

### ITWG NUCLEAR FORENSICS UPDATE

No.11 June 2019

#### CHAIRPERSONS' ADDRESS

Welcome to the Nuclear Forensics International Technical Working Group (ITWG) newsletter. It has been a busy spring, what with the International Atomic Energy Agency (IAEA) Technical Meeting on Nuclear Forensics in early April, a GICNT Nuclear Forensics Working Group meeting in late April and the Radioanalytical and Nuclear Chemistry (RANC) conference in May. Fortunately, for those who were unable to attend these events, this edition of the newsletter contains a summary of the Technical Meeting as well as an article by one of the speakers that reflects on the current state of the nuclear forensics community. In addition, this edition includes an article that previews the upcoming ITWG-24 meeting in Bucharest. We hope that this will help participants prepare to contribute to the working group. Once again, Klaus and I would like to congratulate the IAEA on an outstanding technical meeting and express our appreciation for the close cooperation between the ITWG and the IAEA. We look forward to seeing everyone in Bucharest.

With best regards, Klaus Mayer and Michael Curry

## ANNUAL MEETING OF THE NUCLEAR FORENSICS INTERNATIONAL TECHNICAL WORKING GROUP

#### MICHAEL CURRY AND KLAUS MAYER

The Nuclear Forensics International Technical Working Group (ITWG) will hold its 24th annual meeting in Bucharest on 25–27 June 2019. In line with the ITWG's mission to identify, develop and promote best practices, the meeting will be structured to provide updates from key stakeholders, discuss plans for upcoming exercises and develop guidelines. In keeping with the working-group nature of the ITWG, appropriate time has been allocated to task groups and less time has been devoted to lectures and presentations.

The International Atomic Energy Agency (IAEA), and the ITWG co-chairs will each provide updates, and these will include a briefing with case studies on the IAEA Incident and Trafficking Database programme. There will also be technical sessions with briefings on nuclear forensics techniques, as well as professional development seminars on the draft Graded Decision Framework guideline and chain-of-custody best practices. Furthermore, there will be breakout sessions for the ITWG's five task groups as described below. In addition, the closing plenary session will include briefings by experts in the fields of chemical and biological forensics in order to increase communications across the chemical, biological, radiological and nuclear (CBRN) forensics fields. Finally, in addition to an official dinner at Mogosoaia Palace, our Romanian hosts from the Horia Hulubei National Institute of Physics and Nuclear Engineering are offering an optional half-day tour of the laboratory on 28 June.

The professional development seminar on the Graded Decision Framework will certainly be of interest to all ITWG participants. However, the inputs of the National Nuclear Forensics Library Task Group (TG), the Exercise TG and the Guidelines TG will be particularly useful for further perfecting this ITWG product.

All TGs will finalize their Strategic Plans, which will outline their anticipated activities and priorities for the coming 2–3 years. The Exercise TG will review the outcomes from the ITWG's sixth collaborative material exercise (CMX-6) and the Data Review Meeting in Warsaw on 4–6 June 2019. Laboratories will share and discuss specific experiences.

The National Nuclear Forensics Libraries TG will discuss preparations for the upcoming Galaxy Serpent

# THE IAEA TECHNICAL MEETING ON NUCLEAR FORENSICS: SHARING GLOBAL SUCCESS IN NUCLEAR FORENSICS DEVELOPMENT AND IMPLEMENTATION JERRY DAVYDOV, DAVID KENNETH SMITH AND NICOLA VORHOFER

#### The next meeting

'When's the next meeting?' With these words, on a sunny day in July 2014, the International Atomic Energy Agency (IAEA) concluded its 2014 international conference, 'Advances in Nuclear Forensics: Countering the Evolving Threat of Nuclear and Other Radioactive Material Out of Regulatory Control'. Some five years later, the IAEA has provided its response.

On 1–4 April 2019, the IAEA brought together 158 experts from 80 member states and two international organizations; the European Commission; and the International Criminal Police Organization (INTERPOL) to highlight the role of nuclear forensics in the fight against the threat of nuclear and other radioactive material out of regulatory control (MORC). They shared experiences of responding to nuclear security events and advances in nuclear forensics research and development, and discussed the need for technical and human capacity measures in states with established nuclear forensics programmes and those contemplating the development of such programmes.

The technical meeting, 'Nuclear Forensics: Beyond the Science', was co-chaired by Maria Wallenius



**Figure 1.** IAEA Technical Meeting on Nuclear Forensics: Beyond the Science, held at the Agency headquarters in Vienna, Austria (1–4 April 2019). Credit: Dean Calma/IAEA.

of the European Commission's Joint Research Centre-Karlsruhe and Frank Wong of the United States Department of Energy's Lawrence Livermore National Laboratory. It provided an opportunity for states to exchange information on national approaches to initiating nuclear forensics capabilities as part of their nuclear security infrastructure. The different risks, opportunities and obstacles facing states, such as the unauthorized or malicious use of nuclear



**Figure 2.** An example of an interactive session's results: The Technical Meeting participants share their impressions from the meeting. Credit: Frank Wong, Lawrence Livermore National Laboratory (LLNL), United States.

