

# ITWG NUCLEAR FORENSICS UPDATE

No. 20 September 2021

# CHAIRPERSONS' ADDRESS

Welcome to the 20th issue of the Nuclear Forensics International Technical Working Group (ITWG) newsletter. The ITWG Update emerged from a discussion we held during our 2016 annual meeting in Lyon, France, and developed rapidly into a prominent medium for communicating the activities of ITWG. Although this year's annual meeting could not be held in-person, we had an excellent exchange on a variety of topics (p. 1) using the electronic platform Zoom. Further contributions in this issue of the newsletter describe nuclear forensics capacity building activities in Thailand (p. 2) as well as a description of the International Atomic Energy Agency's (IAEA) Virtual Programme for Capacity Building in Nuclear Forensics (p. 5). The Nuclear Forensics Calendar provides an updated list of forthcoming events, ITWG webinars and training courses. Our recently established section on notable publications offers a selection (making no claim to be exhaustive) of current articles related to nuclear forensics. We hope this will be of interest to readers and help better connect this community.

With best regards,

Klaus Mayer and Michael Curry

# SCIENCE, POLICY AND SELF-REFLECTION AT THE ITWG'S FIRST VIRTUAL ANNUAL MEETING KLAUS MAYER AND MICHAEL CURRY

The Nuclear Forensics International Technical Working Group (ITWG) held its annual meeting on 15-18 June 2021. As in previous years, the event included updates from key stakeholders, discussions on upcoming exercises and presentations on technical progress. Unlike in previous years, however, the 2021 annual meeting was conducted entirely online. Despite the inevitable downsides-most notably, missing each other's in-person company and opportunities for informal bi- or multilateral discussions in the margins of the meeting or for networking among experts-the virtual format proved satisfactory for conducting the core business of the meeting. There were also a few silver linings: nobody suffered from jet lag, all the briefings were recorded and attendance soared. Nearly 130 nuclear forensics practitioners attended from over 30 countries and international organizations, making this year's meeting the largest yet by a substantial margin.

# Scientific talks and professional development seminars

The 2O21 ITWG Nuclear Forensics Laboratories (INFL) session of the annual meeting, organized by Naomi Marks and Maria Wallenius, featured an impressive range of scientific talks on cutting-edge research, regional updates and nuclear forensics case studies. Technical presentations on neutronics modelling, standoff optical detection of radiation, ATONA detector systems and more received close attention from the audience. A detailed update on the Graded Decision Framework provided useful professional development for those who hope to use it as a tool in the upcoming seventh Collaborative Materials Exercise (CMX-7).<sup>1</sup> The various updates on national and regional nuclear forensics activities will help ITWG colleagues around the world coordinate current and future work.

# Plenary session and task groups

The headline attraction of the 2O21 plenary session was a panel discussion looking back over 25 years of the ITWG. The panel was moderated by David Smith and featured long-time ITWG contributors Sid Niemeyer, Ben Garrett, Paul Thompson and Tom Jourdan. Each panellist shared unique reflections

<sup>&</sup>lt;sup>1</sup> Schwantes, J. and Marsden, O., 'Twenty years of collaborative materials exercises by the Nuclear Forensics International Technical Working Group', *ITWG Nuclear Forensics Update*, no. 14 (Feb. 2020), pp. 1–3.

# Science, Policy and Self-reflection... continued from page 1

on the early years of the ITWG community and its evolution over the past quarter of a century. The panel reminded us not only how the world has changed since 1995, but also how the ITWG itself has been an agent of change, strengthening nuclear security through forensic science.

The plenary session also featured updates from international partners, such as the International Atomic Energy Agency (IAEA) and the Global Initiative to Combat Nuclear Terrorism (GICNT). The audience learned how these groups were adapting to the Covid-19 pandemic, including with online training resources and virtual workshops, and about upcoming engagements such as the IAEA Technical Meeting on Nuclear Forensics and the GICNT's MED Trident exercise, both of which it is hoped will be held in-person in 2022.

