LA-UR-12-25825
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| Title: | Fuel Cycle Research & Development Technical Monthly - September 2012 |
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| Intended for: | Report |

# Fuel Cycle Research & Development

## Technical Monthly – September 2012

### MPACT Campaign

#### Management and Integration

- [LANL] Mike Miller attended and presented an invited talk at the IAEA workshop on Facility Specific Safeguards by Design held September 11-14 in Vienna. The workshop gathered together researchers, regulators, inspectors, and vendors from a broad spectrum of the international community with the goal of generating an IAEA Nuclear Energy series document on safeguards by design for nuclear reactors, the first in a planned series of facility specific guideline documents.

### Accounting and Control Technologies

#### Microcalorimetry

- [LANL] The microcal team was able to demonstrate acquisition and perform isotopic analysis of plutonium data at 1 kHz total array counting rate with 84% of array pixels working.

#### Electrochemical Sensor

- [INL] The technical report, Electrochemical actinide Sensors was written documenting FY12 accomplishments.

#### Fast Neutron Imaging to Quantify Nuclear Materials

- [ORNL] Analysis of mock holdup scenarios was completed and reported on at the end-of-year program review. Analysis was compiled into the report, Performance of active neutron interrogation liquid scintillator for assaying fuel cycle materials.

#### Lead Slowing Down Spectrometer

- [LANL] Study into the He4 detector issue continued. Work continued on perturbation methods to analyze spent fuel LSDS data, and using a limited time window, have achieved some success. We are looking into the possibility of predicting the isotopic response of fission chambers, from the response of other isotopes. (e.g., determining the response of a 239Pu chamber from that of a 235U chamber).
- [PNNL] Studied the use of Th fission chambers for the analysis as well as the impact of the lead size. ISU is preparing a small Th fission chamber report.

### MPACT Analysis Tools

#### Multi-isotope Process Monitor

[PNNL] The dynamic fuel mixing experiment was reworked to provide better experimental control and data quality. This experiment was performed utilizing event mode data logging techniques. A program to extract the event mode data into a useable format is being developed. We investigated the impact of gamma-ray counting statistical precision on the effectiveness of Principal Component Regression (PCR) as applied to a three-component mixture (Am-241, Co-57, and Eu-152) of radioisotopes. The results indicate an approximate 1/sqrt(counts) dependence of the RMS reconstructed component-activity precision on the total spectrum intensity, when the three spectral components are of comparable intensity. Counting experiments were begun to provide data to test and verify the uncertainty analysis and to explore the effect of detector resolution on data analysis results.

#### Material Control including Process Monitoring (Pattern Recognition, Sensors)

- (ANL) The quartz chips and heat exchange manifold were received from the external foundry. An experimental set-up will be tested and installed in an inert atmosphere glovebox.

**Material Control including Process Monitoring (Pattern Recognition, Sensors)**

- [ANL] We received the quartz chips and heat exchange manifold from external foundry. Experimental set-up will be tested and installed in an inert atmosphere glovebox.

**Sensor for measuring density and depth of molten electrolyte**

- [INL] Flow meters and pressure transducers have been assembled to be tested. Data acquisition hardware has been ordered and some components have arrived.

**MPACT System Integration and Technical Support**

- [LANL] Exchanged reports with Fuel Cycle Options team on Proliferation and Security metrics.

**Safeguards and Security by Design**

**Used fuels storage security analysis, guidance and best practices**

- Work was coordinated with Scott Demuth on the LANL/SNL joint milestone. Issues were prioritized for used fuel storage security.

For more information on MPACT contact Mike Miller (505) 667-3335