## LOOKING BACK AND TAKING STOCK OF WHERE WE ARE IN NUCLEAR FORENSICS LARS VAN DASSEN $\overset{*}{}$

#### Is nuclear forensics a scientific discipline?

Some of the discussions over the past few days have revolved around whether nuclear forensic science is a scientific discipline on its own. It is difficult and may even be unnecessary to find an answer to this question. It is obvious that various sub-fields of physics, chemistry and other disciplines contribute to a deeper analysis and understanding of phenomena pertinent to nuclear forensics. In my opinion, if we want nuclear forensics to become a scientific discipline that has its own corner or standing, then this can only be achieved by enriching it with insights from the various social sciences related to the investigation and prevention of crime, such as criminology, sociology and maybe even psychology. We need to understand the reasoning and ambitions of perpetrators-and we therefore need to understand the range and limits of human faculties, as well as the human factors that create holes in nuclear security systems, and in the functioning and efficiency of legal systems. This leads into an interesting field.

#### The legal aspect

I noted something that stands out from this week's presentations on legal aspects and prosecutions. It appears to be difficult to convict individuals who are suspected of illegal handling of nuclear and other radioactive materials. Why should this be the case? Is it linked to the structure and traditions of the legal system of a particular country? Is it related to the unusual kind of evidence that prosecutors must deal with in cases of nuclear security events? Is it difficult to present the results of an examination of nuclear or other radioactive material, or of evidence that is contaminated with radionuclides, to the judicial authorities or a jury in an understandable way?

On the second day of this technical meeting, Frank Wong facilitated an interactive panel that

\* This article is an adapted and abridged version of an address delivered by the author at the IAEA technical meeting on nuclear forensics. Lars van Dassen is the Director of the Office of International Relations at the Swedish Radiation Safety Authority. His experience of studying and working on practical aspects of combating illicit trafficking of nuclear and other radioactive materials spans 30 years.



**Figure 1.** David Kenneth Smith, IAEA Nuclear Security Coordinator (Forensics), presented the goals and objectives at the opening of the Technical Meeting on Nuclear Forensics: Beyond the Science. Credit: Dean Calma/IAEA.



**Figure 2.** Technical Meeting's Co-Chair Maria Wallenius, JRC Karlsruhe, European Commission. Credit: Dean Calma/IAEA.



**Figure 3.** Technical Meeting's Co-Chair Frank Wong, Lawrence Livermore National Laboratory (LLNL), United States. Credit: Dean Calma/IAEA.

#### The IAEA Technical Meeting on Nuclear Forensics... continued from page 2

and other radioactive material, the specificities of their legal systems and the broad range of national technical capabilities and subject matter expertise, were all discussed in the light of the unique challenges they pose to the conduct of a nuclear forensics examinations.

#### Incident response

The focus was on the application of nuclear forensics in responding to incidents involving nuclear and other radioactive MORC. The meeting covered a broad range of topics applicable to nuclear forensics, such as the links to radiological crime scene management in the context of national laws and international legal instruments. Discussions covered the role of nuclear forensics in satisfying the legal requirements set by national systems and international legal instruments such as the Convention on the Physical Protection of Nuclear Material and its amendment. The meeting took note of IAEA INFCIRC/917, which makes a shared commitment to advance nuclear forensics through training, knowledge transfer, national frameworks that include nuclear forensics capabilities and sustained outreach.

The meeting was broken up into four topics areas—Capability Building: Initiation and



**Figure 3.** Raja Abdul Aziz Raja Adnan, Director of the IAEA Division of Nuclear Security, Delivers Opening Remarks. Credit: Dean Calma/IAEA.

Sustainability; Human Resource Development and Sustainability; Practice and Experience; and Research and Development: Current Status and Future Opportunities—and featured presentations, panel discussions and an interactive session on responding to a nuclear security event and the ensuing radiological crime scene management. Along with participating international partners such as the Nuclear Forensics International Technical Working Group (ITWG), the Global Initiative to Combat Nuclear Terrorism (GICNT), INTERPOL and the



**Figure 4.** IAEA Technical Meeting on Nuclear Forensics: Beyond the Science, held at the Agency headquarters in Vienna, Austria, (1 April 2019). Credit: Dean Calma/IAEA.

United Nations Office on Drugs and Crime (UNODC), participants recognized that no single agency or ministry can achieve the goals of nuclear forensics, but that instead a whole-of-government approach is required.

