

Nuclear Safeguards and Nuclear Security Trainings at EUSECTRA

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A. Abstract

The European Nuclear Security Training Centre (EUSECTRA) is located at the European Commission's Joint Research Centres in Karlsruhe and Ispra. Its main objective is to strengthen states' Nuclear Security and Nuclear Safeguards capabilities through scenario-based training with real nuclear and radioactive materials. Nuclear Security trainings are targeted to a variety of competent experts. Additionally, under the EURATOM legal framework EUSECTRA provides specialised nuclear safeguards training aimed at nuclear safeguards inspectors from organisations such as International Atomic Energy Agency (IAEA) and DG-ENERGY. EUSECTRA's nuclear security objective is to provide states the means to mitigate threats related to material out of regulatory control, nuclear- and radioactive incidents, illicit trafficking, nuclear security, nuclear proliferation, criminal intend and nuclear terrorism. A large selection of nuclear materials, incl. uranium and plutonium samples with varying enrichment grade and different elemental and isotopic composition, are used at EUSECTRA. All training modules are integrated coherently into a tailored training curriculum. The team of trainers includes EUSECTRA's training professionals who administer, assist and supervise all trainings. Another core capability are Nuclear Safeguards related trainings, one of which are dedicated trainings for Nuclear Safeguards Inspectors and relevant monitoring experts on Neutron Coincidence Counting and high-resolution gamma spectroscopy. Furthermore, within the European Commission's support program to the IAEA the so-called Additional Protocol Exercise (APEX) is provided to IAEA Safeguards Inspectors as a means to identify potential indicators and signatures of activities and to strengthen cooperation and expand synergies for mutual benefit. The recent and still ongoing Covid 19 crisis has led to a curtailment of physical trainings, which are still the backbone of EUSECTRA's activities and shifted emphasis to online and distance trainings. Hybrid and distance learning courses have been developed. In parallel, highly interactive eTraining modules are being developed. EUSECTRA

continues to transfer into a flexible and adaptable training platform that is as interactive as possible and where state of the art technology and equipment are integrated seamlessly into our training modules. The focus will remain on field- /practical exercises making full use of EUSECTRA's broad range of equipment, scenarios and the wide spectrum of nuclear and radioactive material.

1. Introduction

Radioactive materials are commonly used in various applications worldwide, i.e. industrial-, medical and educational applications [1,2]. Nuclear material applications are on the other hand far less common. Nevertheless, the widespread application of these materials and their accessibility might cause issues regarding theft, criminal and terror acts. Some of which are recorded in the international Atomic Energy Agency's (IAEA) Incident and Trafficking Database (ITDB) [3]. Located at the European Commission's Joint Research Centres in Karlsruhe and Ispra the European Nuclear Security Training Centre (EUSECTRA) [4] aims to improve Member States capabilities to counter threats related to material out of regulatory control, nuclear- and radioactive incidents, illicit trafficking, nuclear security incidents and accidents, nuclear non-proliferation, criminal intend and terrorism. The Joint Research Centre (JRC) was tasked by the European Commission (DG HOME) to set up a dedicated training centre as recommended by the EU CBRN Action plan adopted by the European Council in December 2009 [5]. Moreover, it became a cornerstone in supporting member states to mitigate risks associated with nuclear security events, strengthen the state's nuclear safeguards and non-proliferation regimes and support nuclear forensics capacities and capability building.

Based on the unique combination of scientific expertise, specific technical infrastructure and availability of a wide range of nuclear materials, EUSECTRA complements national training efforts by providing realistic scenarios with real special nuclear material. The training program offers unparalleled opportunity for trainees to see and experience actual materials and commodities, as EUSECTRA is one of the few places in the world where a wide range of samples of plutonium and uranium of different isotopic compositions can be used for training in detection, categorization and characterization.

2. Training Activities

Combating illicit trafficking of radioactive and nuclear materials requires collaboration between various competent national and international authorities such as police, forensics, customs, border control guards, nuclear regulatory bodies, radiation protection agencies and competent experts. During such a nuclear security event, each relevant shareholder has their assigned roles and responsibilities, which are based on national regulations and regulatory framework [6,7]. Interagency cooperation, communication and consolidation of many interdisciplinary skills plays a key role as well as a thorough understanding of the intricacies involved with detection, handling and analysis of nuclear and or radioactive materials. Hence, non-radiological experts, such as frontline officers, law enforcement, and first responders, to name a few, need to become familiar with radiation detection, radiation protection principles,

radioactivity threat assessment including special nuclear materials (SNM), contamination control, and proper equipment handling. These complex requirements call for tailored training modules for all national actors and institutions involved in order for them to fulfil their roles under their country's national nuclear security plan. EUSECTRA has already recognized this fact and provides member states with tailored and sustainable training modules that address mitigation of hazards and threats related to nuclear security events. However, EUSECTRA goes a step further and offers additional training modules on nuclear safeguards and nuclear forensics.

