

## **Nuclear Forensics Activities supported by the EU CBRN Action Plan and the EU CBRN Risk Mitigation Centres of Excellence (CoE) Initiative**

**S. Abousahl, Z. Pajalova**

European Commission  
Joint Research Centre  
Brussels, Belgium

**Abstract.** Even though, the responsibility for nuclear security is with the EU MS, as this is a matter of national security, European institutions have been involved in activities related to nuclear security for decades. In accordance with provisions of Chapter 7 of the EURATOM Treaty (1957), the European Commission has the responsibility to verify that nuclear materials are not diverted from their intended uses as declared by the users. Based on the work on nuclear safeguards, the European Commission in particular through its Joint Research Centre has acquired expertise in nuclear material analysis, which is also applied in Nuclear Forensics to provide evidence on history or even the origin of nuclear material. In the field of nuclear and radiological security, the EC/JRC activities are well defined and aim at contribution to efficient and effective safeguarding; enhanced proliferation resistance of nuclear fuel systems; and support the EU and its Member States policies in enhancing internal and external security by combating illicit trafficking of nuclear and radioactive materials, in the areas of prevention, detection and response including Nuclear Forensics. Naturally, the EC has attributed to the JRC the implementation of several projects and actions inside and outside Europe.

In 2009, the EU Council adopted the EU CBRN Action Plan with the aim to strengthen CBRN security throughout the EU. Based on an all-hazard approach, the Action Plan's overall goal is to reduce the threat of, and damage from CBRN incidents of accidental, natural and intentional origin, including terrorist acts. The European Commission Directorate General HOME AFFAIRS is in charge of the follow up of this action plan.

A total of 124 actions are to be implemented by the EU Member States and the EU Institutions. In addition to 25 actions relating to radiological and nuclear security, there are 32 actions covering biological or chemical security. A further 67 actions are horizontal actions in the sense that they apply to all the areas. The implementation of the AP is guided by consultation with national authorities and other relevant stakeholders. The IAEA, Interpol, and Europol are closely associated to the implementation of the AP.

Several actions, directly or indirectly, address also issue of Nuclear Forensics as for example Horizontal Action H.45, which states the following: "The Member States together with the Commission should enhance and support cooperation between Forensic laboratories, reference and specialised laboratories, including those equipped for measurement/analysis of CBRN materials. "

In the area of Nuclear Forensics, JRC implemented/implements 2 projects.

Under the project "Development of a mechanism for enhanced operational support to Member States in the area of nuclear forensics (RN. 25 and H. 21)" (2013-2014) and based on a questionnaire on

## **S. Abousahl and Z. Pajalova**

current Nuclear Forensics capabilities of the EU MS, syllabus for a training course on core capabilities in Nuclear Forensics is being prepared and appropriate Member States are invited to a training course. This aims at establishing core capabilities in Nuclear Forensics in all EU Member States, recognizing that few Member States do have capabilities which go beyond that.

As investigations on illicit trafficking of nuclear materials may require analytical information that cannot be acquired by core capabilities, legal basis for operational Nuclear Forensic support (i.e. analysing the samples at the JRC laboratories) needs to be in place. Therefore, it is intended to offer concluding a collaboration agreement (or equivalent) with interested Member States. This whole procedure, including transport of "unknown" nuclear material and its analysis will be exercised in so-called joint analysis exercise.

Because of increasing concerns of illicit trafficking of nuclear and other radioactive materials, the Joint Research Centre was tasked to set up a dedicated 'Security Training Centre for the Law Enforcement Community (EUSECTRA) (Action RN. 20 and Action RN 24)' with the aim of developing a security training programme applicable to the law enforcement staff, and in particular front line officers.

The Centre serves as platform for knowledge transfer and for networking of experts and offers hands-on training on detection of radioactive/nuclear materials and response to incidents with radioactive/nuclear materials including Nuclear Forensic analysis.

Reference and standardised training materials have been and are presently being developed in close collaboration with international experts (e.g., from IAEA, US-DoE, FBI, Netherlands Forensic Institute) and under the Border Monitoring Working Group.

Moreover, the EU through its FP7 Security Research finances CBRN projects in the area of Prevention, Preparedness, Protection; Detection; Response, Crisis Management and Recovery to be implemented by the research institutes in the EU MS.

As for example, project "GIFT – CBRN (Forensics)" submitted at the end of 2012 and currently under implementation by 21 organisations from Netherlands, UK, Sweden, Finland, Ireland, France, Spain, Belgium, Turkey and also by the JRC, aims at development of common guidelines, practices and procedures for CBRN Forensic investigations at a European level as part of a CBRN Forensic Toolbox and testing and validation of the CBRN Forensic Toolbox in the field with end users. The work of JRC within this project focuses on development of methods for collection of fingerprints and DNA samples from contaminated evidence.

