

ITWG NUCLEAR FORENSICS UPDATE

No. 5 December 2017

COMMENT FROM THE CO-CHAIRS

Welcome to the fifth edition of the ITWG newsletter. It includes notable activities in the field of nuclear forensics over the past several months including, among other items, an update from the ITWG Evidence Task Group, a description of plans for the GICNT Nuclear Forensics Working Group, a readout from a recent IAEA regional seminar for Russian-speaking colleagues and a calendar of upcoming activities. We hope the newsletter will help you feel more connected with the nuclear forensics community and allow you to more fully participate in it.

With our best wishes for a healthy and productive new year, Klaus Mayer and Michael Curry

RECENT DEVELOPMENTS IN THE ITWG EVIDENCE TASK GROUP

ÉVA KOVÁCS-SZÉLES AND JAMES BLANKENSHIP

Crime scene management is the responsibility of law enforcement. A crime scene with nuclear or other radioactive material present, however, poses particular challenges due to the potential hazards associated with handling them. Specialized techniques are required to collect and analyse radioactive materials and conventional evidence contaminated with them. The requirements and ways of thinking of analytical experts are different from those of law enforcement, which can cause problems and difficulties with communication. Nuclear forensic evidence needs to be presented in a manner that can be understood by the court, which is a new skill set for analysts.

Tasks of the Evidence Task Group

The Evidence Task Group was therefore established as a bridge between analytical experts and law enforcement. The main task of this group is to identify the potential challenges of radiological crime scene management and discuss ways in which these challenges can be overcome. Related aims are to develop concepts for and elaborate guidelines on responding to radiological incident sites, including the collection and preservation of evidence, radiological hazard assessment and the categorization of seized nuclear and other radioactive materials; to raise awareness of applicable national laws and regulations; as well as to help adapting classical forensics techniques and methods to radioactively contaminated evidence to support prosecutions and supply information on source and route attribution. To improve communication, a primer has been developed for prosecutors and judges, as well as educational materials on nuclear forensics and the process of presenting or giving evidence as an expert witness. The Evidence Task Group is currently reviewing and updating published guidelines on evidence collection at a crime scene contaminated with nuclear or other radioactive material.

The Evidence Task Group is also developing documents and guidelines on four topics. The first will discuss the chain of custody and continuity of evidence. This refers to the procedures and documents that account for the integrity of physical evidence by tracking its handling and storage from its point of collection to its final disposition. The rules of evidence need to be formally addressed within the nuclear forensics community of practice in terms of state-level awareness, the competence of organizations and individuals as part of a National Response Plan, and so on.

The second guideline will present evidence collection plans, and describe how to ensure that the evidence, which may be radioactive or radioactively contaminated, is properly packed, stored and transported by crime scene personnel. This means balancing the needs of the investigator with the requirements of the receiving laboratory in a way that minimizes risk and ensures timely and probative results.

UPCOMING TRAININGS AND MEETINGS

- · Joint US-Nordic Workshop on Nuclear Security and Forensics, Oslo, 17-19 January 2018
- GICNT Nuclear Forensics Working Group Exercise, Bangkok, 6–8 March 2018
- IAEA Consultancy Meeting, Steering Group for 2019 IAEA Technical Meeting on Nuclear Forensics, Vienna, 20–22 March 2018 (by official nomination only)
- Methods and Applications for Radioanalytical Chemistry (MARC) Conference, Kona, HI, USA, 8–13 April 2018, <www.marcconference.org>
- GICNT Radiological Security Workshop, Budapest, 10–12 April 2018
- IAEA International Training Course on Nuclear Forensics Methodologies, Richland, WA, USA, 23 April–4 May 2018
- GICNT Implementation and Assessment Group Meeting, Helsinki, June 2018
- ITWG Annual Meeting (ITWG-23), Bern, 5-7 June, 2018
- IAEA General Conference, Vienna, 17–21 September 2018

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.

Recent Developments in the ITWG Evidence Task Group continued

The third guideline will cover the conduct of traditional forensic examinations on evidence containing nuclear or other radioactive material, taking account of the effects of radiation on the evidence, the effects of radioactive/nuclear materials contamination control on the examination process and proper analysis of radioactively contaminated evidence. Experts on radioactive and nuclear material need to support the operational requirements of the police forensics unit, and existing methods and technologies have to be adapted to a radioactive environment.

