

## The Pivot to Virtual Engagement in International Nuclear Forensics

In response to unprecedented global challenges including the 2020 coronavirus pandemic, nuclear forensics international engagements pivoted to virtual meeting formats and emerged with stronger, resilient and lasting partnerships. The need for international collaboration in nuclear security has never been greater; the security of the global nuclear fuel cycle involves extraction, refining and processing sites often far removed from reactors and industrial sites that utilize nuclear and other radioactive material for diverse applications. Reliance on nuclear and other radioactive materials continues unabated with the accompanying potential for low probability, high consequence malicious use by terrorists. The International Atomic Energy Agency's (IAEA) Incident and Trafficking Database reported 140 confirmed incidents of nuclear and other radioactive material out of regulatory control in 2019 and 116 confirmed incidents in 2020.

The scope of the change in engagement driven by the pandemic affected nuclear forensics implementation at all levels: institutionally, nationally, regionally and internationally. The objectives of nuclear forensics outreach remain as before: to identify, develop and socialize best practices in the field of nuclear forensics. The challenge is to ensure the resilience of virtual engagements to allow for the full spectrum of coordination, research, training, peer-reviews, and outreach to other communities –to include law enforcement –while maintaining timeliness as well as the highest confidence in the provision of this information.

Using web-based tools including video conferencing, webinars, podcasts, on-line e-learning, as well as electronic dissemination of newsletters and updates, the nuclear forensics community adapted rapidly. Concerted effort was made throughout to understand the needs and preferences of end-users for receiving nuclear forensics assistance; questionnaires and anonymous polling were effective to focus virtual messaging and outreach.

Several examples are highlighted. Within working nuclear forensic laboratories, periodic (monthly) technical and programmatic meetings were scheduled to promote cohesion and coordination in operations as physical accesses were limited. In place of in-person research meetings, different technical topics were presented virtually each month by principal investigators augmented by brief status reports from scientists and examiners. Inside the academic setting, in-person instruction was curtailed, research activities modified, and replaced by an array of virtual information streams to include nuclear security seminar series and podcasts. International assistance adapted; the IAEA embarked on a series of webinars in 2021 to include operational perspectives connecting radiological crime management and nuclear forensics as well as offering like e-learning modules. International nuclear forensics conferences also shifted formats without sacrificing technical content; the NuFor meeting organized in the United Kingdom focusing on emerging science and early career investigators was conducted entirely virtually in 2020 and was convened in a hybrid (in-person and virtual) format in 2021.

To best provision international assistance, the Nuclear Forensics International Technical Working Group (ITWG) polled its membership and, not unexpectedly, results indicated a strong preference for regularly scheduled (e.g. monthly) webinars. This virtual series commenced in October 2020. A year later, eight webinars have been conducted including a presentation on the development of uranium ore concentrate reference materials, status reports on prior and current ITWG collaborative material analytical exercises (CMX) as well as outcomes from virtual exercises involving national nuclear forensic libraries (e.g. Galaxy Serpent). Additional subjects included the recovery of evidence contaminated by radionuclides, laboratory protocols for analysis of solids and powders, as well as radioactive source identification. Beyond the webinar series, a highlight for ITWG virtual engagement was the working group's first all virtual annual meeting convened over a four-day interval in June 2021. This meeting featured technical presentations from the ITWG Nuclear Forensics Laboratories (INFL) to include updates from nuclear forensic laboratories globally. Plenary sessions featured a 25-year retrospective on the establishment and technical evolution of the ITWG by its founding members, updates from the ITWG's international partners (IAEA, Global Initiative to Combat Nuclear Terrorism) as well as standing ITWG task group reports. Over 130 experts participated from more than 30 states and international organizations.

A mix of in-person, virtual and hybrid engagements will certainly become the 'new normal' for international engagements in nuclear forensics. Recent success in virtual engagements will further strengthen international nuclear forensics in the years ahead.

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