Reports from the representatives of the ITWG's five task groups rounded off the plenary session. The Evidence and Testimony Task Group (Jim Blankenship and Jens-Tarek Eisheh) gave an update on its strategic plan, which includes new guidelines, pocket cards and other future activities. The Exercise Task Group (Olivia Marsden and Jon Schwantes) delivered a refresher on its popular CMX series, which included a sneak preview of CMX-7 which starts in August. The Guidelines Task Group (Mike Kristo and Zsolt Varga) reminded participants about the procedure for producing ITWG Guidelines and summarized the nine guidelines where work is currently in progress. The ITWG Executive approved two guidelines shortly after the annual meeting. These new guidelines—one on Isotope Dilution Mass Spectrometry and the other on Laser Ablation Inductively Coupled Plasma Mass Spectrometry—will be published on the ITWG websites shortly. The Libraries Task Group (Ali El-Jabi and Steve LaMont) delivered a detailed update on the recent Galaxy Serpent v4 National Nuclear Forensics Libraries (NNFL) exercise, the exercise structure and an overview of results.<sup>2</sup> Finally, the Outreach Task Group (David Smith and Ed van Zalen) reported on its creative and innovative work on adapting the ITWG's recent activities to the constraints of Covid-19 and setting up a series of thematic webinars in close cooperation with the other task groups and INFL.

### Innovative hosts on uncharted ground

Our colleagues at France's Alternative Energies and Atomic Energy Commission (CEA) faced a daunting task as hosts of this first-ever virtual annual meeting. Dr Pascal Girard, his team at the CEA and the outstanding staff at WeConext earned not only our gratitude but also our admiration for their flawless execution of this unprecedented ITWG event.

Next year's Annual Meeting will be hosted by the United States Lawrence Livermore National Laboratory, where we hope to gather for a belated celebration of the ITWG's 25th birthday.

<sup>2</sup> Borgardt, J., 'ITWG Libraries Task Group update: Summary results from the Fourth Galaxy Serpent Exercise', *ITWG Nuclear Forensics Update*, no. 19 (June 2021), pp. 5–7.

### NUCLEAR FORENSICS CAPACITY BUILDING IN THAILAND

### HARINATE MUNGPAYABAN AND AREERAK RUEANNGOEN

### Capacity building

Nuclear forensics in Thailand was initiated at the policy level to foster nuclear security and prevent criminal activity on the borders of the Southeast Asia region. Prime Minister Yingluck Shinawatra stated at the Seoul Nuclear Security Summit of March 2012 that Thailand, as a hub of logistics for trading and transportation, and thus vulnerable to malicious cross-border activity, was ready to support the Association of Southeast Asian Nations (ASEAN) community and other countries in the fight against illicit trafficking.<sup>1</sup> Nuclear forensics is a significant

<sup>1</sup> Shinawatra, Y., Statement at the 2012 Nuclear Security Summit, Seoul, 27 Mar. 2012.

element of the prevention and the response to a nuclear security event. Subsequently, the Office of Atoms for Peace (OAP) was tasked with building the capacity of nuclear forensics at the national level. The OAP has received strong support from international networks. The European Union Chemical, Biological, Radiological and Nuclear (CBRN) Risk Mitigation Centres of Excellence (COE) supported the funding of the Network of Excellence for Nuclear Forensics in the South East Asia Region (Project 3O) in 2013–14. The purpose was to strengthen regional public security by upgrading nuclear forensics capabilities, technologies and methodologies for assessing nuclear and other radioactive materials. A scanning electron microscope with Energy Dispersive X-Ray Analyzer (SEM/EDX)



**Figure 1.** Thailand's Office of Atoms for Peace collaborates with ASEANTOM and the IAEA

was provided to the nuclear forensics laboratory at the OAP to enable it to serve as a hub laboratory in the regional network. Under this project, a regional forum for nuclear forensics experts was established to share best practices and provide specific technical training on radiological crime scene management. It is not only Thailand that benefits from this project. ASEAN member states can also make use of the facilities to develop human capital through a number of training courses.

The IAEA has signed a Practical Arrangements agreement on cooperation with the OAP in the area of nuclear forensic science for the period 2019–21. The objective of the agreement is to provide a framework for non-exclusive cooperation on nuclear forensic science. These arrangements also support the discipline of forensic science involving the examination of nuclear and other radioactive materials or evidence contaminated with radionuclides.

International cooperation on nuclear forensics has contributed significantly to building up Thailand's relevant human resources and technical capabilities. The OAP has cooperated with the Centre for Energy Research (EK) in Hungary, the Australia Nuclear Science and Technology Organisation (ANSTO), the Integrated Support Center for Nuclear Nonproliferation and Nuclear Security at the Japan Atomic Energy Agency (ISCN-JAEA), the Horia Hulubei National Institute for Physics and Nuclear Engineering (IFIN-HH) in Romania and the US Department of Energy.

