ITWG Nuclear Forensics International Technical Working Group

ITWG NUCLEAR FORENSICS UPDATE

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CHAIRPERSONS' ADDRESS

Welcome to the 31st edition of the International Technical Working Group (ITWG) Update. We hope you are reading a fresh copy of this newsletter at the 27th annual meeting of the Nuclear Forensics International Technical Working Group (ITWG-27). We want to sincerely thank the United Kingdom's National Nuclear Laboratory for hosting this year's meeting and are very excited to share with you the latest developments in work of the ITWG. As usual, a substantial amount of time at ITWG-27 will be dedicated to the work of the different task groups and we encourage everyone to participate actively. Moreover, as a highlight, we have accommodated two professional development seminars in ITWG-27. You can find a full preview of the annual meeting in the newsletter.

This edition also provides insights into the work of the Guidelines Task Group. The co-leads of this task group, Jovana Nikolov and Ruth Kips, elucidate how everything started, the aim of these best practice guidelines and the process of developing a guideline. We hope this will inspire you to contribute to their work, if you have not done so already, and maybe to propose a guideline for drafting on the topic of your interest.

Another very interesting article in this newsletter is about Norway's framework on human resource development in nuclear security, including nuclear forensics. As we all know, nuclear security is a field where multi-agency response is required when nuclear or other radioactive material is found out of regulatory control. This increases the complexity of the whole issue, but this article explains how Norway is moving from an ad-hoc approach to a more systematic approach in developing human resources. This good example could also be used by other small- or medium-sized countries in their own capacity-building efforts.

With best regards,

Michael Curry and Maria Wallenius

PREVIEW OF THE 27TH ITWG ANNUAL MEETING

MICHAEL CURRY AND MARIA WALLENIUS

The 27th annual meeting of the Nuclear Forensics International Technical Working Group (ITWG-27) will be held in Manchester, United Kingdom, on 25–27 June 2024, just a month after the fourth International Atomic Energy Agency (IAEA) International Conference on Nuclear Security (ICONS 2024) in Vienna. Although ICONS concentrates mainly on nuclear security at policymaker level, nuclear forensics has always featured prominently in its deliberations. Therefore, the ministerial declaration and other conclusions from ICONS 2024 will certainly feed into the future of nuclear forensics and shape ITWG activities. While ICONS takes place only every four years, the next IAEA Technical Meeting on Nuclear Forensics is planned for spring 2025. For this reason, ITWG-27 will be a useful opportunity to assess recent ITWG work, such as its exercises and guidelines, and craft future activities.

To advance ITWG efforts to identify, develop and socialize best practices in nuclear forensics, it is vital that members participate actively in annual meeting activities. In keeping with the nature of the ITWG as a working group, appropriate time has been allocated at ITWG-27 to the task groups (TGs), to the ITWG Nuclear Forensics Laboratories (INFL) and for professional development seminars.

During the session, the Exercise TG will discuss concrete plans for the eighth Collaborative Materials exercise (CMX-8), which will commence in autumn this year. As well as the laboratory element, which is the core of the CMXs, CMX-8 will include a crime scene in a box (CSIAB) element, similar to CMX-7. In

Continued page 2

Preview of the 27th ITWG Annual Meeting *continued from page 1*

addition, CMX-8 will have a new element: a National Nuclear Forensics Library (NNFL) component.

The Libraries and Assessment TG, which is responsible for the NNFL element at CMX-8, will review in detail the outcomes of the fifth iteration of the Galaxy Serpent exercise (GSv5), which placed more emphasis on data interpretation.

The Guidelines TG continues to develop consensus guidelines on a range of nuclear forensics topics. Its session will review a number of newly drafted guidelines, update older ones and seek volunteers for producing additional guidelines.

The Evidence and Testimony TG plans to review the guideline for evidence collection in a radiological or nuclear contaminated crime scene. Moreover, the TG will continue its work on a mock crime scene discussion tool, as well as elaborating on the Pocket Cards—a series of short descriptions of radioanalytical concepts written as learning materials for non-technical personnel.

