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EU efforts to strengthen nuclear security

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Contents

Executive summary

The European Union is firmly committed to strengthening nuclear safety, security, safeguards and non-proliferation through a global and effective approach in the areas in which it has competence.

As an example of EU's active role, on 14 July 2015 the E3/EU+3 (China, France, Germany, the Russian Federation, the United Kingdom and the United States, with the High Representative of the European Union for Foreign Affairs and Security Policy) and the Islamic Republic of Iran reached an agreement on a Joint Comprehensive Plan of Action (JCPOA). The full implementation of this JCPOA will ensure the exclusively peaceful nature of Iran's nuclear programme.

Combined with new and complex threats to global security that have emerged in recent decades, the Fukushima accident in 2011 has triggered new activities worldwide in the area of nuclear safety, nuclear security and emergency preparedness. The EU's energy strategy recognises the role of nuclear energy and calls for the highest safety, security and non-proliferation standards.

Nuclear security has been particularly high on the global political agenda since the first Nuclear Security Summit in Washington in 2010. The International Atomic Energy Agency (IAEA) ministerial Nuclear Security Conference in 2013 confirmed the international community's commitment to addressing the prevention, preparedness, detection and response to acts involving nuclear or radioactive materials.

At the most recent Nuclear Security Summit (The Hague, 2014) political leaders undertook to build and sustain a strong nuclear security culture in order to combat nuclear terrorism and other criminal threats effectively. They also called for stronger international and regional cooperation on education, awareness-raising and training. In view of the upcoming (and last) 2016 Nuclear Security Summit in Washington, this staff working document on EU efforts to strengthen nuclear security describes some of the EU's achievements, focusing on key developments since the launch of the Nuclear Security Summits process in 2010. Similar documents were produced for the Summits in Seoul (2012)[1] and The Hague (2014).[2]

The Euratom Treaty continues to be the basis of the EU's activity on nuclear issues, including nuclear safety and security. Through Euratom, the EU operates an effective regional nuclear safeguards system, encompassing nuclear material accountancy, verification through on-site inspections, regular reporting, and technical and scientific support for EU Member States in close partnership with the IAEA.

EU safeguards activity contributes to full compliance with the Safeguards Agreements with the IAEA (including the Additional Protocol) and establishing integrated safeguards in the Member States that do not have nuclear weapons.

Other regions regard the Euratom Treaty as a model of excellence and are considering incorporating some of its components into their own governance arrangements, e.g. nuclear materials controls based on 'neighbours checking neighbours'.

The EU has a nuclear materials supply assurance system under a policy implemented by the Euratom Supply Agency (ESA).

In December 2015, Euratom acceded to the amended Convention on the Physical Protection of Nuclear Material and Nuclear Facilities (CPPNM) following its ratification by all Member States.

The EU common foreign and security policy (CFSP), the European security strategy (2003), the EU strategy against proliferation of

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1 *EU efforts to strengthen nuclear security*, joint staff working document (SWD(2012) 70 final).

2 *EU efforts to strengthen nuclear security*, joint staff working document (SWD(2014) 107 final).

weapons of mass destruction (WMD), the EU counter-terrorism strategy (2005) and the *New lines for action in combating the proliferation of WMD and their delivery systems* (endorsed in 2008) all reinforce the EU's commitment to nuclear security. In line with United Nations Security Council Resolution (UNSCR) 1540[3] and its strategy against the proliferation of WMD, the EU requires the insertion of non-proliferation clauses in all its agreements with other countries.