The fourth guideline will describe the development of an examination plan. How does the receiving laboratory work with the investigator to ensure that probative examinations are performed in a way that as far as possible preserves the integrity of the evidence? A checklist is being developed on master control of what happens to the evidence, priorities and conflicts in multi-step examination processes, and setting expectations and denoting limitations.

In addition, in 2016 the fifth ITWG collaborative material exercise (CMX-5) in collaboration with the Exercise Task Group involved a role for the chain of custody to enable learning on the practice of evidence continuity during a nuclear forensics investigation. Within the framework of the ITWG annual meetings, the Evidence Task Group organizes live demonstrations of radiological crime scene investigations and evidence collection, as well as mini-table-top exercises using different scenarios to strengthen communications and common ways of thinking between law enforcement and analytical experts, and to highlight weak points and indicate new aspects of and directions for radiological crime scene management.

Future topics under consideration by the Evidence Task Group

It is proposed that future topics to be covered by the Evidence Task Group will be developing guidelines on: (*a*) general nuclear forensic standards for a report for law enforcement officials on the questions of quality assurance, reference materials and method validation; (*b*) selecting a Nuclear Forensics Service Provider; and (*c*) case working documents, that is, which documents, such as the chain of custody, analytical plans, reports, deviations, technical reviews and communications, a nuclear forensics practitioner should be prepared to present at trial.

GICNT NUCLEAR FORENSICS PLANS AND PRIORITIES MOVING FORWARD

ALI EL-JABY

Japan hosted the Global Initiative to Combat Nuclear Terrorism (GICNT) Implementation and Assessment Group (IAG) and plenary meetings in Tokyo on 1–2 June 2017. Over 200 participants from 74 partner nations and four official observers attended the meetings, which highlighted the GICNT's accomplishments over the past two years and launched a new programme of work for 2017–19. In addition, the GICNT formally welcomed Nigeria and Paraguay as new partners during the plenary.

The plenary also endorsed a new leadership team. Finland will serve as the IAG Coordinator for the 2017–19 term and Morocco will serve as the IAG Coordinator for the 2019–21 term. Argentina will serve as Chair of the Response and Mitigation Working Group (RMWG) and the United Kingdom will serve as Chair of the Nuclear Detection Working Group (NDWG). Canada was appointed Chair of the Nuclear Forensics Working Group (NFWG) shortly after the conclusion of the meetings.

At the plenary the partner nations described the impact of GICNT on building their national capabilities. They outlined the measures taken to strengthen nuclear security and discussed the way forward for the next two years. Several countries shared how past regional GICNT events had provided a model for taking on leadership roles in their regions. Partners also noted the utility of exercises in supporting sustainability efforts. Partner nations endorsed the work plans for 2017-19 presented by the outgoing working group chairs and called for further engagement with law enforcement in future activities. In addition, partners expressed an interest in incorporating the cross-disciplinary focus areas of sustainability, radioactive source security and legal frameworks into the work plans.

NFWG work plan

The Partners agreed that, moving forward, the NFWG would continue the fundamental themes identified in past work plans and the nuclear forensics chapter of the GICNT Exercise Playbook. The NFWG will continue to raise awareness among policymakers of nuclear forensics as a key component of nuclear security, and will work to develop practical tools for building sustainable national nuclear forensics capabilities. The NWFG will press ahead with the development of a self-assessment tool to help GICNT partners evaluate their nuclear forensics capabilities, and will contribute nuclear forensics-oriented exercises to the GICNT Exercise Playbook.

Future priorities for the NFWG

In future the NFWG will make a concerted effort to incorporate sustainability as a cross-cutting element of all activities, address the legal requirements that drive nuclear forensics activities in support of an investigation, and promote exercises that enable interactions between the nuclear forensics practitioner, law enforcement, legal (prosecutorial) and policymaker communities of practice, while continuing to consider the roles of national and international coordination mechanisms in supporting capacity building.

The NFWG plans to support a series of regional exercises using the best practices guidance document 'Nuclear Forensics Fundamentals for Policy Makers and Decision Makers'. International cooperation and the exchange of nuclear forensics information in support of an investigation into a nuclear security event will continue to be a theme of interest to the NFWG. Future events might also consider nuclear forensic capabilities that meet the relevant jurisdictional requirements for court proceedings.