The Outreach and Training TG will focus this time on enhancing outreach using a digital presence, and they will proudly present the new restricted ITWG website, which was launched in April with indispensable support from the French Alternative Energies and Atomic Energy Commission (CEA) in France. Moreover, future content of the ITWG Update will be discussed, and the TG will present the new publication series 'ITWG Series on Nuclear Forensics Cases'.

The INFL will select presentations for the technical part of this year's agenda, and it is also organizing two professional development sessions: one on morphology and another one on photographing evidence.

The annual meeting will also feature updates from key international nuclear forensics leaders. The IAEA will update on its nuclear forensics activities and brief the meeting on case studies on its Incident and Trafficking Database (ITDB) programme. Moreover, we expect to hear from other international stakeholders, e.g. the International Criminal Police Organization (INTERPOL) and the United Nations Office on Drugs and Crime (UNODC), about their activities related to nuclear forensics. The ITWG co-chairs will review activities over the past year and upcoming events and announce changes to the leadership team. Finally, in addition to an official dinner, our host from the National Nuclear Laboratory is offering an optional tour of the University of Manchester on 28 June. •

THE ITWG GUIDELINES TASK GROUP

JOVANA NIKOLOV AND RUTH KIPS

One of the main focuses of the Nuclear Forensics International Technical Working Group (ITWG)—founded in 1995—is to provide scientific and technical recommendations, which are adopted voluntarily, to assist the working group and its members to develop and sustain a nuclear forensic capability. The ITWG Guidelines Task Group (TG) was established in this context to provide practitioners with documentation to fulfil the requirements of the nuclear forensics 'model action plan', which is the generalized approach to an examination response to a nuclear security event. Since each nuclear forensic examination is different, these guidelines are not prescriptive. However, they reflect the best practices identified by the collaborative effort of the community of nuclear forensic experts from around the world represented in the ITWG. The guidelines also complement the ITWG collaborative material exercises (CMX)—where a common sample is shared among participating nuclear forensics laboratories. When the results of these initial CMX exercises were shared, they identified the need for consensus guidelines that reflect best practices in the nuclear forensics laboratory. Additionally, the guidelines now encompass evidence collection, non-destructive sample analysis, as well as how to determine and describe confidence in findings. The entire list of currently approved guidelines is available at: http://www.nf-itwg.org/.

Creating new guidelines

Dr Ruth Kips from the Lawrence Livermore National Laboratory (LLNL), United States, and Professor Dr Jovana Nikolov from the University of Novi Sad, Serbia, currently co-chair the ITWG Guidelines TG (see figure 1) and oversee the work of the TG and its strategy. Nikolov is a Full Professor in Nuclear Physics


Figure 1. Current co-chairs of the ITWG Guidelines Task Group Dr Ruth Kips from the Lawrence Livermore National Laboratory, United States, (left) and Professor Dr Jovana Nikolov from the University of Novi Sad, Serbia (right).

at the University of Novi Sad, Faculty of Sciences, with a background in nuclear structure measurements and applied nuclear physics. Kips is the Group Leader for the Microanalytical Signatures Group and the Associate Program Leader for the Office of Nuclear Smuggling Detection and Deterrence at LLNL.

The co-chairs of the Guidelines TG solicit topics for new guidelines from ITWG members, manage the drafting of those guidelines and then coordinate the review process. The guidelines are drafted by members on a voluntary basis and co-chairs encourage multiple authors from different organizations to draft the guideline(s) and carry out the initial technical peer review collaboratively. All registered members of the Guidelines TG can review documents in progress and provide edits or comments (during group meetings on annual ITWG meetings, virtual meetings and dedicated ITWG webinars, or via the ITWG webpage or email). The review process continues until the co-chairs determine that a consensus has been achieved, normally when there are no further substantive edits. At that point, the ITWG Executive Committee approves the final draft guidelines, and the documents are then posted on the ITWG's open (www.nf-itwg.org) and closed websites. They may also be published in a broader forum, upon approval by the Executive Committee. Guidelines are then revised and updated as new procedures, knowledge and/or experience become available. The TG reviews each guideline at least every five years to ensure their adherence with the state of practice. In addition to drafting and reviewing guidelines, the Guidelines TG provides regular input on how forthcoming guidelines should be prioritized.