Significant progress has been made in recent years in the fight against the illicit trafficking of nuclear and radiological materials, through the implementation of an EU-internal action plan on chemical, biological, radiological and nuclear (CBRN) security[4] and outreach activities under the EU's Instrument for Pre-Accession Assistance (IPA and IPA II [5]), Instrument for Nuclear Safety Cooperation (INSC)[6] and Instrument contributing to Stability and Peace (IcSP)[7] succeeding the Instrument for Stability (IfS)[8], through the EU CBRN Risk Mitigation Centres of Excellence (CoE) initiative.[9]

The EU has developed particular expertise in the forensic analysis of nuclear and radioactive materials, and implemented training programmes for frontline responders and national experts in the detection and identification of nuclear materials. Throughout this document, we refer specifically to EU-United States cooperation on the testing and validation of detection equipment (ITRAP+10 project), the enhancement of border security and related training efforts through the Border Monitoring Working Group (BMWG) and progress on nuclear forensics, including the Nuclear Forensics International Technical Working Group (ITWG).

Export controls on 'dual-use' (civil and military) items relate indirectly to nuclear security in that they contributes to the non-proliferation of nuclear weapons and their means of delivery. The EU has continued to develop and implement its common regulatory framework by means of its Dual-Use Regulation,[10] which lays down common control rules and a regularly updated control list of 'dual-use' items. The EU is implementing an outreach programme in export control of dual use items with 34 partner countries.

The EU supports the international dimension of nuclear security through enhanced cooperation with the IAEA and continues to support the G7 Global Partnership programmes and implementation of UNSCR 1540. It contributes actively to the Global Initiative to Combat Nuclear Terrorism (GICNT), including the work of the Implementation Assessment Group (IAG). It has also enhanced nuclear security cooperation with its major partners.

Following the Fukushima nuclear accident in 2011, the European Council underlined the need to draw all possible lessons to be learned.[11] The EU therefore launched a comprehensive programme to reassess all its

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3 http://www.un.org/sc/1540/.

4 Communication from the Commission to the European Parliament and the Council on *Strengthening chemical, biological, radiological and nuclear security in the European Union — an EU CBRN Action Plan* (COM(2009) 273 final, 24.6.2009).

5 Regulation (EU) No 231/2014 of the European Parliament and of the Council of 11 March 2014 establishing an Instrument for Pre-accession Assistance (IPA II) (OJ L 77, 15.3.2014, p. 11–26).

6 Council Regulation (Euratom) No 237/2014 of 13 December 2013 establishing an Instrument for Nuclear Safety Cooperation (OJ L 77, 15.3.2014, p. 109–116).

7 Regulation (EU) No 230/2014 of the European Parliament and of the Council of 11 March 2014 establishing an instrument contributing to stability and peace (OJ L 77, 15.3.2014, p. 1–10).

8 Regulation (EC) No 1717/2006 of the European Parliament and of the Council of 15 November 2006 establishing an Instrument for Stability (OJ L 327, 24.11.2006, p. 1)

9 http://www.cbrn-coe.eu/.

10 Council Regulation (EC) No 428/2009 of 5 May 2009 setting up a Community regime for the control of exports, transfer, brokering and transit of dual-use items (OJ L 134, 29.5.2009, p. 1).

11 Conclusions of the European Council, 24-25 March 2011 (EUCO 10/1/11, rev. 1); http://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/ec/120296.pdf.

nuclear power reactors ('stress tests')[12] to ensure that they are not at risk from similar extreme events. The stress tests, which had both a safety and a security track, were carried out between 2011 and 2012 in the Member States that operate nuclear power plants and on a voluntary basis in neighbour countries that operate, own or plan to build plants. The results yielded important lessons in the prevention and management of such severe accidents and all the countries concerned signed up to an action plan to enhance nuclear safety and security.

In 2014, the EU's 2009 Nuclear Safety Directive was amended[13] to include improvements as regards:

- the independence of national regulators;
- nuclear safety objectives;
- topical peer reviews;
- transparency; and
- on-site emergency preparedness and response (EPR).

The newly revised EU Basic Safety Standards (BSS) Directive[14] consolidates five EU directives, including the High-Activity Sealed Sources (HASS) Directive. It also lays down requirements for the management of orphan sources and scrap metal contamination, and includes several references to EPR.