MOSCOW REGIONAL SEMINAR ON NUCLEAR FORENSICS, SEPTEMBER 2017

TIMOFEY TSVETKOV AND VLADIMIR STEBELKOV

The International Atomic Energy Agency (IAEA) in partnership with the Russian Federation hosted the IAEA Regional Seminar on Introduction to Nuclear Forensics, held at the Laboratory for Microparticle Analysis (LMA) and the National Research Centre Kurchatov Institute (NRCKI), in Moscow on 4-8 September 2017. The regional seminar is part of an ongoing and sustained collaboration between the Russian Federation and the IAEA in the area of nuclear security. More than 30 Russian-speaking nuclear forensic specialists from the Commonwealth of Independent States (CIS) and Eastern European countries contributed to the seminar. National experts from Armenia, Belarus, Bulgaria, Kazakhstan, the Republic of Moldova, Romania, the Russian Federation, Slovakia, Tajikistan and Uzbekistan participated.

Purpose

The seminar was conceived and organized to provide a comprehensive exchange of knowledge and experience in nuclear forensics, as well as information on case studies involving nuclear forensic examinations for the purposes of investigations of smuggling of nuclear and other radioactive materials.

History

The need to conduct a regional seminar on nuclear forensics with a focus on engaging Russian-speaking experts has long been recognized as part of the engagement with experts at the annual meetings of the Nuclear Forensics International Technical Working Group (ITWG) and the Nuclear Forensics Working Group of the GICNT. As an internationally acknowledged leader in nuclear forensics, the Russian Federation proposed to the IAEA that it should conduct the seminar, and appointed the LMA in Moscow to run the event. This was the first time in which the IAEA has offered its member states an interactive seminar in the field of nuclear forensics. This seminar, which was the first of its kind, was an important event on the IAEA's nuclear forensics calendar for 2017.

Programme and topics discussed

The seminar agenda targeted a range of topics of interest to nuclear scientists, law enforcement officials,

regulators and forensics experts. The seminar began by discussing fundamentals such as the concept and objectives of nuclear forensics and its place in the forensic sciences, as well as the unique tasks with which nuclear forensics deals. The participants also compared traditional forensic and nuclear forensic terminology.

Participants then considered a range of national approaches to building and enhancing national capabilities for the identification of seized material. The role and place of these capabilities were also noted in the context of National Response Plans, with regard to specific examples of nuclear forensic examinations involving material out of regulatory control (MORC) conducted by the national investigative authorities and expert organizations of the participating countries. The complementary roles of nuclear and traditional forensic sciences and the work of each type of expert in the investigation of a nuclear security event were also highlighted.

During the seminar, participants visited the Dmitrov Testing Facility (NAMI) for a demonstration of an automated control and detection system for the transport of nuclear and other radioactive materials. The entire day was devoted to the close connection between detection of MORC and nuclear forensics. It was noted that a nuclear forensics examination often begins at the location of a nuclear security event. This segment included video feed of field operations at nuclear security events demonstrating two scenarios. The first scenario involved the successful interception of a terrorist group implicated in the illegal transportation of radioactive material. The second involved the detonation of a radiation dispersal device leading to radioactive contamination in the vicinity of the explosion. Participants noted that in the latter case the involvement of and joint working with criminal investigators in partnership with detection specialists at the crime scene were necessary and that these must be well-orchestrated.

Specialists from various states' law enforcement organizations emphasized that the success of an investigation and of the prosecution of nuclear security-related crimes were reliant on meeting the legal requirements of a criminal prosecution, such as secure sample collection in the field and the procedures for the preservation and transportation of evidence—including the required documentation.



Figure 1. Participants of the IAEA Regional Seminar on Introduction to Nuclear Forensics, September 2017

The seminar also focused on work in analytical laboratories. Participants presented the methods and techniques employed in national laboratories for the forensic analysis of nuclear and other radioactive materials. Scientists from LMA demonstrated the implementation of state-of-the-art analytical measurements, most notably scanning electron microscopy (SEM), secondary-ion mass spectrometry (SIMS) and inductively-coupled plasma mass spectrometry (ICP-MS). Sample preparation techniques for these measurements were also demonstrated.