The EU CBRN Risk Mitigation Centres of Excellence Initiative, launched in 2010 under the Instrument for Stability aims at strengthening national CBRN policies and capacities in currently 43 CoE partner countries and to promote national, regional and international cooperation in the CBRN risk mitigation area through implementation of a methodology and tailored projects. Technical scope of projects varies from awareness raising, strengthening legislative framework and regulatory infrastructure, sharing best practice, development of response plans, provision of training, and detection equipment to Nuclear Forensics.

The JRC provides technical and expert support for the implementation of the initiative.

In order to facilitate the assessment of current national CBRN risk mitigation capacities, a specific questionnaire called "Needs Assessment Questionnaire (NAQ)" was designed for a self-assessment of partner countries coupled with support from the JRC. The questionnaire covers all main CBRN risk mitigation areas including Nuclear Forensic capabilities.

Moreover, two projects in the area of Nuclear Forensics were/are implemented by JRC in the Framework of the initiative.

## **S. Abousahl and Z. Pajalova**

The main objective of the "Pilot regional project in South East Asia for capacity building in countering illicit nuclear trafficking" (2010-2012) was to contribute to a capacity building in selected countries in the South East Asia region. The project comprised activities such as: assessment of national capabilities for responding to nuclear security incidents and awareness rising on related needs with particular attention to Nuclear Forensic capabilities; promoting development and implementation of a national response plan for nuclear security incidents including establishment of a framework for mutual support in Nuclear Forensics; and basic training in Nuclear Forensics.

Based on the results of the pilot project, project no. 30 under the CoE initiative entitled "Network of Excellence for Nuclear Forensics in South East Asia Region" (2013-2014) aims to reinforce regional public security by upgrading Nuclear Forensics capabilities, technologies and methodologies to assess radioactive and nuclear materials.

Project no. 30 foresees activities as: to establish a regional forum for Nuclear Forensics experts to share best practices; to provide equipment for the laboratory of the Office of Atoms for Peace in Thailand, which will serve as a hub laboratory within the regional network as well as to provide a specific technical and training on radiological crime scene management. Moreover, support for development of National Nuclear Forensics Libraries will be provided.

In both projects, due consideration was/is being given to related activities funded or implemented by other donors. The implementation of the pilot project was coordinated with the National Nuclear Security Agency (NNSA) who is also engaged in activities in the same technical area and the IAEA in order to ensure coherence of the respective training activities. Activities under the project no. 30 are being implemented in close coordination with the US DOE's NNSA and the US Department of State.

In addition to these two projects, several projects are currently under implementation, in the framework of the CoE initiative, targeting the development of appropriate response capabilities, thus indirectly addressing also Nuclear Forensics capabilities in the CoE partner countries.

## From Awareness Raising to Capacity Building in Nuclear Forensics in South East Asia

**K. Mayer<sup>a</sup>, J. Galy<sup>a</sup>, P. Alfonso<sup>b</sup>, A. Winterfield<sup>b</sup>, D. Smith<sup>b</sup>, H. Dion<sup>b</sup>, E. Fei<sup>b</sup>, W. Mei<sup>b</sup>**

<sup>a</sup>European Commission  
Joint Research Centre, Institute for Transuranium Elements  
P.O Box 2340, 76125  
Karlsruhe, Germany

<sup>b</sup>US Department of Energy  
National Nuclear Security Administration  
Washington DC  
United States of America

**Abstract.** Illicit trafficking of nuclear and other radioactive materials is an international concern. Whenever illicit nuclear or other radioactive material is detected, an appropriate response process needs to be initiated. An important element of the response process is the nuclear forensic investigation of the intercepted material. Obviously, we need to define what composes an "appropriate" response, what authorities are in charge and what technical capabilities are required.

Sustainable success in the fight against illicit nuclear trafficking can only be achieved if the origin of the material can be identified and, in consequence, if the protection of the material at the place of theft or diversion will be improved. Information on the nature and on the history of nuclear material can be obtained through nuclear forensic analysis. Whenever nuclear material is intercepted from illicit trafficking, the investigating authorities request rapid and reliable information on the seized material. To this end, a number of measures have to be implemented in order to ensure that the appropriate legal and administrative instruments are in place, that the technical infrastructure supporting the investigations is available and that the scientific skills and instrumentation are provided.

In a joint undertaking, the European Commission's Joint Research Centre, Institute for Transuranium Elements (ITU) and the US National Nuclear Security Administration (NNSA) implemented a project in South East Asia for raising awareness on the phenomenon of illicit nuclear trafficking, for sharing experience in responding to nuclear security incidents and for paving the way for establishing nuclear forensics capabilities in that region.