To date, the EU's EPR activities have relied the information exchange and reporting mechanisms developed by the European Commission (the EU's executive body):

- the European Community Urgent Radiological Information Exchange (ECURIE); and
- the European Radiological Data Exchange Platform (EURDEP).

The IAEA has selected the EURDEP data standards as the technical and principle basis for implementing the worldwide system for radiological monitoring; they now serve as global reporting mechanisms.

The Union Civil Protection Mechanism (UCPM)[15] continues to facilitate the practical expression of solidarity with victims of natural, technological and man-made disasters, including radiological and nuclear incidents, in Europe and elsewhere, improving overall disaster management. Reinforced in December 2013, it now includes the Emergency Response Coordination Centre (ERCC), the European Emergency Response Capacity (EERC) and an equal focus on prevention, preparedness and response, thus providing more effective support to increase preparedness at European level to manage the consequences of radiological incidents or nuclear accidents, planning and assessment of risks at national level.

Synergies between safety, security and safeguards (the holistic '3S' approach) applicable to existing installations are possible, in particular in the area of emergency preparedness and risk mitigation. The 3S perspective aims to improve communication between the safety, security and safeguards communities, in order to apply a 'by design' approach to future installations, taking into account concerns from the three areas in the design phase and providing comprehensive and robust responses to the various types of challenge. This could avoid situations arising in which policy decisions are technically unfeasible or impractical.

While recognising progress to date, the EU continues to strive for greater nuclear security; the present report is an illustration of this commitment.

[12] Communication from the Commission to the European Parliament and the Council on the comprehensive risk and safety assessments ('stress tests') of nuclear power plants in the European Union (COM(2012) 571 final, 4.10.2012).

[13] Council Directive 2014/87/Euratom of 8 July 2014 amending Directive 2009/71/Euratom establishing a Community framework for the nuclear safety of nuclear installations (OJ L 219, 25.7.2014, p. 42).

[14] Council Directive 2013/59/Euratom of 5 December 2013 laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation, and repealing Directives 89/618/Euratom, 90/641/Euratom, 96/29/Euratom, 97/43/Euratom and 2003/122/Euratom (OJ L 13, 17.1.2014, p. 1).

[15] Decision No 1313/2013/EU of the European Parliament and of the Council of 17 December 2013 on a Union Civil Protection Mechanism (OJ L 347, 20.12.2013, p. 924).

Nuclear security in Europe

EU nuclear fuel cycle and the implementation of the Euratom Treaty

The EU plays host to all stages of the nuclear fuel cycle. Nuclear facilities and related activities, stocks of nuclear materials and advanced nuclear technology are all covered by nuclear security programmes, including safeguards. The EU is unique in the world in that:

- it has its own supranational safeguards system based on Chapter 7 of the Euratom Treaty; this requires the Commission to verify the management and peaceful use of all civil nuclear materials and special fissile materials in the EU. An active corps of inspectors carries out verification activities ranging from nuclear material accountancy checks to fully independent on-site inspections. Euratom safeguards apply in all Member States, whether or not they have nuclear weapons;
- it has an extensive research and development (R&D) programme that contributes to nuclear safeguards and security;
- Euratom has a number of nuclear cooperation agreements with countries such as the United States, Canada, Japan and Australia that include the supply of nuclear materials and fuel-cycle services. These guarantee that nuclear material will always be covered by adequate safeguards, export controls and security measures;
- verification agreements (INFCIRC/193 for Member States without nuclear weapons, INFCIRC/263 for the UK and INFCIRC/290 for France) allow the IAEA to verify that all Member States fulfil their commitments under the Non-Proliferation Treaty;
- in the common nuclear market established by the Euratom Treaty, the Euratom Supply Agency (ESA) is required to be a party to supply contracts for nuclear materials whenever one of the commercial parties is an EU entity. When concluding supply contracts, ESA implements the EU common supply policy. It also has a right of opinion on all nuclear materials produced in the Member States. ESA is notified transactions involving services in connection with nuclear materials. It verifies compliance with the upstream contact and acknowledges such notifications.