Of particular interest was a presentation on the medical and biological matters that fall within the scope of particular nuclear forensic examinations. This topic is relatively new to the nuclear forensics community but was identified by the seminar participants as a key element in supporting investigations into some nuclear security events.

A session at the main site of the NRCKI featured a visit to the Kurchatov Museum and to the first



Figure 2. Seminar participants review history of the Russian nuclear industry at the Kurchatov Institute

research reactor—F-1, which went critical on 25 December 1946—accompanied by an overview of the long history of the Russian nuclear industry.

Outcomes and findings

As an inaugural event, the IAEA regional seminar provided a valuable forum for the exchange of technical experience and approaches to examination among Russian speaking experts. The seminar received highly positive reviews from all the participating experts who expressed their appreciation to the organizers and enthusiasm for such a regional seminar to be held on a regular basis. Based on their experience at the seminar, the participants also viewed the LMA as well qualified to host future fellowship and training programmes for Russian speaking nuclear forensic experts. With this endorsement, the IAEA has commenced planning for a potential future regional nuclear forensics seminar in the Russian language. •

JOINT GERMAN-SWISS CUSTOMS AND RADIATION PROTECTION EMERGENCY EXERCISE: RESULTS AND LESSONS LEARNED

J.-T. EISHEH AND E.A. KROEGER

A cross-border emergency exercise was carried out in June 2016 in order to test and improve the response to nuclear security events in Germany and Switzerland. The participants from the Swiss authorities were: (a) the Federal Customs Administration (EZV); (b) Spiez Laboratory; (c) the National Emergency Operations Centre; and (d) the Federal Department of Defence, Civil Protection and Sport. The participants from the German authorities were: (*a*) Federal Customs Administration; (*b*) the Federal Office for Radiation Protection (BfS); (*c*) the Federal and state ministries (BMUB and UM Baden-Württemberg); and (*d*) the competent authority in Baden-Württemberg (RP Freiburg).

Joint German-Swiss Customs and Radiation Protection Emergency Exercise continued

Concept

The event was an emergency exercise that took place in the course of a single day, so no prior warning was given to the active participants. The exercise was designed to test the reactions of the Swiss and German customs to an actual unexplained neutron signal from a specially prepared vehicle. The exercise was also planned to test deployment times and the capabilities of the scientific measurement team of the BfS. During the course of the exercise, there was no actual export of radioactive material out of the European Union and no contamination. Only sealed sources were used. A fictional insert was used to rule out explosives, so there was no further police involvement. An important part of the planning was that the exercise should be carried out in full public view. For this reason, a public relations strategy was required.

Timeline

The exercise took place on the German side of the Swiss-German border at the Zollamt Weil am Rhein Autobahn. The Swiss customs set up extra radiation controls in the early morning of 1 June 2016 and checked elevated measurements against the paperwork on transported radioactive materials for 320 vehicles. The measurement results and the paperwork for the vehicle specially prepared by BfS did not match, due to an unexplained neutron measurement. The vehicle was not allowed into Switzerland and was sent back to German customs. The competent authorities in the German state of Baden-Württemberg knew about the exercise and deliberately did not send their own Mobile Expert Support Team (MEST), but instead asked BfS for support from its MEST. The source was identified by the BfS MEST and dose rate measurements and gamma spectroscopy were carried out at the scene.

Results

The Swiss customs reacted to the unexplained neutron alarm in the correct way. The German customs also reacted in the correct way and called for support from a MEST. The BfS MEST was on the scene within three hours of being notified and started measurements. The team identified the source, took detailed measurements, and documented and communicated its results as far as possible. The BfS back office evaluated the spectra and dose rate measurements and identified an undocumented Am/Be source.

Public relations

The exercise was not publicized beforehand as it was meant to be an emergency exercise for the customs and BfS staff involved. However, the exercise took place in full view of the border crossing and the motorway. In case of questions, press statements were prepared by BfS in advance of the exercise, but they were not released.

Lessons learned

- Advance planning with all players is essential; in this case it took two years.
- The scope and focus of the exercise should be agreed on in advance, along with fictional inserts which allow time-consuming steps to be skipped (in this case, the level of personal protective equipment was artificially set by the exercise organizers).
- Paperwork is a consideration; the specially prepared vehicle had two sets of paperwork, the correct set and a fictional incomplete set.
- Communication and documentation are essential, and in this case some improvements will be made to support the MEST at the scene.
- Evaluation is important to improve future exercises.
- Personal connections between staff in different authorities are extremely advantageous.
- Next time further police authorities should be included.

