



ITWG NUCLEAR FORENSICS UPDATE

No. 23 June 2022

CHAIRPERSONS' ADDRESS

Welcome to the Nuclear Forensics International Technical Working Group (ITWG) newsletter, the ITWG Update. As the ITWG prepares for its first in-person annual meeting since 2019 and to celebrate its 25th anniversary, there is a lot of news to share. First, congratulations to the International Atomic Energy Agency (IAEA) for hosting an outstanding technical meeting on nuclear forensics and radiological crime scene management. Beyond the informative and engaging content (video recordings of sessions are now available on the IAEA's Nuclear Security Information Portal, NUSEC), the meeting provided a useful overview of the range of nuclear forensics work being conducted by member states around the world and a strong sense of direction for future nuclear forensics activities. Second, congratulations to the IAEA on the ninth Triennial Technical Meeting of States' Points of Contact for the Incident and Trafficking Database (ITDB) programme, which provides valuable context for nuclear forensics work. This issue of the newsletter contains articles on the upcoming 2022 Annual Meeting of the ITWG in California (page 1), on the 30th anniversary of nuclear forensics at the European Commission's Joint Research Centre (JRC) in Karlsruhe, Germany (page 2) and on the outcomes of the IAEA Technical Meeting on Nuclear Forensics in Vienna (page 4). Finally, we want to thank the Lawrence Livermore National Laboratory (LLNL) for hosting the ITWG annual meeting later this month and giving us a chance to gather again to engage on the topics we care so much about.

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 25th in-person annual meeting in Pleasanton, California on 21-24 June 2022. 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 and an exchange on operational experience, and to discuss scientific advances. In keeping with the working-group nature of the ITWG, appropriate time has been allocated to the task groups (TGs), to the ITWG Nuclear Forensics Laboratory (INFL) group and to professional development seminars. In consequence, less time has been devoted to lectures and presentations.

The International Atomic Energy Agency (IAEA) will provide an update on its nuclear forensics activities and a briefing with case studies on the

IAEA Incident and Trafficking Database (ITDB) programme. National representatives who lead the Global Initiative to Combat Nuclear Terrorism (GICNT) Nuclear Forensics Working Group will also report on their planned activities. The technical sessions will include briefings on nuclear forensics techniques, as well as professional development seminars on contamination control and on morphology. The ITWG co-chairs will report on the activities of the past year and on upcoming events, and announce changes to the leadership team. Finally, in addition to an official dinner, our US hosts from the Lawrence Livermore National Laboratory (LLNL) are offering an optional half-day tour of the laboratory on 24 June.

The professional development seminars on contamination control and morphology will certainly

Continued page 2

Annual Meeting... *continued from page 1*

be of interest to all ITWG participants. However, the inputs of the National Nuclear Forensics Library TG, the Exercise TG and the Guidelines TG will be particularly useful for further perfecting this ITWG product. All the TGs will update their Strategic Plans, which will outline their anticipated activities and priorities for the coming two or three years.

The Exercise TG will review the outcomes from the ITWG's seventh collaborative material exercise (CMX-7) and prepare for the Data Review Meeting in Prague in October 2022. Laboratories and investigators will share and discuss specific experiences. The National Nuclear Forensics Libraries TG will discuss preparations for the upcoming Galaxy Serpent exercise (GSv5), in which increased emphasis will be put on data interpretation.

The Evidence and 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 forensics results in a way that is tailored to law enforcement, public messaging and decision makers.

The Guidelines TG is developing consensus guidelines on a range of nuclear forensics topics and that will enable the comparison of results among nuclear forensics practitioners. These will provide additional credibility when presenting information to legal authorities. At ITWG-25, the TG will review a number of these guidelines, which are currently in development, and solicit the production of new guidelines.

The Outreach and Training TG will focus on opportunities for enhanced outreach (digital presence, technical meetings and international conferences) and the content of future editions of the ITWG Update. It will also share effective approaches to training in nuclear forensics for inclusion in the continuing work on the training matrix (task versus practitioner). •

JRC KARLSRUHE CELEBRATES 30 YEARS OF NUCLEAR FORENSICS

KLAUS MAYER, MARIA WALLENUS AND ZSOLT VARGA

On 9 March 1992 the German authorities took uranium fuel pellets intercepted from illicit trafficking in Augsburg, Germany, to the Joint Research Centre (JRC) Karlsruhe for detailed analysis. This was the first nuclear forensics investigation performed in the laboratories of the JRC. As of June 2022, samples from more than 60 incidents have been analysed at the JRC.

