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SURROGATE POST-DETONATION URBAN DEBRIS (SPUD) STANDARD REFERENCE MATERIAL

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Content

The characterization of urban debris after a nuclear weapon detonation is complicated by the high concentrations of elements like Ca, Fe, Al, and Si and other naturally occurring and anthropogenic materials that are entrained into the nuclear fireball from the local environment. Yet, this nuclear forensics characterization is essential in the identification of the fuel type, weapon design, production process and date, etc. The resulting nuclear forensics data must be accurate, precise, and anchored by validated measurement methods as conclusions drawn from these data will be coupled with law enforcement and intelligence information to identify those responsible. Reference materials (RMs) establish the traceability, accuracy, and precision of nuclear forensic measurements and provide the ability to benchmark measurement methods essential to meeting the requirements of legal scrutiny. NIST, in concert with partner labs (AFIT (DoD), FBI (DOJ), and NPL) and with support from the FBI, have developed two Surrogate Post-Detonation Urban Debris (SPUD) Standard Reference Materials (SRMs) – SRM 4600 and 4601. The 4600 material is doped with natural Uranium and the 4601 material is doped with U235. These SRMs have been developed to mimic the "rubble" of a city after an Improvised Nuclear Device (IND) detonation, which is capable of producing fresh fission as well as activation products. For the first stage of SRM characterization, we have been assessing the homogeneity of the minor and trace elements in these SRMs by microbeam X-ray fluorescence (XRF) spectrometry and neutron activation/prompt gamma analysis, respectively. The primary goal of the homogeneity assessment is to determine the sample mass required for all elements to be homogeneous, with a secondary goal of determining this same minimum sample mass for the individual elements of interest. Results obtained from XRF analysis using PCA techniques suggest that a minimum sample mass of approximately 3 mg is required for all elements and sample masses of 0.1 mg up to 3 mg is required for the various elements of interest.

About the Presenter

Dr. Jacqueline Mann has over 18 years of inorganic elemental and isotopic analysis experience at the National Institute of Standards and Technology (NIST), with 14 of those years involving the certification of Standard Reference Materials (SRMs). She has worked on the development of new experimental design approaches and mass spectrometric techniques for concentration and isotopic measurements for improvement of measurement uncertainty. Currently, she is the lead SRM POC/SME in the NIST Radioactivity Group for the nuclear forensics community and is actively involved in the certification of SRMs/CRMs for Pre-Det and Post-Det nuclear forensics with fellow Federal agencies.

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