  ESA takes part in the assessment of intergovernmental agreements notified under article 103 of the Euratom Treaty by commenting on supply aspects of the agreements in question.

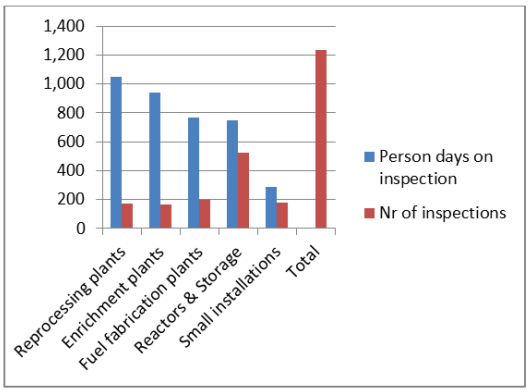
  By publishing its regular reports and price indices, ESA adds transparency to the European nuclear fuel market.

EU safeguards R&D has been instrumental in fostering technological advances that have improved the effectiveness and efficiency of operational safeguards activities, in particular in reprocessing, mixed-oxide fuel fabrication, and gas centrifuge enrichment plants, and more recently also in final repositories for spent nuclear fuel. The EU was the first region to exploit such repositories commercially and thus bring them under (Euratom) safeguards. This has led to the development of safeguards approaches specifically adapted to repository facilities which have been used as a basis for implementing international safeguards in similar facilities outside the EU. Close cooperation between the IAEA and Euratom safeguards services in the Commission has resulted in the transfer and development of technology and methods (see section below on EU support for the IAEA — EC-SP).

Inspection activities

There are important synergies between supervised systems of Nuclear Material Accounting and Control (NMAC) and nuclear security. The Euratom safeguards system supervises all EU civil nuclear operators'

NMAC systems, which also seek to complement nuclear security measures such as physical protection.



Inspection activities for the year 2014

Minimisation of high enriched uranium

One of the conclusions of the last Nuclear Security Summit focused on the critical need to restrict access to vulnerable nuclear materials, notably high enriched uranium (HEU) by unauthorised persons. It was agreed that civil uses of HEU should be minimised. At the same time, it was acknowledged that applications of vital importance for research and medical care, which need HEU to continue operating, would be at risk if the material were to become scarce. Therefore, the ESA, which is entrusted with securing the supply of nuclear materials for EU users, signed a memorandum of understanding (MoU) with the US Department of Energy/National Nuclear Security Administration (DoE/NNSA) in December 2014 under which the United States will supply the EU with the requisite HEU until its technological conversion to low enriched uranium (LEU) is complete, and the EU will eliminate HEU that is not directly usable.

An important objective of the MoU was to maintain Europe's capacity to produce medical radio-isotopes, in particular Tc99 m, which is vital for diagnosing and identifying treatment options for heart disease and cancer. EU-based production of Tc99 m covers Europe's needs and about 50 % of the needs of the US market.

The MoU provides for quantities of HEU in excess of those still required for the above purposes to be eliminated by dilution for further use in the United States or the EU. Sufficient quantities (beyond those still needed in the EU) have been identified and proposed for exchange. A document with a list of the materials was signed on 14 January 2016 and attached as an annex to the MoU.

A US-European collaboration for the development of high-density fuels for research reactors is in progress in the framework of the HERACLES-CP project funded by the DG RTD EURATOM financial programme (HERACLES-CP aims to provide scientific and engineering solutions to reduce proliferation risks by replacing HEU fuel with a lower enriched, high density solution).

EU legislation on the management of radioactive sources

The Euratom Treaty addresses the need to protect the health of workers and the general public against the dangers of ionising radiation. As a result, a comprehensive set of directives, regulations, recommendations and decisions has been adopted.