On 19–20 May 2022, a dedicated event celebrating 30 years of providing such nuclear forensics support brought together experts and policymakers from the European Commission, the EU member states, the IAEA, the United States, the technology region Karlsruhe, partner states and a representative of the European Parliament.

The event began with a high-level meeting with the main stakeholders, which set out the policy context. The Deputy Director General of the JRC described its task as 'providing scientific evidence for policymaking' while the Deputy Director General for Energy stressed the importance of integrating safety, safeguards and security. The IAEA highlighted the strong partnership with the JRC on nuclear forensics. The president of the German Federal Office for Radiation Protection underlined the need for the JRC to provide nuclear forensics support to EU member

states 'now and in the future'. The representative of the Dutch Authority for Nuclear Safety and Radiation Protection emphasized the excellent collaboration with the JRC on the numerous incidents that have occurred in the Netherlands in recent years. Another member state's perspective was offered by Finland's Radiation and Nuclear Safety Authority, recalling the long-standing cooperation with the JRC which has covered conceptual topics as well as joint R&D activities. The US Department of Energy (DOE) National Nuclear Security Administration acknowledged the broad cooperation with the JRC on safeguards and nuclear security, which has resulted in scientific progress and joint capacity building activities with partner states.

The second day had a more technical focus, in which partner institutions such as the US National Laboratories (Rob Steiner for the Los Alamos and the Lawrence Livermore National Laboratories), the French Alternative Energies and Atomic Energy Commission (Fabien Pointurier), the Japan Atomic Energy Agency (Yoshiki Kimura) and the UK Atomic Weapons Establishment (Paul Thompson) shared their current R&D work, including their cooperation with the JRC, as well as their visions for



Figure 1. Klaus Mayer conducts a tour of laboratories at the JRC Karlsruhe for those participating in the event ‘Keeping Europeans safe: 30 years combating illicit trafficking of nuclear materials’.

future activities. Alina Smyslova (US DOE Office of Nuclear Smuggling Detection and Deterrence, NSDD) underlined the importance of international collaboration on nuclear forensics. Olga Belyaeva (Center for Ecological-Noosphere Studies at the Armenian National Academy of Sciences) illustrated the advances in nuclear forensics capabilities in her country through capacity building projects jointly implemented by the JRC and the NSDD. The benefits of cooperation between law enforcement and nuclear scientists to close the gap between nuclear and classical forensics were explained by Alina Nitrean (Moldovan Ministry of Internal Affairs). Jean Galy (the JRC) illustrated the spin-offs from the initial nuclear forensics activities of JRC Karlsruhe in areas such as training, capacity building, outreach,

radiological crime scene management and conceptual considerations, among other things.

A round-table discussion involving Andrei Apostol, Emily Kröger, Frank Wong, Michael Curry, Éva Széles and Kari Peräjärvi, which also involved the audience in interactive elements, re-emphasized the objectives of nuclear forensics analysis and provided guidance on which nuclear forensics parameters and areas the JRC might focus on in future. In addition to defining research priorities, continued efforts are required to attract young researchers to the field of nuclear forensics through internships, fellowships, exchange programmes and summer schools. Overall, the event covered a wide range of policy contexts and scientific topics, offered plenty of networking opportunities and resulted in fruitful discussions. •



Figure 2. Participants at ‘Keeping Europeans safe: 30 years combating illicit trafficking of nuclear materials’.

THE 2022 TECHNICAL MEETING ON NUCLEAR FORENSICS: FROM NATIONAL FOUNDATIONS TO GLOBAL IMPACT

GARY EPPICH

Experts from around the world met in Vienna on 11–14 April 2022 to discuss the most recent developments in nuclear forensics, radiological crime scene management and the intersection of these fields. The 2022 Technical Meeting on Nuclear Forensics: From National Foundations to Global Impact was held three years after the previous IAEA Technical Meeting on Nuclear Forensics. The discussions focused on the application of nuclear forensics to incidents involving nuclear or other radioactive material out of regulatory control.

This hybrid meeting, co-chaired by John Buchanan (INTERPOL) and Ruth Kips (LLNL), brought together over 190 participants representing 64 IAEA member states, the European Commission, and several international organizations, including INTERPOL and the United Nations Interregional Crime and Justice Research Institute (UNICRI).

