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Teaching Nuclear Forensics Material Analysis – Getting Creative with Virtual Tools

In order to help partner countries meet their nuclear security objectives, Lawrence Livermore National Laboratory (LLNL), together with Los Alamos National Laboratory (LANL), through partnership with the U.S. Department of Energy's National Nuclear Security Administration (DOE/NNSA) Office of Nuclear Smuggling Detection and Deterrence (NSDD), have assisted over twenty countries to develop, sustain, and advance indigenous nuclear forensic capabilities. This is achieved through scenario-based policy discussions, hands-on laboratory-based training sessions, and material sample exchanges.

The ongoing COVID-19 pandemic has adversely impacted the ability of nuclear forensic assistance providers to implement hands-on capacity building and in-person scientific exchanges. To meet the challenge, LLNL and LANL developed and implemented unique virtual interaction initiatives for continued interaction with international partners. In this context, LLNL and LANL virtualized the workshop on Analytical Plan Development in Support of Investigations, which aims to provide guidance in the development and execution of an analysis plan for nuclear or other radioactive material found outside of regulatory control.

In support of NSDD, LLNL and LANL subject matter experts (SMEs) modified the workshop materials, first presented in 2015, for enhanced interactive engagement during the virtual live sessions. In advance, participants read and watch materials hosted on a password-protected website, nuclear-forensics.org, which cover analytical techniques such as gamma- and alpha-spectrometry and isotope ratio measurements. These materials range from fact sheets to narrated presentations and animations, allowing participants with diverse backgrounds to learn basic concepts at their own pace. Short quizzes using Mentimeter during the virtual training help instill important concepts.

Following the guidance of the IAEA Nuclear Security Series 2-G: Nuclear Forensics in Support of Investigations, participants were guided through a three-stage fictious scenario exercise between lectures, where they were asked to put themselves in the roles of laboratory staff performing a nuclear forensics examination. Participants were given the opportunity to work with and interpret real nuclear forensics data derived from the Nuclear Forensics International Technical Working Group (ITWG) CMX-4 collaborative material exercise. Participants compared and contrasted the provided datasets to interpret information and assist a fictitious investigative authority in answering key questions about the materials out of regulatory control. Participants also learned how they might answer questions posed by investigating authorities in furtherance of prosecution, a key contextualizing component connecting forensic laboratory scientists with the broader investigatory process. Furthermore, participants were exposed to interpretation methods that help determine material origin, which aside from assisting the investigation directly, can help illuminate nuclear material security gaps and smuggling pathways.

By the end of the workshop, participants obtained a better understanding of how they can assist the investigatory authority by providing data in furtherance of prosecution of alleged smugglers, as well as how to determine the potential origins of nuclear or other radioactive material out of regulatory control. To this end, virtualizing NSDD's capacity building activities such as the Analytical Plan Development workshop during unprecedented worldwide travel restrictions enhances the ability of the partner country to investigate nuclear material smuggling incidents, ultimately supporting enhanced deterrence of future smuggling events.

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