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Field Sample Preparation Method Development for Isotope Ratio Mass Spectrometry

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Nonproliferation & International Security (NA-241) established a working group of researchers from Los Alamos National Laboratory (LANL), Pacific Northwest National Laboratory (PNNL) and Savannah River National Laboratory (SRNL) to evaluate the utilization of in-field mass spectrometry for safeguards applications. The survey of commercial off-the-shelf (COTS) mass spectrometers (MS) revealed no instrumentation existed capable of meeting all the potential safeguards requirements for performance, portability, and ease of use. Additionally, fieldable instruments are unlikely to meet the International Target Values (ITVs) for accuracy and precision for isotope ratio measurements achieved with laboratory methods. The major gaps identified for in-field actinide isotope ratio analysis were in the areas of: 1) sample preparation and/or sample introduction, 2) size reduction of mass analyzers and ionization sources, 3) system automation, and 4) decreased system cost. Development work in 2 through 4, numerated above continues, in the private and public sector.

LANL is focusing on developing sample preparation/sample introduction methods for use with the different sample types anticipated for safeguard applications. Addressing sample handling and sample preparation methods for MS analysis will enable use of new MS instrumentation as it becomes commercially available. As one example, we have developed a rapid, sample preparation method for dissolution of uranium and plutonium oxides using ammonium bifluoride (ABF). ABF is a significantly safer and faster alternative to digestion with boiling combinations of highly concentrated mineral acids. Actinides digested with ABF yield fluorides, which can then be analyzed directly or chemically converted and separated using established column chromatography techniques as needed prior to isotope analysis. The reagent volumes and the sample processing steps associated with ABF sample digestion lend themselves to automation and field portability. Work to date, on this and other sample type processing method development will be presented.

Country or International Organization

United States of America

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