The paper describes the strategy developed for implementing the project in partnership between JRC and NNSA. Workshops and seminars were held in cooperation with and hosted by partners from the region; the IAEA was associated to these events and the ASEAN Regional Forum provided the regional platform.

### 1. Introduction

Illicit trafficking of nuclear and other radioactive material continues to be a reason for international concern. Measures for countering illicit nuclear trafficking need to be implemented in order to address the threats of nuclear proliferation and of nuclear terrorism. Risks do not only arise in States using nuclear energy or holding substantial amounts of nuclear material. Also regions that serve as transshipment platforms for large quantities of goods may be affected by illicit nuclear trafficking and

should implement appropriate measures for detection of and response to such incidents. South East Asia is such a region where large amounts of goods are passing ports of transshipment while there are only few nuclear activities. The objective of the project presented here was to raise awareness for nuclear security challenges in general and for nuclear forensics in particular. Ultimately, these measures contribute to strengthening the non-proliferation regime and to counteraction against the threat of nuclear and radiological terrorism. Several initiatives are already addressing the detection issue (e.g. the Megaports initiative by the US Department of Energy's Second Line of Defence program). This needs to be complemented by setting up the corresponding response capabilities. Trained experts and validated plans and procedures are an important element in responding to nuclear security incidents. Funding for this project was provided by the US DOE and by the European Union through its "CBRN Centres of Excellence Initiative" by entrusting the Institute for Transuranium Elements of the Joint Research Centre with a "pilot regional project on nuclear forensics" and followed by a project on "Network of Excellence for Nuclear Forensics in South East Asia Region". In consequence, several years of cooperative multilateral activities characterize the efforts to develop and enhance the nuclear forensic capabilities in the region.

## **2. Raising Nuclear Forensics Awareness**

The need for establishing nuclear forensics capabilities is obvious to States that have experienced nuclear security events such as illicit trafficking. States that have not been confronted with such incidents should consider developing nuclear forensics capabilities as part of their preparedness for countering illicit trafficking. The United States Department of Energy and the European Commission offer cooperative programs for raising awareness and for supporting the establishment of response capabilities. In the present project, US DOE and the Joint Research Centre, Institute for Transuranium Elements (ITU) closely cooperated for initiating the establishment of nuclear forensics capabilities in South East Asia.

### ***2.1. Assessment of Current Response Capabilities***

In a first step, information on the national capabilities for handling seizures of nuclear or other radioactive material was compiled through bilateral discussion with representatives (technical experts) of ASEAN states. In summary: None of the ASEAN countries has nuclear forensic capabilities in place, i.e. no possibility for a basic or a comprehensive characterization of intercepted material. Limited capabilities for categorization of detected (and intercepted) material, however, exist at the locations where appropriate (portable) detection equipment was provided through the SLD program. Also the response plans in place are typically conceived for nuclear safety incidents and address emergency procedures and risk mitigation.

### ***2.2. Awareness Building and National Response Plan***

Based on the picture established through the analysis of current response capabilities, the content of the awareness building measures was tailored. It was agreed with DOE NNSA to hold a nuclear forensics awareness workshop in combination with a seminar on the development of a national response plan. DSO Singapore offered to act as host organization. The workshop focused on conceptual aspects related to nuclear security events, in particular to the response. Lecturers and instructors came from JRC-ITU, from the US Department of State, from the NNSA, from the FBI and from the IAEA. The target audience of the workshop were decisions makers in national authorities in charge of response to illicit nuclear trafficking. In addition, also senior experts from radiation protection measurement laboratories had been invited. During the three days' workshop participants learnt about current concepts in nuclear forensics. This branch of science deals with nuclear material intercepted during illicit trafficking; the characterization of the material may provide investigative leads (relevant for prosecution) and it may provide hints on the history of the material (including information on its age, intended use and potential origin). As nuclear forensics starts at the "crime scene", all actors have to be aware of the technical issues. Moreover, the administrative framework (i.e. a response plan) needs to be established to ensure to smooth cooperation and communication

between the different authorities involved. These were the essential messages passed to the workshop participants as part of the awareness building in nuclear forensics.

The conclusions of the workshop highlighted the necessity to develop a nuclear security culture in the region, including preventive and adequate response measures. These measures should be based on the available resources. Three subjects raised particular interest and discussion:

1. the need for a national response plan and the coordination amongst national authorities
2. establishing core capabilities in nuclear forensics including the minimum equipment, infrastructure and training of staff
3. establishing national libraries (i.e. databases containing information on nuclear and other radioactive material held within the country)

Participating states indicated their preparedness to collaborate with the EU and the US in the area of nuclear forensics.

