Strengthening environmental sampling analysis in the ROK through DOE/MOST collaboration: Initial results of uranium round-robin tests

Lee Riciputi[1], Susan Hayes[1], Jang Soo Shin[2], Kwang Yong Jee[2], Khris Olsen[3], Joel Carter[1], J. Michael Whitaker[1]

[1]Oak Ridge National Laboratory, Oak Ridge, TN 37831, USA
[2]Korean Atomic Energy Research Institute, Daejeon, 305-353, Republic of Korea
[3]Pacific Northwest National Laboratory, Richland, WA, 99352, USA

Oak Ridge National Laboratory (ORNL), Pacific Northwest National Laboratory (PNNL), and the Korean Atomic Energy Research Institute (KAERI) are working to develop and evaluate the separations, analytical chemistry, and mass spectrometry capabilities required for the Republic of Korea (ROK) to carry out isotope ratio and concentration analysis for uranium (U) and plutonium (Pu) in samples taken under safeguards environmental monitoring programs. This will allow the ROK to undertake independent verification, and improve nuclear transparency by providing another potential NetWork Analytical Laboratory (NWAL) in the International Atomic Energy Agency's (IAEA's) analytical system.

The two main elements of interest in our chemical separation and mass spectrometry collaboration are uranium and plutonium, each posing a unique set of challenges. The following steps are envisioned:

1) Round-robin analysis of a set of uranium samples to test analytical capabilities for determining both concentration and isotope ratios at levels expected in environmental samples (1 - 500ng).
2) Evaluate and demonstrate needed improvements to mass spectrometers revealed by the round-robin test, and then evaluate analysis of a set of U samples in a swipe matrix to test both extraction chemistry, cleanliness of sample preparation, and analytical capabilities.
3) Upon demonstration of low-level uranium separation and analysis, a second phase will evaluate round-robin samples for plutonium to test analytical capabilities for determining both concentration and isotope ratios at levels expected in environmental samples (0.0001 to 1 ng).
4) After mass spectrometry for low levels of Pu has been demonstrated, round-robin analyses of plutonium in a swipe matrix will be evaluated for both extraction chemistry and analytical capabilities.
5) The final step will evaluate mixed U-Pu samples in a dirty matrix that simulates expected conditions for actual environmental swipe samples.

The initial set of U samples, designed to test instrumentation capabilities only, were sent out in November, 2003. Six different analytical laboratories in the ROK, as well as ORNL and PNNL will analyze these samples, reporting data by the end of March, 2004. The data will be evaluated in April, and both data and recommendations developed from these results will be presented at the INMM conference.

Work sponsored by the Office of Nonproliferation and International Security.(NA243 under NA-24), U.S. Dept. of Energy, under contract DE-AC05-00OR22725 with Oak Ridge National Laboratory, managed and operated by UT-Battelle, LLC.

Presented at the 45th Annual INMM (Institute of Nuclear Materials Management) Meeting, Orlando, FL, July 18-22, 2004