EUSECTRA's training approach is focused on a balanced selection of theoretical components and practical exercises. Generally, these practical exercises are hands-on training modules where radioactive and nuclear real sources and familiar equipment is used. Consequently, EUSECTRA offers various training environments, for instance, there is a dedicated outdoor training area with a radiation portal monitor (RPM) park and facilities indoors such as laboratories and training rooms, with a large inventory of detection equipment. Training modules include border detection, train-the-trainers, mobile emergency response (i.e., MEST), reach-back, creation of national response plans, nuclear forensics, radiological scene crime management courses for law enforcement, nuclear security awareness and sustainability of a national nuclear security posture just to name a few.

EUSECTRA host dedicated training laboratories for Nuclear Safeguards applications, which are accessible for Nuclear Safeguards Inspectors from DG-ENER and IAEA. In nuclear safeguards the focus on quantitative determination of nuclear and fissile materials for accountancy purposes. Training includes nuclear material quantification and isotopic determination by destructive and non-destructive assays. Under the EURATOM legal framework [8] EUSECTRA provides specialised nuclear safeguards training aimed at nuclear safeguards inspectors from regulatory bodies such as the International Atomic Energy Agency (IAEA) and DG-ENERGY. For instance, within the European Commission's support program to the IAEA the so-called Additional Protocol Exercise (APEX) is provided to IAEA Safeguards Inspectors, which is a practical exercise on Complementary Access (CA). CA is a powerful safeguards measure to assure the absence of undeclared nuclear materials and activities. APEX is designed to train inspector to identify potential indicators and signatures of activities and to strengthen cooperation and expand synergies for mutual benefit.

EUSECTRA also provides specialized nuclear forensics training modules. Nuclear forensics is an interdisciplinary field for science and law enforcement, but which also affects a country's national nuclear security architecture. It describes the examination of nuclear and other radioactive materials using analytical techniques to determine the origin and history of material in the context of law enforcement investigations or the assessment of nuclear security vulnerabilities [9]. For instance, highly specialised training on nuclear forensic in different areas of the JRC can be offered, including mass spectrometry, electron microscopy, advanced gamma spectroscopy, mass spectrometry, etc. As a result, nuclear forensics capacity is limited to very few laboratories worldwide and is a scarce commodity. The JRC has agreements with some EU Member States for joint analyses to train experts and specialists and provides a framework for supporting

Member States in nuclear forensics capacity building. The target audience is correspondingly diverse. It covers a broad spectrum of national and international experts, to name a few: nuclear safeguards inspectors, scientists, frontline officers, law enforcement, military, national and international policy makers and security experts, (future) trainers and implementers. Furthermore, JRC experts teach at University level lectures on nuclear forensics. A comprehensive introduction to radiochemistry, radiation detection, signatures, geological origin of uranium, introduction to the nuclear fuel cycle, process related signatures and age dating of SNM are taught.

Nuclear security training modules for law enforcement agencies are common at EUSECTRA. Often, the radiological crime scene management modules are in high demand. As defined by the IAEA, a radiological crime scene management is the process used to ensure safe, secure, effective and efficient operations at a crime scene where nuclear or other radioactive materials are known or suspected, to be present [10]. The scope of this module is to consolidate joint efforts of law enforcement authorities with national radiological and nuclear experts and promote their cooperation in processing a crime scene while ensuring the integrity of SOP's and chain of command. Self-protection, evidence collection and management, contamination control, identification of radionuclides and radiological assessment are some examples regularly taught in these courses. The training is structured to include presentations, field reports, discussion sessions, and realistic exercises using real nuclear and radiological materials.

Quite commonly, nuclear security training include specialized training for customs and border control units: so-called front line officers. The scope of these modules is to strengthen a state's response to combat illicit trafficking of nuclear and or radioactive materials. In these modules, the participants learn how to correctly operate detection devices, e.g. stationary speed measuring devices and hand-held devices, and the important interaction between a primary and a secondary inspection. They also cover how to interpret the measurement results and put them in the right context. Generally, such a training last about a week.