#### Beyond the science

The title 'Nuclear Forensics: Beyond the Science' highlighted the fact that the implementation of nuclear forensics is part of a robust nuclear security infrastructure. The meeting acknowledged the strong interest in and growth of nuclear forensics since the 2014 conference. The availability of technical guidance documents, research on both non-destructive and destructive analysis, applied laboratory-based training, mentoring of emerging nuclear forensics examiners, analytical and interpretative exercises, expert advisories and national systems for the identification of nuclear and radioactive materials, including national nuclear forensics libraries, has blossomed during this time, as was reflected throughout the meeting. The community aspect of international assistance in nuclear forensics was an important conclusion from the meeting's deliberations.

In its concluding session, the meeting took a strategic look forward. Among the future needs identified were mechanisms to best engage with academic fields such as geochemistry and environmental science, traditional forensics, materials science, predictive modelling and cyber applications, as well as further development of regional and global networks for nuclear forensics assistance and information exchange (such as the IAEA's Nuclear Security Support Centres and the International Nuclear Security Education Network). Looking forward, there was a universal call-to-action to communicate the value of nuclear forensics more broadly, for greater support and raised awareness, and increased international collaboration—and to train the next generation of experts and consider the establishment of professional standards and credentials.

Maria Wallenius noted that: 'All nations, big and small, must be prepared to respond to nuclear security events. The overwhelming interest in this meeting has demonstrated the seriousness with which this topic is being treated'.

An IAEA TECDOC will be published containing all 58 of the extended synopses contributed to the Technical Meeting, as well as a summary of all the technical and panel sessions and their key outcomes. The TECDOC will feed into the priorities of nuclear forensics as part of the upcoming IAEA International Conference on Nuclear Security: Sustaining and Strengthening Efforts (ICONS2020) on 10–14 February 2020. The outcomes from the technical meeting provide a nuclear forensics roadmap for the IAEA's programme of assistance, as well as those of its partners, which will strengthen nuclear security plans and preparations globally.

#### UPCOMING TRAININGS AND MEETINGS

- ITWG CMX-6 Data Review Meeting, Warsaw, Poland, 3-5 June 2019
- ITWG-24 Annual Meeting, Bucharest, Romania, 25–27 June 2019
- NuFor Nuclear Forensics Conference, Bristol, United Kingdom, 10-11 July 2019
- Nuclear Forensics Summer School, Kiev, Ukraine, 9-13 September 2019
- Practical Introduction to Nuclear Forensics (International), Budapest, Hungary, 9-13 September 2019
- 2019 IAEA General Conference, Vienna, Austria, 16-20 September 2019
- Nuclear Forensics Training Course for Balkan Countries, Novi Sad, Serbia, 24-26 September 2019
- IAEA International Conference on Nuclear Security: Sustaining and Strengthening Efforts (ICONS2020), Vienna, Austria, 10–14 February 2020

Dates and locations of IAEA training and meetings will be officially confirmed with host member states; participation in IAEA training and meetings is by nomination and in accordance with established IAEA procedures.

#### Annual Meeting of the Nuclear Forensics ITWG... continued from page 1

exercise (GSv4), in which increased emphasis will be put on data interpretation.

The Evidence & Testimony TG plans to finalize several new documents, such as guidelines on the chain-of-custody and on documenting casework. This TG will also discuss the possibility of creating a new table-top activity that will focus on how to interpret and present nuclear forensic results in a way that is tailored to law enforcement, public messaging or decision makers.

The Guidelines TG developing consensus guidelines that will enable the comparison of results among nuclear forensics practitioners, which will provide additional credibility when presenting information to legal authorities. At ITWG-24, the task group will discuss the most recent revision of the Graded Decision Framework Guideline, while also reviewing other guidelines in the process of development and soliciting the production of new guidelines.

The Outreach and Training TG will focus on opportunities for enhanced outreach (digital presence, technical meetings and international conferences); the content of future editions of the ITWG Update newsletter; as well as share effective approaches for training in nuclear forensics to include continued work on the training matrix (task verses practitioner).



**Figure 1.** Nuclear forensics laboratory at the Horia Hulubei National Institute for Physics and Nuclear Engineering (IFIN), Măgurele, Romania'. Credit: IFIN.

#### Looking Back and Taking Stock... continued from page 3

included participation and voting by the audience and discussion of a fictitious scenario involving a radiological crime scene and a nuclear forensics investigation. The panel demonstrated that lack of communication across professional domains can indeed be an obstacle.

Nonetheless, only in a few cases it is possible to say that a failure to investigate or prosecute was caused by a specific factor, such as lack of communication between the agencies involved. In most cases, there will be a combination of factors. The various factors that make investigations, prosecutions and sentencing difficult are not mutually exclusive, but rather mutually reinforcing. We need to understand this area much better.