International practice underscores that written procedures are essential to ensure high-confidence findings in a nuclear forensics examination. ITWG guidelines do not by themselves constitute a nuclear forensics quality assurance programme but can provide the basis for such a control as required. It is important to emphasize that individual guidelines are not standalone but rather work in a complementary fashion to provide the highest confidence in findings as part of a planned examination.

ITWG guidelines can also form the basis of technical training to inform improved nuclear forensics practice. Practitioners should be encouraged to use the guides; the experience of subject matter experts can help to optimize nuclear forensics capabilities. To ensure the ITWG guidelines receive the broadest possible distribution, the TG encourages referencing or publishing them in other outlets at national or regional level.

One of the Guidelines TG's strategic goals is to prioritize developing guidelines for processes or techniques commonly encountered in the examination, analysis and interpretation of nuclear forensics findings. In particular, the aim is to prioritize guidelines that enable existing capabilities for nuclear forensics to be identified and utilized:

1. Design and internal handling of a nuclear forensics laboratory;

Continued page 4

The ITWG Guidelines Task Group *continued from page 3*

2. Sequencing laboratory analyses consistent with 24-hour, 1-week and 2-month reporting (Analytical Plan/Model Action Plan);
3. Physical determination (weight, colour, density, size, texture); and
4. Confidence in findings (i.e. written procedures, trained experts, use of analytical standards).

How it all began

At the first ITWG meeting in 1996—held at the European Commission Joint Research Centre in Karlsruhe, Germany—the terms of reference put forward that one of the aims of the ITWG was to 'identify and prioritize techniques and methods for forensic analyses of nuclear materials in order to answer questions regarding source attribution and the intended use of seized nuclear materials'. In 2004, the ITWG Executive recognized the need for 'creating general guidelines' (as opposed to standards) that would strengthen confidence in findings in ITWG sample analysis exercises, as well as in actual case work. In 2006, following the 11th annual meeting of the ITWG in Speyer, Germany, the ITWG Guidelines TG was created to 'develop consensus guidelines, consistent with the International Atomic Energy Agency/ITWG Model Action Plan, to be utilized by all ITWG nuclear forensics laboratories (INFL). The use of such guidelines will enable intercomparison of results among all of the INFL laboratories, as well as provide additional credibility for our analytical results to legal authorities.'

The TG developed the following definition for INFL consensus guidelines: 'INFL consensus guidelines provide general descriptions and/or recommended approaches for specific activities or procedures in nuclear forensics. Consensus guidelines are consistent with the ITWG Model Action Plan but provide additional detail. Consensus guidelines are less detailed than laboratory procedures but provide sufficient detail to be useful. The term "consensus" means that all members can support the guideline; it does not mean that all members believe that it is the best guideline possible for the specific activity or procedure.'

The process to prepare guidelines has evolved between the early 2000s and today. As an association of ITWG nuclear forensic practitioners, many of whom are nuclear scientists, analytical chemists or radiochemists, the initial direction of guidelines tended to reflect the analytical methods commonly encountered in nuclear forensics examinations, in particular those used in the examination of several high profiles cases of seized highly enriched uranium in the late 1990's. In more recent years in order to address current needs in the nuclear forensics community, guidelines have been drafted with a focus on topics related to the broader context of a nuclear forensics investigation, such as the importance of uncertainty in nuclear forensics measurements, the communication of confidence levels to non-experts, and the collection of evidence in a radiological or nuclear contaminated crime scene. •