Since its adoption in 1959, the BSS Directive has been updated many times. In the aftermath of the Chernobyl accident, other legislation was adopted on the exchange of information and the contamination of food. Legislation was also developed on the protection of outside workers and the control of high-activity sealed sources (HASS) [16].

Other legislation covers the shipments of radioactive substances.

HASS Directive implementation

The Commission has recently assessed the EU Member States' implementation of the 2003 HASS Directive. In most Member States, implementation has been very good or excellent. The main provision of the Directive that could be implemented more thoroughly is the requirement for search and recovery campaigns for orphan sources.

The assessment of the 2003 Directive looked *inter alia* at the issue of national source registries and concluded that nearly all Member States have established national electronic databases for source holders and radioactive sources, most of them for sealed sources above the exemption levels. These conclusions are confirmed by contributions to this SWD. All established databases are protected against unauthorised access.

In 2018, the HASS Directive will be repealed and replaced by corresponding provisions in the new BSS Directive.

[16] Council Directive 2003/122/Euratom of 22 December 2003 on the control of high-activity sealed radioactive sources and orphan sources (OJ L 346, 31.12.2003, p. 57 – 64).

Development of EU radiation protection legislation on control of radioactive sources

The Euratom framework for radiation protection, including the regulatory control of radioactive sources, was revised in 2013. The newly revised BSS Directive consolidates five existing Euratom directives, including the HASS Directive. The aim of the HASS-related amendments in the new BSS is to align Euratom HASS provisions with the IAEA code of conduct on the safety and security of radioactive sources, particularly as regards the definition of a 'high-activity sealed source' and the IAEA source categorisation system. In addition, the new Directive includes requirements on the management of orphan sources and scrap metal contamination.

Regulations on the shipments of radioactive substances and the application of the Euratom safeguards

To complement the radiation protection legislation, Council Regulation (Euratom) No 1493/93 introduced an EU-wide mandatory system for declarations of shipments of radioactive substances between EU countries[17]. After the removal of internal border controls in 1993, national authorities needed the same level of information on shipments of radioactive substances as before, to continue implementing radiation protection controls.

As regards source materials and special fissile materials, the Euratom Safeguards Regulation was revised in 2005. Commission Regulation (Euratom) No 302/2005[18] sets out obligations on declarations, accountancy, reporting and international transfers of such materials.

[17] Council Regulation (Euratom) No 1493/93 of 8 June 1993 on shipments of radioactive substances between Member States (OJ L 148, 19.6.1993, p. 1).

[18] Commission Regulation (Euratom) No 302/2005 on the application of Euratom safeguards – Council/Commission statement (OJ L 54, 28.2.2005, p. 1).

Council Directive 2011/70/Euratom of 19 July 2011 establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste

In 2011, the EU made a major effort forward with the adoption of the Radioactive Waste and Spent Fuel Directive, including management and disposal of disused sealed sources that are declared as radioactive waste. With this legally binding measure, all Member States committed to addressing the long-standing issue of radioactive waste and spent fuel management.

The directive requires EU Member States to define and detail their spent fuel and radioactive waste management policies and to have measures in place for implementation of these policies in national programmes covering all stages of spent fuel and radioactive waste management from generation to disposal. National programmes were communicated to the Commission by 23 August 2015, together with the first Member States' reports on implementation of the Directive. The Commission will report to the Council and the European Parliament on implementation of this Directive in the second half of 2016.

The EU's CBRN Action Plan

The EU Council adopted the CBRN Action Plan[19] in December 2009 in order to strengthen CBRN security throughout the EU. Based on an 'all-hazard' approach, the Action Plan's overall goal was to reduce the threat and consequences of CBRN incidents of accidental, natural and intentional origin, including terrorist acts. It comprises 124 actions to be taken in 2010-2015, including 25 on radiological and nuclear security and 32 on biological or chemical security. A further 67 actions apply to more than one area.