To establish a robust national nuclear forensics capability, the OAP utilized the Nuclear Forensics Self-Assessment Tool (SAT) developed by the Global Initiative to Combat Nuclear Terrorism (GICNT) to identify existing capabilities and gaps. Thailand has created a national roadmap for the development of



Figure 2. The IAEA mission to enhance nuclear forensics capabilities in Thailand

nuclear forensic science in the country, focused on increasing the capabilities and technical expertise of a national nuclear forensics laboratory. The accreditation of Thailand's national nuclear forensics laboratory in accordance with International Organization for Standardization ISO/IEC 17025 standard (General Requirements for the Competence of Testing and Calibration Laboratories) was an early priority.

The OAP also started to develop international collaborations at the regional level within ASEAN and the ASEAN Network of Regulatory Bodies on Atomic Energy (ASEANTOM) in 2016–17. As an example of this activity, in 2017 the OAP hosted a regional workshop on Introduction to Nuclear Forensics and Biological Dosimetry, which was supported by the IAEA and attended by ten ASEAN member states. The OAP also played a role in arranging a tabletop exercise of practical scenarios.

Nuclear forensics was introduced to the nation's competent authorities with the aim of creating standard operating procedures (SOPs). In Thailand, the competent authorities in the field of nuclear forensics are: the Office of Police Forensic Science, the Central Institute of Forensic Science, the Office of the National Security Council, the National Intelligence Service, the Border Patrol Police, the Immigration Bureau, the Ministry of Defence, the Ministry of Foreign Affairs and the OAP.

In 2019, the IAEA organized the Integrated Nuclear Security Support Plan (INSSP) Mission to Enhance Nuclear Forensics Capabilities in Thailand, supported by experts from the European Commission Joint Research Centre (JRC Karlsruhe) and the EK. The competent authorities have carried out a tabletop exercise using SOPs, which led to the identification of areas for further improvement in interagency cooperation. The experts have also suggested improvements to signature analysis by further

## Nuclear Forensics Capacity Building in Thailand continued from page 3



**Figure 3.** Workshop on regional training in nuclear forensics (ASEANTOM 2017)

developing the current methodology and participating in inter-laboratory exercises.

On ISO/IEC 17025, the OAP is developing nuclear forensics laboratory analysis methods applicable to a number of nuclear and other radioactive materials. ISO/IEC 17025 accreditation of the OAP's nuclear forensics laboratory is vital to ensuring confidence in the laboratory's analytical results, especially in situations where such results are produced in the short time frames that are typical for nuclear smuggling investigations.

The OAP's nuclear forensics laboratory has recently been accredited in accordance with ISO/IEC 17025 for the qualification of uranium and thorium in a geological sample using gamma spectrometry. The OAP plans to extend the scope of accreditation to meet regulations in compliance with the Nuclear Energy for Peace Act.



**Figure 4.** OAP is also applying nuclear forensics capabilities to radiation protection and IAEA safeguards

### **Current status**

The driving forces behind nuclear forensics in Thailand have been the Thai government and international assistance. The IAEA has approved a Coordinated Research Project (CRP): Establishment of an assessment methodology for nuclear forensics signatures to deter the unauthorized activities involving nuclear and radioactive materials in Thailand (2019–2021). With regard to the ITWG, Thailand's nuclear forensics laboratory participated in Galaxy Serpent v4 and plans to participate in CMX-7 in order to improve its proficiency. As mentioned above, Thailand's nuclear forensics laboratory was officially accredited according to ISO/IEC 17025 in June 2021.

To sustain the above-mentioned capabilities in the long term, the laboratory will not only use them for nuclear forensics, but also apply them in the areas



Figure 5. Workshop on regional training in nuclear forensics (ASEANTOM 2017)

of radiation protection and IAEA safeguards. For example, the laboratory was recently involved in confirming that a shipment of latex mattresses was not contaminated with radioactive material. In another case, a 'magic card' that claimed to be able to cure all diseases was shown to contain uranium and thorium. Analysis results proved that the manufacturer was violating laws and regulations.

## Upcoming training and meetings

Thailand is developing international cooperation in nuclear forensics through training courses at the national and international levels. The ISCN-JAEA plans to cooperate with the OAP on arranging a regional training course in 2021. Furthermore, the IAEA will hold an international training course in Thailand in 2022. At the national level, the OAP offers nuclear forensics workshops to the competent authorities in Thailand every year.

## Ways forward

To move forward on nuclear forensics, Thailand is considering measures on the long-term prevention and mitigation of terrorism in the ASEAN region focused on three areas:

1. Strengthening networks: Communication among the competent authorities to exchange knowledge and good practice through joint exercises.

2. Analysis of signatures: Enhancing capabilities to support nuclear forensics investigations.

3. Development of a national nuclear forensics library (a database of nuclear and other radioactive materials and pertinent signatures).