Goals and objectives of the technical meeting

A key objective of the meeting was to demonstrate the links between nuclear forensics and radiological crime scene management, to enable nuclear and radiological material evidence to be used to support judicial

proceedings. Another important objective was to highlight states' experience of using nuclear forensics for the prevention of and responses to criminal or intentional unauthorized acts involving nuclear or other radioactive material out of regulatory control.

In her opening remarks, Elena Buglova, Director of the IAEA Division of Nuclear Security, noted that 'national authorities have the primary responsibility for ensuring that nuclear and other radioactive materials, associated facilities, and associated activities are properly secured'. She also highlighted the IAEA's role in assisting member states to establish and maintain their nuclear security regimes: 'Nuclear forensics is a very important part of a state's nuclear security regime. It contributes to the investigation of criminal or intentional unauthorized acts through tracing the origin of radioactive material. When radioactive material is out of regulatory control, it is imperative to know where it comes from in order to support the investigation'.

In their opening remarks, the co-chairs welcomed the participants and noted that this meeting would build on the themes of the previous Technical Meeting held in 2019. Keynote remarks were made by Simon



Figure 3. Coordinator of Austrian Special Intervention Unit Cobra demonstrates the use of an evidence recovery robot. Credit: D. Calma/IAEA.



Figure 4. A technical team from the Centre for Energy Research, Hungary, demonstrates how evidence contaminated with radionuclides can be handled and processed at a radiological crime scene. Credit: D. Calma/IAEA.

Minks, the National Senior Public Prosecutor of the Netherlands, who explained how technical data could be used by prosecutors in furtherance of legal proceedings against suspects accused of criminal smuggling and the trafficking of nuclear or other radioactive material. He advised participants, many of whom play a technical role in nuclear forensics in their state: ‘Before you are involved in a case, the prosecutor will be formulating questions for you; if the prosecutor is not asking you the right questions, do not hesitate to say so’.

Further keynote remarks were provided (in order of delivery) by Jay Tilden, Associate Administrator and Deputy Under Secretary for Counterterrorism and Counterproliferation, US National Nuclear Security Administration; Klaus Mayer, Group Leader and Researcher, the JRC; Mikhail Kondratenkov, Head of Division at the Department for Non-Proliferation and Arms Control, Ministry of Foreign Affairs, Russian Federation; and John Buchanan, Coordinator of the Radiological and Nuclear Terrorism Prevention Unit, INTERPOL.

Programme of the technical meeting

Over 60 abstracts were submitted to the meeting. Presentations were made in a lecture-style format, as well as in poster format and as shorter, technical presentations. The scientific programme comprised presentations on:

- nuclear forensics capability development and sustainability;
 - radiological crime scene management;
 - international cooperation and exercises in nuclear forensics and radiological crime scene management;
 - analytical methods for assessing radiological and nuclear material evidence;
 - novel techniques applied to nuclear forensics examinations;
 - research into nuclear forensics signatures, including isotopic signatures and radiochronometry (‘age-dating’); and
 - nuclear forensics laboratory capabilities.
- A number of panel discussions were led by experts in nuclear forensics and radiological crime scene management. These discussions focused on challenging issues facing the nuclear forensics community:
- Covid-19 pandemic-related challenges, following the closure of most of the institutions for extended periods;
 - ensuring that evidence collected at a crime scene can be used in legal proceedings to enforce national laws and regulations prohibiting the possession and use of nuclear and radiological material out of regulatory control;
 - the development of analytical capacity in states new to nuclear forensics;

The 2022 Technical Meeting on Nuclear Forensics... *continued from page 5*

- the use of self-assessment tools, such as the tool developed by the GICNT, to help states to identify their nuclear forensics capacity needs and requirements; and
- the future of nuclear forensics as a science and as a capability for assisting the competent authorities to combat illicit smuggling and the trafficking of nuclear and other radioactive material.

Interactive elements of the technical meeting

Participants also had an opportunity to take part in interactive demonstrations of key radiological crime scene management and nuclear forensics techniques and approaches. A fictitious case study led by Frank Wong (LLNL) involved the identification, seizure and analysis of Cs-137 in the fictional country 'Rudas Cove'. Participants were able to witness the entire sequence of activities from the collection of evidence from a crime scene contaminated with radionuclides to analysis by a nuclear forensics laboratory and the interpretation of nuclear forensics technical data.