A common denominator in almost all training modules is to provide all non-technical experts with a better understanding and overview to select the appropriate detection equipment for the right situation. It also aims to provide a structured methodology for performing an appropriate measurement for detection, identification, characterization, or radiation protection. Compared to nuclear safeguards training, the emphasis in nuclear safeguards is on detection and identification rather than quantification.

The team of trainers consists of training experts from the Joint Research Centres (JRC) who administer, assist and supervise all training. In addition, a large pool of external, national and international experts is available. For instance, EU and international experts are often involved in curriculum development and training delivery. A corner stone is collaboration with international partners such as the International Atomic Energy Agency (IAEA), the Nuclear Forensics International Technical Working Group (NF-ITWG), the Border Monitoring Working Group (BMWG), the National Nuclear Security Administration (NNSA), the US-Department of Energy (US DoE), JAEA and the European Nuclear Education Network (ENEN), etc. but also with internal partners such as DG-Energy, DG-Taxud, etc. A key objective of EUSECTRA is to assist

Member States in countering threats related to nuclear terrorism, illicit trafficking, and material beyond regulatory control, as well as improving nuclear safeguards and non-proliferation capabilities and promoting nuclear forensics. At the same time, it mitigates the risk to the public and the environment from nuclear security incidents by bringing together all relevant international stakeholders in a training platform. Specialised training modules, e.g. nuclear forensics and specialized nuclear security training courses, can be provided upon request.

EUSECTRA actively contributes to international cooperation with various shareholders and partners and strongly supports young experts and scientists in the field of nuclear security worldwide. For instance, JRC cooperates with US's Department of Energy Office of Nuclear Smuggling Detection and Deterrence (US DOE NSDD) and Science and Technology Center in Ukraine (STCU) on a project called "Next Generation of Nuclear Forensic Scientists" [11]. Additionally, JRC experts are active in the European Safeguards Research and Development Association (ESARDA) and the implementation of ESARDA training courses. EUSECTRA also cooperates with other international partners such as Federal Bureau of Investigation (FBI), Japan Atomic Energy Agency (JAEA), Nederland Forensisch Instituut (NFI), Commissariat à l'énergie atomique et aux énergies alternatives (CEA) and International Nuclear Security Education Network (INSEN). Besides, EUSECTRA is also strongly connected internally within the European Bodies, for instance with DG JRC, DG TAXUS, DG DEVCO, DG HOME and DG ENERGY.

Since its inauguration, EUSECTRA hosted participants from over 95 countries and provided comprehensive training to more than 1800 trainees in over 180 training modules. Figure 1 shows the evolution and number of trainings versus the number of trainees over the course of eight years. However, the recent and still ongoing Covid 19 crisis has led to a curtailment (see Figure 1) of physical training, which are still the backbone of EUSECTRA's training and shifted emphasis to online and distance training.