NORWAY'S PERSPECTIVE ON DEVELOPING HUMAN RESOURCES TO COMBAT ILLICIT TRAFFICKING

HENRIK HORNE

Norway strives to be an impactful global contributor to combating nuclear terrorism and the illicit trafficking of nuclear and other radioactive materials and works towards that goal internationally and domestically. In 2023, Norway contributed more than $24 million[1] internationally to various nuclear security assistance projects in Central Asia, Georgia, Moldova, Romania, Slovakia and Ukraine. Norway is also an active member of the Group of Seven (G7) Global Partnership Against the Spread of Weapons and Materials of Mass Destruction, and the founding member of the Information Sharing Initiative—a joint effort to support the work of the Global Partnership Nuclear & Radiological Security Working Group (NRSWG) through effective information exchange between donor states. Domestically, Norway develops and maintains a robust nuclear security regime that includes planning, systems and measures aimed at combating nuclear smuggling.

As a nuclear security assistance provider, Norway has invested significant funds into addressing

[1] This is the accumulated value during the entire duration of the projects.

Figure 2. Emergency preparedness exercise at Nord University, Norway

recipient countries' needs for infrastructure to detect radiological materials and the equipment necessary for nuclear security response. Infrastructure and equipment are crucial for detecting and responding to incidents involving nuclear or other radioactive materials out of regulatory control (MORC), but they are only useful if operated by trained, qualified and motivated personnel. Such personnel must be guaranteed to be available to ensure that Norway's investments in infrastructure for combating MORC, both at home and abroad, achieve their goals.

The diversity of organizations involved combined with the variety of interpretations of states responses means the response to MORC is multifaceted. In response to MORC in Norway, each stakeholder organization plays a critical role, yet the overarching challenge lies in developing a cohesive response framework that aligns with their individual capabilities. This complexity is further compounded by the low frequency of these events in Norway, which influences how the entities involved strategically prioritize resources and responsibilities. As a result, tasks related to MORC are often assigned as secondary responsibilities, leading to an ad-hoc approach to developing human resources, as described by the World Institute of Nuclear Security (WINS).[2]

These challenges, however, are largely a result of Norway's national priorities and its purposeful approach to nuclear security response that aligns with its overarching framework for civil protection. Nuclear security, being a national responsibility, must be developed in line with national needs and the state's ambitions. Committed to its international obligations and addressing the threat of nuclear terrorism, Norway has established a system that follows the principles for its emergency preparedness and response management while also considering operational realities. This approach is not unique to Norway, and the added value of the WINS framework for sustaining human resources around MORC lies in its adaptability to each state's needs and requirements.

Norway is currently moving from an ad-hoc approach to maintaining and managing human resources for dealing with MORC to a more systematic approach. In Norway, the framework for civil protection and public safety is comprehensive yet adaptable, designed to address a wide range of threats to lives, health and fundamental societal values and functions. Embracing a systematic method, this framework incorporates a cycle of knowledge development, prevention, emergency preparedness, recovery and evaluation. Each component of this cycle is interlinked and reflects the complexities of modern threats and the necessity for multifaceted responses. Norway's approach to developing a capable and resilient workforce for prevention, detection and response to nuclear security events involving MORC is grounded in the International Atomic Energy Agency's Nuclear Security Series documents, international good practices, and the framework methodology for identifying and developing the required competencies proposed in 2022 by WINS. Moving from an ad-hoc approach, Norway is looking to systematically define the skills, technical expertise and role expectations needed to handle these situations, ensuring professionals can confidently address emerging threats. The framework's emphasis on continuous learning and adaptation ensures that training remains relevant in a rapidly evolving landscape.

[2] World Insitute for Nuclear Security, 'Sustaining human resources in the area of prevention, detection and response to nuclear and other radioactive material out of regulatory control', May 2022.

