes of uranium as well as in related fields such as nuclear forensics and counterterrorism.

University of California
Lawrence Livermore National Laboratory
Technical Information Department
Livermore, CA 94551