The Action Plan contributes to the implementation of the EU's counter-terrorism strategy as well as the internal security strategy and covers three main areas of CBRN security work:

- prevention: ensuring that unauthorised access to CBRN materials of concern is as difficult as possible;
- detection: being able to detect CBRN materials in order to prevent or respond to CBRN incidents; and
- preparedness and response: being able to respond efficiently to incidents involving CBRN materials and recover from them as quickly as possible.

In December 2012, the Council adopted a Conclusion underlying 'the need to identify areas with insufficient security arrangements and to focus on and prioritise further common efforts to enhance the security of production, storage, handling and transportation of high-risk CBRN and E [explosive] materials'[20]. The Council also encouraged the Commission to use the CBRN Action Plan and the Action Plan on Enhancing the Security of Explosives (APESE) 'as a foundation for creating a revised policy'.

The subsequent Communication on *A new EU approach to the detection and mitigation of CBRN-E risks*[21] was the next step in the implementation of the CBRN agenda. Its main focus was on detection. Acknowledging that resources were limited, it highlighted actions and areas where more needed to be done, which should be prioritised and where the EU could add the most value. Although most of the actions were linked to the Action Plan, the Communication proposed concrete ways to implement them further and move forward.

Implementation of the Action Plan is guided by consultation with national authorities and other stakeholders such as the private sector, the healthcare sector and academic institutions. The IAEA, Interpol and Europol are closely involved with implementation efforts.

In 2014, to ensure dissemination of research results and engagement with research stakeholders in order to raise awareness of security issues and facilitate the exchange of good practices on dealing with security, the Commission created a 'community of users' in the area of disaster risk and crisis management, which includes CBRN-E aspects.

Implementation of radiological and nuclear (RN) actions

Work has been carried out in all areas of radiological and nuclear (RN) security covered by the Action Plan. The main actors in implementation are the Member States, EU bodies and international organisations such as the IAEA and Interpol. These actors have addressed all 25 RN actions and fully implemented most of them.

One of the biggest achievements in recent years was the opening in April 2013 of the European nuclear security training centre (EUSECTRA) at the Commission's Joint Research Centre (JRC) premises in Karlsruhe and Ispra (see 'Examples of JRC nuclear security R&D projects and activities').

[19] Council document 15505/1/09 REV 1.

[20] Council document 16980/12.

[21] COM(2014) 247 final.

Numerous training activities take place in the Member States to ensure a minimum level of training for frontline officers, harmonised at EU level.

In this context, it is worth mentioning Europol's and DG HOME's RN training activities. Europol has organised specific courses focused on response to a radiological emergency resulting from a nuclear security incident (Portugal, October 2014 and Poland, November 2015). DG HOME is running training for first responders (police, fire/rescue and paramedics), incident commanders and medical emergency staff on the triage, monitoring and treatment of mass casualties following a terrorist attack involving ionising radiation (pilot course in October 2015; subsequent courses in December 2015 and throughout 2016).

Another key element of the successful fight against RN threats is the exchange of information. This element will be further developed in the next chapter, describing Europol's activities.

One of the key databases in this area is the IAEA-based Incident and Trafficking Database (ITDB). As initially envisaged, this contains information from IAEA member states on cases of illicit trafficking, but also on incidents involving any nuclear and other radioactive material not under regulatory control. Via the JRC, the EU has contributed significantly to improving the usability of the ITDB. Among other contributions, the JRC developed a new IT reporting tool which should improve the reporting culture.

Last but not least, the Commission and the Member States have funded a large number of research activities in the past few years. The Commission has contributed significant resources to the successful ITRAP+10 project, which aims to test various families of the RN detection equipment produced in the EU. The JRC, which leads the project, invited manufacturers of instruments for detecting illicit trafficking of radioactive sources and nuclear material to participate in an extensive test programme. Test procedures were developed on the basis of International Electrotechnical Commission (IEC) and American National Standards Institute (ANSI) standards, and the IAEA recommendations available at that time. The standards lay down performance requirements and procedures for testing such equipment. Most of the tests in Phase I were fed into an impressive set of reports tailored to the needs of the various interested parties, with benchmarked results for individual manufacturers and suggestions for standardisation organisations as to how standards could be made clearer, simpler and cheaper to implement, while still ensuring reliable test results. On the basis of the work under the project, relevant international standardisation fora are revising their standards (see also paragraph on 'ITRAP+10: testing radiation detection equipment to be used in the fight against illicit trafficking').