# CONTINUING SUPPORT DURING THE COVID-19 PANDEMIC: THE IAEA'S VIRTUAL PROGRAMME FOR CAPACITY BUILDING IN NUCLEAR FORENSICS AND RADIOLOGICAL CRIME SCENE MANAGEMENT

HENRIK HORNE, PETER BURTON AND ÉVA KOVÁCS-SZÉLES

### Introduction

In the June 2020 edition of the ITWG Nuclear Forensics Update, the International Atomic Energy Agency (IAEA) outlined its plans for a temporary transition of some activities to virtual platforms in response to the measures put in place to limit the Covid-19 pandemic. This included the launch of a new webinar series on the IAEA's Nuclear Security Series (NSS) related to nuclear security response. One year later, the Division of Nuclear Security has delivered its fourth webinar on Nuclear Forensics and Radiological Crime Scene Management (RCSM), and the transition to a virtual platform has grown to become a key component of the Division's outreach programme, supporting the work of the IAEA member states to develop, strengthen and maintain their national nuclear security regimes.

# The IAEA's virtual programme on nuclear forensics and RCSM

The first two webinars, which were held in October 2020, focused on the IAEA NSS publications related to Nuclear Forensics and RCSM, outlining the scope and structure of NSS document no. 2-G (Rev. 1), 'Nuclear Forensics in Support of Investigations' and NSS document no. 22-G, 'Radiological Crime Scene Management'. These provided the audience with a basic introduction to nuclear forensics and



**Figure 1.** Evidence labels and protective equipment prepared for use at an IAEA radiological crime scene training course. Credit: Dean Calma/IAEA

RCSM, and attracted more than 320 participants worldwide, including law enforcement professionals, regulators and scientists. The sessions, presented by Dr Éva Kovacs-Széles (Hungarian Centre for Energy Research), Dr Elder Magalhaes (Brazilian Nuclear National Commission) and Dr Ed van Zalen (Netherlands Forensic Institute), covered key aspects and concepts related to nuclear forensics and RCSM. Invited subject matter experts addressed a number of questions from the audience on how nuclear forensics and RCSM capabilities can be designed, implemented and sustained effectively, and provided an overview

## Continuing Support during the Covid-19 Pandemic continued from page 5

of the IAEA's programme of assistance for capacity building in the respective fields.

A third virtual session was held in April 2021. It explored the challenges and opportunities that can arise when developing a national programme on RCSM, from the perspective of IAEA member states. The session, which was attended by over 90 participants, was presented by Capt. Alexandre Villedieu from the Specialized Command for Nuclear Security (COSSEN) in France and Dr Jens-Tarek Eisheh of the Federal Office for Radiation Protection (BFS) in Germany. The two experts outlined how their national RCSM structures had been developed, and discussed perceived threats and current capabilities. They also discussed elements of a 'typical' nuclear security event, and the implications these have for radiological crime scene responses.

The most recent virtual event, held in May 2O21, focused on the investigative aspects of nuclear forensics in responding to a nuclear security event. It was hosted by Dr Frank Wong of Lawrence Livermore National Laboratory. The 170 participants were invited to observe a simulated evolving nuclear security event in which law enforcement responded to a report that radioactive material had been smuggled into a residential area of the fictitious city of Rudas Cove. The scenario highlighted the intertwined nature of nuclear forensics and radiological crime scene management, and allowed the audience to actively engage in the narrated investigation as the scenario developed using an online virtual participation tool. The session was followed by a panel discussion, where John Buchanan (INTERPOL), Elena Dinu (Romanian Prosecutor's Office) and Dr Ruth Kips (Lawrence Livermore National Laboratory) addressed key aspects of the scenario and the requirements for an investigation of a nuclear security event from the perspectives of law enforcement, nuclear forensic science and the prosecuting authorities, as well as the importance and complexity of interagency cooperation when responding to an event involving nuclear or other radioactive material.