Conclusions

Cross-border emergency exercises promote cooperation between the competent authorities within a state (customs and radiation protection). They also promote international cooperation between radiation protection authorities. The exercise was an excellent opportunity to test reaction times and deployment capabilities, and to compare equipment. The exercise also tested the response of back office staff at BfS. The personal contacts and connections formed while planning and carrying out this exercise will be extremely useful in future responses to nuclear security events. In general it can be stated that a cross-border emergency exercise promotes prevention, detection and appropriate response to nuclear security events, and in particular promotes deterrence as part of prevention.

ITWG SCIENTISTS PRESENT AT THE 9TH INTERNATIONAL CONFERENCE ON ISOTOPES AND EXPO IN DOHA

VITALY FEDCHENKO AND DAVID SMITH

The 9th International Conference on Isotopes and Expo (9ICI) was convened in Doha, Qatar, on 12–16 November 2017. This international technical conference, which was first held in 1995 and is convened every two to three years, is organized to exchange interdisciplinary information on the applications of stable and radioactive isotope science for end-users, producers, researchers and policymakers. The meeting rotates to different international venues and was last convened in Chicago, USA, in 2014. This was the first time the conference had been hosted in the Gulf region. In 2017, the 9ICI was considerably smaller than past gatherings, and some 150 experts from more than 30 states participated.

The technical sessions at the conference covered isotope production, isotope research and applications, medical isotopes, isotopes in the environment, isotope security studies, isotope science and policy, as well as isotope production and transportation infrastructure. The meeting was held in conjunction with the Qatar Physical Society and the World Council on Isotopes. Among the conference partners were the Institute of Nuclear Materials Management (INMM), the American Nuclear Society (ANS) and the International Atomic Energy Agency (IAEA).

New audiences for the ITWG

This year the conference organizers approached the IAEA Division of Nuclear Security in advance of the meeting to solicit papers on nuclear forensics applied to nuclear security. In this regard, there was specific interest in representation from the Nuclear Forensics International Technical Working Group (ITWG). Organizational circumstances precluded arrangements for a dedicated session on nuclear forensics. However, under the auspices of the ITWG Training and Outreach Task Group, two papers on isotope science with application to nuclear security and nuclear forensics were presented by ITWG scientists at 9ICI. The first, by Vitaly Fedchenko of SIPRI, was entitled 'Isotope Science's Contribution to Nuclear Security, Nuclear Non-Proliferation and Arms Control'. The second, by David Smith of the IAEA Nuclear Security Division, was entitled 'The Science of Signatures: Isotopes Applied to Nuclear Forensics'. These papers represent a new direction for the conference: to begin to emphasize isotope science applied to international security studies.

The first paper discussed three case studies involving isotope analysis of radioactive material. It provided information on methods of verification of nuclear reactor operations in the context of nuclear non-proliferation, historical studies of atmospheric nuclear test fallout, and radiochemical analysis that provided insight into the existence of hitherto unknown nuclear production facilities. The second paper emphasized the role of isotopes as persistent and robust signatures in nuclear forensics, with a bearing on the origin and history of nuclear materials, using the example of the application of a nuclear forensic examination as part of a nuclear security investigation. Both presentations highlighted the role of the ITWG as an association of nuclear forensic practitioners supporting law enforcement and nuclear security investigations.

Input from the ITWG

The 9ICI provided an opportunity to introduce nuclear forensic science and the ITWG to a new regional and wider technical audience. The conference programme was structured around the interfaces between the uses of isotopes in industry, the environment, medicine, research, safety, safeguards and security. The talks highlighted the potential for mutually beneficial cooperation between these areas.

Nuclear forensic science clearly aroused strong interest among all the participants. The meeting provided an opportunity to present nuclear forensics and the work of the ITWG to experts from Qatar and the Gulf region, as well as to other experts not formerly aware of the issues. Based on the interest in Qatar, the conference organizers requested that the ITWG consider expanding its participation at the next conference, to be held in Kuala Lumpur, Malaysia, on 3–7 February 2020.

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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.