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Strategies and Considerations for Developing a National Nuclear Forensics Library

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A national nuclear forensics library (NNFL) is an important resource for making rapid and credible material provenance assessments during the course of nuclear forensics investigations. While the concept of cataloging forensic characteristics needed to definitively identify materials used, produced, or stored within a state is gaining international acceptance, only general guidance is available to countries wishing to develop their own NNFL. One gap in the available guidance we have specifically identified and are working to address is how to consider the range and sophistication of nuclear and radiological activities within a state and how this correlates with the complexity of an NNFL. For example, a country that has substantial nuclear fuel cycle activities is likely going to require a more complex library than a country that only possesses industrial and medical radioactive sources.

Over 200 IAEA member states only have uranium mining and milling, radiological sources, and research or power reactor operations. Developing a functional NNFL capable of identifying whether material found outside of regulatory control is consistent with known holdings should be a relatively small effort, largely drawing upon existing information, for example data from a national radioactive source registry. The set of material characteristics necessary to uniquely identify materials is not necessarily extensive, and very likely does not require any additional laboratory analysis to produce. There is also probably no extensive subject matter expertise or complex comparative analysis algorithms required to compare unknown materials with those in the NNFL during the course of an investigation.

For the approximately 40 states with significant nuclear fuel cycle activities, the task of developing a NNFL is much tougher given the wide variety and changing characteristics of materials as they progress through the fuel cycle. In this case, a much more extensive set of material characteristics is necessary to uniquely identify materials from the state's nuclear operations and may require extensive work on the part of nuclear fuel cycle, analytical chemistry, and comparative analysis experts to determine what should be captured in an NNFL.

We are developing guidance for state's considering development of a NNFL that takes this range of nuclear operations into account right from the start, and hopefully constrains the level of effort required to construct a functional NNFL early in the process. This approach incorporates a scoping study to identify the nuclear and radiological activities within a state, what data already exists that may be useful to the NNFL and where there are gaps, how to develop a strategy to fill those gaps, and an estimate of the level of effort that will be required to produce a functional NNFL. By doing so, many states should be able to establish operational NNFLs relatively quickly, and without significant cost. For more advanced fuel cycle states, the guidance should also prove useful, detailing an approach to engage a variety of subject matter experts early on to identify data necessary to the NNFL, where there are gaps, and where additional work including laboratory analysis or comparative analysis algorithm development may be required to produce a functional NNFL.

Primary author: Dr LAMONT, S. (U.S. Department of Energy)

Co-authors: Mr FEI, E. (U.S. National Nuclear Security Administration); Dr DION, H. (U.S. National Nuclear Security Administration); Ms BRISSON, M. (U.S. Department of Energy); Ms FENDRICH, S. (U.S. Department of State)

Presenter: Dr LAMONT, S. (U.S. Department of Energy)

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