### Lessons learned

The adoption of virtual content was beneficial and enhanced the Crime Scene Management and Nuclear Forensics (CFS) outreach programme, allowing continuous engagement with member states and partner organizations despite the restrictions imposed by the pandemic. The use of webinars allowed the Unit to continue to raise awareness and understanding of the scope and application of nuclear forensics and RCSM with a global audience, in addition to providing an opportunity to increase the Unit's available online resources. The recorded events, which highlight various aspects of nuclear forensics and RCSM, now complement the IAEA's published resources in their respective fields, such as the Nuclear Security Series. This allows those with access to the Nuclear Security Information Portal (NuSec) to re-watch relevant content and learn at their own pace, making awareness training on nuclear forensics and RCSM more accessible, flexible and customized. This can

# NOTABLE PUBLICATIONS ABOUT THE WORK OF THE ITWG, NUCLEAR FORENSICS AND RELATED DISCIPLINES

- Borojovich, E. J. C. et al., 'Halides as potential signatures for geolocation of Uranium Phosphate rocks for nuclear forensic applications', *Journal of Radioanalytical and Nuclear Chemistry*, vol. 329, no. 1 (June 2021), pp. 179–190.
- Dakalo, M. et al., 'Rare earth elements in Uranium ore deposits from Namibia: A nuclear forensics tool', *Journal of Environmental Radioactivity*, vol. 237 (Oct. 2021).
- Evitts, L. J. et al., 'Utilizing neutronics modelling to predict changing Pu ratios in UO<sub>2</sub> in the presence of Th', *Progress in Nuclear Energy*, vol. 137 (July 2021).
- Tilden, J. A. and Boyd, D., 'The evolving missions of technical nuclear forensics', *National Interest*, 3 July 2021; also published as Tilden, J. A. and Boyd, D., 'Nuclear forensics and deterrence', *National Interest*, vol. 174 (May/June 2021), pp. 72–82.
- Thompson, N.B.A., et.al., 'Objective colour analysis from digital images as a nuclear forensic tool', *Forensic Science International*, vol. 319 (February 2021), 110678.

be particularly useful for those who are new to the field of nuclear forensics or radiological crime scene management, such as young professionals and students.

The inclusion of an interactive element, particularly in the recent webinar on the investigative aspects of nuclear forensics, promoted a more dynamic interaction between the audience and the panellists. Based on the feedback submitted, this was wellreceived by the participants as it allowed them to share their own experiences of nuclear security response using an online virtual polling tool. The information provided through this tool allowed the panellists to address the specific concerns and questions of the attendees, and to provide more tailored information that could be useful for states looking to establish, strengthen or maintain their nuclear forensics capacities domestically. The positive experiences of using additional tools to interact with participants mean that their use will be considered in the planning of future virtual sessions.

Further feedback received during and after these virtual events has been valuable for assessing whether

the objectives of the webinars were met and the questions from the general audience related to nuclear forensics and RCSM were addressed successfully. The engagement with the topics, together with data from the Integrated Nuclear Security Support Plan (INSSP) team, showed that there is an increasing interest among states in developing capacity in these fields, particularly in countries that have little established experience. This information is useful for the preparation of future virtual events, and for revising other related training materials and courses.

### The future of virtual outreach events

Based on the positive experiences of these four webinars, the CFS is currently working on its next virtual events, which are planned to take place in Q3 and Q4 of 2O21. These events will cover topics that further highlight the intertwined relationship between nuclear forensics and RCSM; the technical aspects of nuclear forensics, including new scientific directions in the field and scientific developments; and RCSM case studies, good practices and procedures from the perspectives of IAEA member states.

# UPCOMING TRAINING COURSES AND MEETINGS\*

- IAEA International Training Course on Practical Introduction to Nuclear Forensics, Budapest, Hungary, 27 September–1 October 2021
- ITWG Webinar: Rad Source Identification, Virtual, 12 October 2021
- JRC National Workshop on Response to Nuclear Security Events (Serbia), Virtual, 12-14 October 2021
- AWE and IOP (Institute of Physics) NuFor 2O21 (Nuclear Forensics Conference), London, England, 13–14 October 2O21
- IAEA Webinar on RCSM and NF (Operational Perspectives Connecting Radiological Crime Scene Management and Nuclear Forensics), Virtual, 20 October 2021
- IAEA Regional Training Course on Introduction to Nuclear Forensics, Mexico City, Mexico, 8–12 November 2021
- ITWG Webinar: (Some) Nuclear Forensic Signatures in the Front-end of the Fuel Cycle, Virtual, 9 November 2021
- 12th International Conference on Methods and Applications of Radioanalytical Chemistry (MARC XII), Kailua-Kona, Hawaii, 3–8 April 2022
- IAEA Technical Meeting on Nuclear Forensics: From National Foundations to Global Impact, Vienna, Austria, 11–14 April 2022

\*Please check directly with the event organizer on the status and dates for implementation of the individual events listed above.

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

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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/



The 'ITWG Nuclear Forensics Update' is produced by the Stockholm International Peace Research Institute (SIPRI) on behalf of the Nuclear Forensics International Technical Working Group and with the financial support provided by the United States Department of Energy, National Nuclear Security Administration. The content and the views expressed here belong to the authors.