Practical demonstrations by the Austrian Federal Ministry of Interior Special Intervention Unit, 'Cobra', and the Hungarian Police and Centre for Energy Research showed participants how nuclear and other radioactive material can be identified and safely secured at a crime scene. Naomi Marks (LLNL) facilitated an interactive exercise simulating how a national nuclear forensics library might be used by a state in this scenario. The fictitious case study concluded with a 'mock trial', presented by Simon Minks. Participants were asked to weigh the evidence against the suspect, consider the strengths and weaknesses of the nuclear forensics technical data as used in a courtroom setting and ultimately decide whether to convict or acquit the suspect. Participants gave high marks to the quality of the technical programme, as well as the many interactive elements of the meeting.

More information about the meeting and abstract submission can be found at: Technical Meeting on Nuclear Forensics: From National Foundations to Global Impact. •

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

- Assulin, M., 'Oxygen isotopic composition of U₃O₈ synthesized from U metal, uranyl nitrate hydrate and UO₃ as a signature for nuclear forensics', *ACS Omega*, vol. 7, no. 9, pp. 7973–80.
- John, S. O. O. and Usman, I. T., 'Isotopic profiling of natural uranium mined from northern Nigeria for nuclear forensic application', *South African Journal of Science*, vol. 118, nos 3/4 (2022).
- Liu, Y. et.al., 'Radioanalytical chemistry for nuclear forensics in China: Progress and future perspective', *Chinese Chemical Letters*, vol. 33, no.7 (July 2022), pp. 3384–94.
- McLain, D.R. et al., 'Age determination of a ⁷⁵Se gamma radiography source for nuclear forensics', *Journal of Radioanalytical and Nuclear Chemistry*, vol. 331 (2022), pp. 2169–74.
- Ravi, K. P. et al., 'Application of radio-analytical technique for determination of "age" of nuclear materials for nuclear forensics', *Journal of Radiation Research and Applied Sciences*, vol. 15, no. 1 (Mar. 2022), pp. 213–18.
- Schwantes, J., Corbey, J. and Marsden, O., 'Exercise Celestial Skónis: Part 1, history, purpose, design and results of traditional forensic examinations of the 6th Collaborative materials exercise of the nuclear forensics International Technical Working Group', *Forensic Chemistry*, vol. 29 (July 2022).
- Schwantes, J., Corbey, J. and Marsden, O., 'Exercise Celestial Skónis: Part 2, emerging technologies and state of practice of nuclear forensic analyses demonstrated during the 6th collaborative materials exercise of the nuclear forensics International Technical Working Group', *Forensic Chemistry*, vol. 29 (July 2022).
- Zhang, Zh. et.al., 'Linear relationship among nonlinear transport-depletion problem: Forensics of enrichment and burnup of PWR', *Annals of Nuclear Energy*, vol. 173 (Aug. 2022).



Figure 5. Radiological crime scene management demonstration given by the Hungarian Police, Hungarian Centre for Energy Research. Credit: D. Calma/IAEA.

UPCOMING TRAINING COURSES AND MEETINGS*

- ITWG Annual Meeting, San Francisco, California, United States, 20–24 June 2022
- IAEA Regional Training Course on Introduction to Nuclear Forensics, Mexico City, Mexico, 11–14 July 2022
- JAEA 7th Asia-Pacific Symposium on Radiochemistry 2022 (APSORC22), Fukushima, Japan, 11–16 September 2022
- IAEA International Training Course on Nuclear Forensics Methodologies, Richland, WA, USA, 12–23 September 2022
- IAEA Regional Training Course on Practical Introduction to Nuclear Forensics, Budapest, Hungary, 3–7 October 2022
- ITWG CMX-7 Data Review Meeting, Prague, Czechia, 10–13 October 2022
- IAEA Regional Training Course on Nuclear Forensics for Association of South East Asian Members (ASEAN), Daejeon, Republic of Korea, 17–21 October 2022
- IAEA International Training Course on Practical Introduction to Nuclear Forensics, Sydney, Australia, 14–18 November 2022
- IAEA International Training Course on Introduction to Nuclear Forensics, Bangkok, Thailand, 21–25 November 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.

CONTENTS

Chairpersons' Address	1
Annual Meeting of the Nuclear Forensics International Technical Working Group	1
JRC Karlsruhe Celebrates 30 Years of Nuclear Forensics	2
The 2022 Technical Meeting on Nuclear Forensics: From National Foundations to Global Impact	4
Notable Publications about the Work of the ITWG, Nuclear Forensics and Related Disciplines	6
Upcoming Training Courses and Meetings	7

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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