### **3. Training**

Establishing core capabilities in nuclear forensics and developing national nuclear forensics libraries were addressed in more detail in a dedicated training session on technical nuclear forensics held in Thailand in December 2011. This was followed by a hands-on training on core capabilities in nuclear forensics which was held in April 2012 at the laboratory premises of ITU. As the project was moving on, more sophisticated subjects were addressed and more training was offered. In September 2013 a radiological crime scene management training was held at ITU's nuclear laboratories and in June 2014 a hands-on training on first steps in a nuclear forensic investigation followed.

#### ***3.1. Basic Training on Nuclear Forensics***

An introduction to technical Nuclear Forensics was provided through a dedicated workshop which was held under the auspices of the ASEAN Regional Forum and hosted by the Royal Thai Atoms for Peace Office. The workshop was again implemented in partnership between JRC-ITU and the NNSA. The workshop was very well attended (43 participants from 13 ARF countries, plus ASEAN secretariat, US, EU, UNICRI and IAEA participants). The meeting aimed at explaining the concepts and approaches currently used in the technical implementation of nuclear forensics. A visit to the Port of Laem Chabang, combined with a table top exercise, illustrated the link between nuclear detection (this port has been provided with a large number of radiation portal monitors through the US Megaports Initiative) and response, including nuclear forensics.

A series of lectures and experience reports underlined the elements of core capabilities of nuclear forensics. This includes organizational issues, technical infrastructure, measurement capability and skilled workforce. The deliberations of meeting participants were summarized by the co-chairs (NNSA and JRC) as follows: "The co-chairs also noted that this workshop is fully consistent with and advances the goals of the Nuclear Security Summit, the Global Initiative to Combat Nuclear Terrorism and the Nuclear Forensics International Technical Working Group. The co-chairs agreed that continued progress in this field is highly dependent on sustained and frequent exchanges amongst networks of regional and international technical experts.

The following areas were identified for future cooperation:

- Development of national response plans;
- Development of national nuclear forensics libraries;
- Development of a regional network of experts in nuclear forensics;

- Development of nuclear forensics capabilities (core capabilities or advanced capabilities)
- Development of a framework for regional and multilateral cooperation;
- Identification of needs for follow-on training in nuclear forensics."

### ***3.2. Training on Core Capabilities in Nuclear Forensics***

Core capabilities provide information of immediate relevance to law enforcement (basically answering the question: "which law(s) have been broken?"). To this end, a basic characterization of the material is required. In order to familiarize experts from ASEAN countries with procedures and operational aspects of nuclear forensics in response to a nuclear security incident, a hands-on training course at the premises of ITU Karlsruhe was organized. The training was held in the period 16-20 April 2012. The course program was implemented again in partnership between JRC-ITU and NNSA. 15 experts from 6 ASEAN countries participated in this training session. The agenda was composed of lectures and exercises performed at ITU in the European Nuclear Security Training Centre (EUSECTRA). Therefore, the exercises greatly benefited from the possibility to use uranium and plutonium samples (in addition to radioactive sources) for search exercises and for measurements aiming at a basic characterization of the material. In addition to familiarizing course participants with radioisotope identifiers (RID) and other portable measurement equipment, also operational aspects were included in the presentations and in the exercises. Thus, the course included all aspects on evidence collection, self-protection, on-site categorization of the material and sample analysis. Particular emphasis was given to non-destructive analysis (i.e. gamma spectrometry) of the seized nuclear material because this technique does not require sample preparation and thus ensures to a maximum extent the preservation of evidence. At the same time it does not require special laboratory facilities for handling the sample.

The participants underlined the value of practical training. In particular the opportunity for practicing the detection, localization, categorization and basic characterization of nuclear material was appreciated.

### ***3.3. Radiological Crime Scene Management Training***

Jointly with the FBI (Federal Bureau of Investigation) and the NFI (Netherlands Forensic Institute) a specific training for law enforcement personnel and nuclear measurement experts was held at the premises of JRC-ITU. The main objective of the training was to raise awareness for the interagency cooperation required at a crime scene contaminated with radioactive material. Moreover, procedures and protocols for the collection, preservation and management of evidence were discussed as well as the importance of maintaining the chain of custody, while respecting good practices of radiation protection. Participants enjoyed in particular the practical exercises taking them to different scenarios and providing encouragement to closely collaborate between classical crime scene investigators and radiation measurement experts.

## **4. Conclusion**

Nuclear forensics is a key element of nuclear security. Core capabilities in nuclear forensics should be available to each government in order to be in a position to provide information of immediate relevance to investigating authorities. To this end, JRC-ITU and NNSA implemented in partnership a project for capacity building in nuclear forensics in South East Asia. This is to be understood as a first and important step for developing sustainable response capabilities in this region and for initiating the networking of experts.