Several presentations pointed out where and how new technologies and disciplines and sub-disciplines contribute to the natural science aspects of nuclear forensics. This deepening is important in its own right. What is needed, however, is a conscious—and I underline conscious—broadening of the discipline by connecting it with sociology, psychology, criminology, legal studies and possibly economics.

This would not be anything new. Even the classical Greek philosophers more than two millennia ago were on to this. Some wanted to study nature—the sky, stars, oceans and animals predominantly—to identify its regularities, if not laws. Whenever it was perceived that this was too inconclusive or too difficult, attention was turned to social life, ethics and the structure of human societies, such as the state. Observations and regularities in this domain were in turn stepping stones back to inquiries into nature and physics.<sup>1</sup> In

short, the interplay between the natural and the social sciences is as old as humanity's thinking about the world. Nuclear forensics can and should be proud to stand in this tradition. Moving in this direction could make nuclear forensics a discipline on its own—a discipline that stands on the shoulders of both natural and social scientific disciplines and produces something new and specific to our understanding of a particular problem. In this way, maybe nuclear forensics can become an issue that people can work with full-time, rather than a part-time occupation among many other issues.

#### What's next?

It has been mentioned during this excellent conference that the first generation of nuclear forensics was born out of the cold war and the desire of the nuclear-armed antagonists to understand the material composition of each other's nuclear weapons. The second generation perhaps began in 1993-96, with the seizures of significant amounts of nuclear material, such as the material seized at Munich airport, as well as the G7 response to these by convening the 1996 Moscow Summit and the creation of the ITWG. We are still in this second generation, further developing and disseminating nuclear forensics capabilities and the accompanying awareness-raising. What will the third generation look like? I think it will have two distinguishing features. First, nuclear forensics should become interdisciplinary, by spanning pertinent subfields of both the natural and the social sciences. Second, the appropriate use and awareness of nuclear forensics capabilities should become an international norm. This conference has done a lot to take us there, and for that we should be thankful to David Smith's leadership and dedication to making this event a success.

<sup>1</sup> For an excellent discussion of this issue see Leroi, A. M., *The Lagoon: How Aristotle Invented Science* (Penguin Books: New York, 2014).

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#### NUCLEAR FORENSICS

Nuclear forensics is an essential component of national and international nuclear security response plans to events involving radioactive materials diverted outside of regulatory control. The ability to collect and preserve radiological and associated evidence as material is interdicted and to conduct nuclear forensics analysis provides insights to the history and origin of nuclear material, the point of diversion, and the identity of the perpetrators.

#### THE NUCLEAR FORENSICS INTERNATIONAL TECHNICAL WORKING GROUP

Since its inception in 1995, the Nuclear Forensics International Technical Working Group (ITWG) has been focused on nuclear forensic best practice through the development of techniques and methods for forensic analysis of nuclear, other radioactive, and radiologically contaminated materials. The objective of the ITWG is to advance the scientific discipline of nuclear forensics and to provide a common approach and effective technical solutions to competent national or international authorities that request assistance.

#### **ITWG PRIORITIES AND ACTIVITIES**

As a technical working group, the priorities for the ITWG include identifying requirements for nuclear forensic applications, evaluating present nuclear forensic capabilities, and recommending cooperative measures that ensure all states can respond to acts involving illicit trafficking and unauthorized possession of nuclear or other radioactive materials. An objective of the working group is to encourage technical peer-review of the nuclear forensic discipline. These goals are met through annual meetings, exercises, and informal and formal publications.

Outreach is a primary goal of the ITWG. The working group disseminates recent progress in nuclear forensic analysis and interpretation with the broader community of technical and security professionals who can benefit from these advancements. Affiliated international partner organizations include the International Atomic Energy Agency (IAEA), the European Commission, the European Police Office (EUROPOL), the International Criminal Police Organization (INTERPOL), the Global Initiative to Combat Nuclear Terrorism (GICNT) and the United Nations Interregional Crime and Justice Research Institute (UNICRI).

#### **ITWG MEMBERSHIP**

Nuclear forensics is both a technical capability as well as an investigatory process. For this reason the ITWG is a working group of experts including scientists, law enforcement officers, first responders, and nuclear regulators assigned by competent national authorities, affiliated contractors, and international organizations. The ITWG is open to all states interested in nuclear forensics.

ITWG participating states and organizations recognize that radiological crimes deserve thorough investigation and, when warranted, criminal prosecution. The ITWG encourages all states to possess the basic capability to categorize nuclear or other radioactive materials to assess their threat. As an international group, the ITWG shares its expertise through its membership to advance the science of nuclear forensics as well as its application to nuclear security objectives.

#### http://www.nf-itwg.org/

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