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Nuclear Forensics and Attribution: A National Laboratory Perspective

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Current capabilities in technical nuclear forensics - the extraction of information from nuclear and/or radiological materials to support the attribution of a nuclear incident to material sources, transit routes, and ultimately perpetrator identity - derive largely from three sources: nuclear weapons testing and surveillance programs of the Cold War, advances in analytical chemistry and materials characterization techniques, and abilities to perform "conventional" forensics (e.g., fingerprints) on radiologically contaminated items. Leveraging that scientific infrastructure has provided a baseline capability to the nation, but we are only beginning to explore the scientific challenges that stand between today's capabilities and tomorrow's requirements. These scientific challenges include radically rethinking radioanalytical chemistry approaches, developing rapidly deployable sampling and analysis systems for field applications, and improving analytical instrumentation. Coupled with the ability to measure a signature faster or more exquisitely, we must also develop the ability to interpret those signatures for meaning. This requires understanding of the physics and chemistry of nuclear materials processes well beyond our current level - especially since we are unlikely to ever have direct access to all potential sources of nuclear threat materials.