Continued page 6

Norway's Perspective... *continued from page 5*

Figure 3. Measurements conducted at a facility in Norway using an IdentiFINDER

Central to this approach is aligning training efforts with international standards and promoting coordination and communication both within and between nations (see figures 2, 3 and 5). Transparent communication and coordinated responses are crucial for managing incidents that span borders. By clearly defining specific competencies for each role, the framework eliminates any uncertainty from job titles and helps agencies allocate resources more efficiently. Additionally, Norway's systematic approach to developing human resources in nuclear security

Figure 4. Panel on human resource development at the International Atomic Energy Agency (IAEA) International Conference on Nuclear Security 2024

can be effectively extended to nuclear forensics and radiological crime scene management (RCSM). By leveraging the principles outlined above, countries

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

- Wren, M. S. et al. 'A new method for quantifying Cu-64 in nuclear debris samples', *Talanta*, vol. 275, Aug. 2024, 126140.
- *A Prosecutor's Guide to Radiological and Nuclear Crimes* (United Nations Interregional Crime and Justice Research: Turin, May 2024).
- Guérin, N. et al., 'Validation and improvement of curium radiochronometry to determine the model discharge date of spent nuclear fuels', *Journal of Radioanalytical Nuclear Chemistry*, 6 May 2024.
- Dunn, S. A. et al., 'Morphology and particle size (MaPS) exercise: Testing the applications of image analysis and morphology descriptions for nuclear forensics', *Journal of Radioanalytical Nuclear Chemistry*, vol. 333, 20 Mar. 2024, pp. 2163–81.
- Lorincik, J. et al., 'Participation of Czech laboratories in isotopic, structural, and elemental characterization of uranium nuclear forensic samples within the 7th collaborative material exercise', *Journal of Radioanalytical Nuclear Chemistry*, 19 Jan. 2024.
- Onkangi, J. N. and Angeyo, H. K., 'Exploring machine-learning-enabled libs towards forensic trace attributive analysis of fission products in surrogate high-level nuclear waste', *Journal of Applied Spectroscopy*, vol. 90, no. 6, Jan. 2024, pp. 1325–33.

without dedicated resources can still build strong capabilities in these areas.

By adopting this strategic framework, Norway exemplifies its dedication to maintaining the highest standards in nuclear security (see figure 4). Aligning training programmes with role expectations and international cooperation principles creates a comprehensive workforce development strategy that strengthens national security and supports regional collaboration. This ensures that Norway's nuclear security professionals are prepared to manage the evolving nuclear security landscape, providing a model for other nations to follow. •

Figure 5. Radiation Portal Monitors on the Norwegian-Russian border checkpoint, Storskog

UPCOMING TRAINING COURSES AND MEETINGS*

- IAEA Regional Training Course on Basic Introduction to Nuclear Forensics, Nairobi, Kenya, 10–14 June 2024
- IAEA National Workshop on Radiological Crime Scene Management, Sofia, Bulgaria, 17–21 June 2024
- ITWG 27th Annual Meeting, Manchester, UK, 25–28 June 2024
- IAEA Regional Workshop on Radiological Crime Scene Management, Yaounde, Cameroon, 8–12 July 2024
- UNICRI and the International Association of Prosecutors Webinar on Prosecution of Radiological and Nuclear Crimes, online, 18 July 2024
- IAEA International Integrated Workshop on Radiological Crime Scene Management and Nuclear, Seibersdorf, Austria, 29 July–2 August 2024
- IAEA Peer-to-Peer Workshop on Nuclear Forensics, Yogyakarta, Indonesia, 26–30 August 2024
- IAEA Regional Training Course on Practical Introduction to Nuclear Forensics, Saclay, France, 30 September–4 October 2024
- IAEA Regional Training Course on Practical Introduction to Nuclear Forensics, Hungary, 30 September–4 October 2024
- IAEA International Training Course on Nuclear Forensic Methodologies, Karlsruhe, Germany, 14–25 October 2024
- IAEA Regional Workshop on Radiological Crime Scene Management, Tbilisi, Georgia, 4–8 November 2024
- IAEA Regional Training Course on Basic Introduction to Nuclear Forensics, Egypt, 17–21 November 2024
- IAEA Regional Workshop on Radiological Crime Scene Management, Gabarone, Botswana, 9–13 December 2024

*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.

CONTENTS

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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