Europol activities in the area of CBRN

Capabilities and tools

As the EU's law enforcement agency, Europol's main aim is to support EU Member States' law-enforcement agencies in the fight against organised crime, terrorism and other forms of serious crime by gathering, analysing and disseminating intelligence, and coordinating international operations.

Europol brings added value by means of:

- multi-agency approach (law enforcement, security services, customs);
- ultilingual capabilities;
- apid information exchange;
- uropean crime overview;
- nvestigative (operational, technical, analytical) support;
- xpertise, training and involvement in European projects;
- &D activities;
- legal platform for managing EU-wide law-enforcement databases; and
- oint investigation teams.

In addition, Europol can activate:

- 24/7 emergency system, which involves liaison officers from all Member States and non-EU countries based at Europol, and each unit of the Europol Operations Department;
- he EU first response network; and
- contingency team through standard operation procedures.

First Response Network

In the event of a radiological emergency caused by a suspected or confirmed terrorist or criminal incident or threat, Europol can implement its contingency and business continuity plans. *Inter alia*, these include activating a 24/7 network of Europol staff and liaison officers from all Member States, non-EU countries and organisations represented at Europol headquarters.

Should the level of threat warrant more direct support, Europol can activate the First Response Network mechanism. This supports Member States', competent authorities' and Europol's reaction to a major terrorist incident. Following consultation and agreement between the competent authority of the Member States affected and the Director of Europol, a 'first response team' of experts will be called upon to assist Member States' investigations in the first four to eight weeks, to facilitate the exchange of information and to assess the need for other necessary measures to protect the security of the EU and EU interests abroad.

Criminality involving nuclear and other radioactive materials

Europol is responsible for dealing with criminal activities involving nuclear and other radioactive materials, among other forms of serious crime, as detailed in Council Decision 2009/371/JHA.

On the basis of an 'all-hazards' approach to a threat, Europol conducts several activities that help Member States develop their capacities to prevent and respond to CBRN incidents.

Europol was involved in the discussions to establish the EU's CBRN Action Plan and has been entrusted with implementing some of the actions as lead or partner institution.

CBRN Working Group of the European Explosive Ordnance Disposal Network (EEODN)

EU experts identified a need for a network of explosive ordnance disposal specialists and set this out in the APESE. In May 2008, with the support of the Commission and the Member States, Europol created the European Explosive Ordnance Disposal Network (EEODN).

The subsequent approval of the EU CBRN Action Plan in November 2009 led to the creation of a CBRN Working Group within the EEODN. The EEODN's main objectives are to facilitate cooperation, share information among EU CBRN and explosives specialists and organise joint training sessions and exercises.

In the framework of this project, Europol organises regular two-day conferences on CBRN and explosives, during which EU experts exchange information about recent explosives- and CBRN-related cases, threats, activities and latest developments in the sector, such as new detection equipment and risk-mitigation technologies. Also, the EEODN organises regular training courses and exercises on explosives and CBRN. These improve awareness, knowledge and experience, in particular among participants from Member States in which such incidents are rare.

In order to ensure a wide audience, it was necessary to establish a funding scheme for EEODN activities, thus minimising the financial impact on Member States. Between 2008 and 2010, two annual conferences were hosted and funded by Europol and the Member States. In 2010 and 2011, the EEODN started to receive co-funding in the form of grants under the Prevention of and Fight against Crime (ISEC) Framework Partnership programme. Since the beginning of 2013, the European Police College (CEPOL) has been co-financing and helping to coordinate and manage EEODN activities.