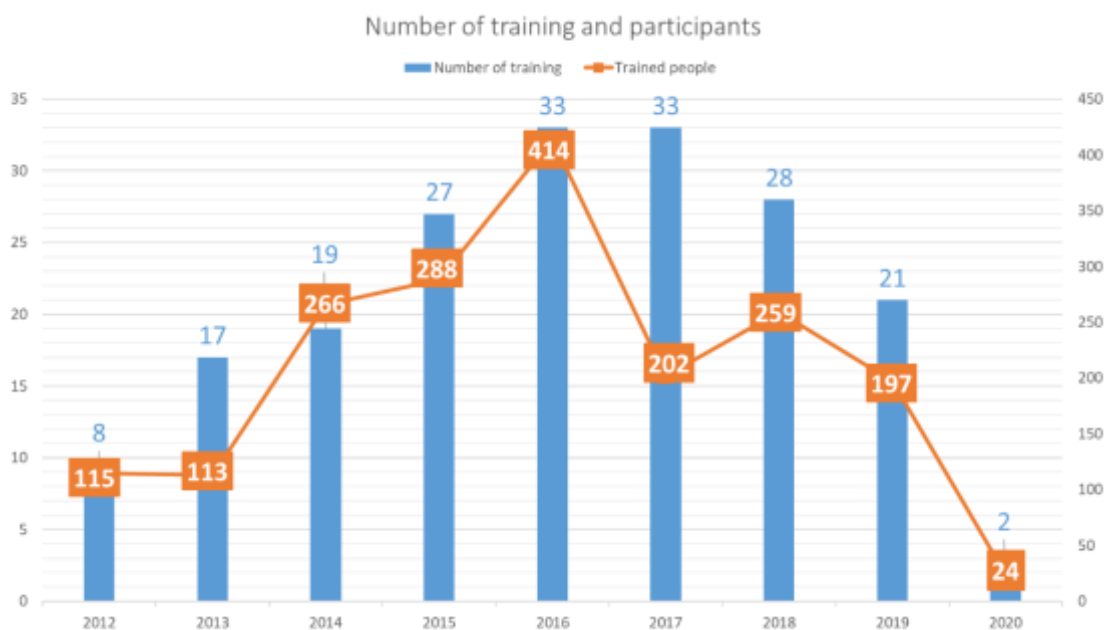


Figure 1: Number of training and participants from 2012-2020 at EUSECTRA.

EUSECTRA already offers a variety of innovative virtual and online-based training courses and modules: from hybrid courses to distance learning and eTraining modules. These newly developed eTraining modules are highly interactive and leverage EUSECTRA's state-of-the-art digital infrastructure. In these interactive eTraining modules, the full potential of EUSECTRA equipment and scenarios can be used, while ensuring secure communication channels with JRC trainers. In addition, EUSECTRA is actively collaborating with the EU Academy [12] to develop interactive training materials including a serious game platform.

Knowledge transfer and management and national capacity building is another core objective of EUSECTRA. For this reason, EUSECTRA is a success story and has become a cornerstone of an EU-wide and international training network designed to ensure the transfer and dissemination of knowledge needed to mitigate threats and risks related to nuclear security, nuclear safeguards, and nuclear non-proliferation. It has proven to be a platform for experts to enhance cross-border cooperation and networking through joint training sessions with national input. It also shares and teaches best practices and actively contributes to the development of harmonized (EU) nuclear security procedures in terms of prevention, detection and response.

3. Conclusion

For over a decade, EUSECTRA's core objective is to strengthen states' Nuclear Security, Nuclear Safeguards and Nuclear Forensics capabilities through tailored and scenario-based training with real nuclear and radioactive materials while providing state-of-the-art equipment and a unique training infrastructure. EUSECTRA offers a wide range of different training modules, e.g. on topics related to nuclear safety, nuclear safeguards or nuclear forensics. The training program provides unparalleled opportunities for trainees to experience real fissile and other radioactive and nuclear materials and goods. EUSECTRA is one of the few training facilities in the world where a wide range of special nuclear materials (SNM), e.g. plutonium and uranium with different isotopic compositions, can be used for special nuclear safety and nuclear safeguards exercises.

At its core, EUSECTRA seeks to assist Member States in strengthening their nuclear security, nuclear safeguards, and nuclear forensics capabilities: from countering threats related to accidents involving radioactive and/or nuclear materials to nuclear terrorism, illicit trafficking, and incidents involving materials not under regulatory control. EUSECTRA contributes to strengthening the international nuclear safeguards community and enhances a state's preparedness, detection capabilities, and response capabilities to nuclear security incidents. At the same time, EUSECTRA aims to contribute to public safety by providing a comprehensive learning and teaching platform to mitigate the risks posed by such events and incidents to the general public and the environment. Thus, it has become a proven implementation tool for EU policies to support EU Member States and beneficiary countries alike, to promote visibility and to strengthen the culture of nuclear safety in the States at EU, national and international levels. EUSECTRA's activities are in line with and based on the European Commission's CBRN Action Plan.

Over the years, EUSECTRA has welcomed many participants from around the world to its training facilities at JRC Karlsruhe and JRC Ispra and has accumulated years of experience in teaching and conducting training. EUSECTRA is regularly recognized by the countries it trains as beneficial in improving preparedness, detection, and response to nuclear security events. Moreover, its strength lies in its flexibility to adapt quickly to change. This was evident during the current Covid 19 pandemic, where EUSECTRA quickly introduced new remote and virtual training modules while ensuring constant communication with all training participants and a high level of interactivity. EUSECTRA is constantly striving to improve its curriculum and modernize its equipment inventory to meet its mission of providing state-of-the-art training. However, the emphasis remains on hands-on training with real equipment in EUSECTRA's facilities.

5. References

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