The creation of the EEODN community not only improves exchange of information, but also facilitates communication between experts and provides platforms for bilateral or regional cooperation between Member States.

European Union Bomb Data System (EBDS)

Europol is leading the development and maintenance of the EU Bomb Data System (EBDS), which contains information on incidents, threats, reports and analysis relating to explosives and CBRN. Since 2010, the system has been available to all EU competent authorities and some non-EU countries.

EU explosives and CBRN experts identified the EBDS as a necessary tool. The creation of a centralised database guarantees the efficient, safe and structured distribution of information. Whenever and wherever an explosive ordnance disposal/CBRN-related incident occurs, specialised units across the EU start gathering the necessary technical intelligence and information.

Like the setting-up of the EEODN, the creation of the EBDS was the subject of an action in the APESE. Work has gone further, however, as the APESE simply called for a database on incidents involving explosives and improvised explosive devices. Following an initiative by France during its Presidency of the EU in 2009, Europol was able to include a CBRN component in the EBDS project.

The EBDS is a dual system, with separate powerful databases for explosives-related incidents and CBRN. It has specialised libraries where users can upload and access intelligence files in the most common formats. It also includes specialised discussion fora where experts can interact directly, ask questions and share experience and best practice. National experts are responsible for uploading their respective national contributions.

The EBDS has become an efficient platform for sharing information on explosives and CBRN incidents and has been used successfully to support several international investigations, within the EU and elsewhere.

CBRN threat assessment and monitoring

Europol assesses and monitors CBRN threats, situation and trends on an ongoing basis, focusing mainly on criminal cases involving radioactive materials, such as thefts, attempted sales, international trafficking and potential links with organised criminal and terrorist organisations.

In the course of this work, Europol exchanges information with competent authorities in the Member States, some non-EU countries and relevant EU and international agencies. In the field of radio-nuclear threats, it cooperates with the IAEA, the Commission's Directorate-General for Energy (DG ENER) and the JRC. This inter-agency cooperation enables it to produce intelligence reports that bring together strategic intelligence from law enforcement and technical or scientific information.

Cooperation with the IAEA

Europol and the IAEA maintain informal relations in the fields of nuclear security, safety and radiological emergencies. Initial cooperation was established in 2002 in the area of crime linked to nuclear and radioactive substances covered by Europol's mandate. Since then, Europol has contributed actively in an advisory capacity to the review of IAEA manuals, guides and tools in the field of nuclear safety and the fight against illicit trafficking in nuclear and radioactive materials.

As a result of its cooperation with the IAEA, Europol has gained access to the following tools providing reliable information on nuclear and radiological incidents and threats:

- he ITDB;
- he International Catalogue of Sealed Radioactive Sources and Devices (ICSRS); and
- he Unified System for Information Exchange on Incidents and Emergencies (USIE).

As a member of the Inter-Agency Committee on Radiological and Nuclear Emergencies (IACRNE), Europol also contributes to IACRNE's bi-annual Joint Radiation Emergency Plan of the International Organisations.

CBRN-E training

Because of the specific nature of CBRN threats, the organisation of national CBRN training remains a key priority for law-enforcement agencies. Europol regularly organises international CBRN-E training courses and exercises. Joint international training helps to overcome deficits in CBRN-E capabilities and ensure a more balanced approach to CBRN-E preparedness and response in the EU. The training is based on realistic scenarios and serves to increase awareness of recent threats. In addition, it allows participants to compare their response protocols and contribute to the development of common methodologies and standards. The compatibility and complementarity of response protocols are crucial for the interoperability that may be required to respond to incidents with cross-border implications or receive direct operational support from other countries.

In cooperation with the IAEA, Europol organised two training courses in 2014 and 2015 on responding to a radiological emergency resulting from a nuclear security event (see p. 12). The aim was to improve European law-enforcement agencies' preparedness and response to incidents involving nuclear and radioactive materials. The full cycle of a response to a radiological incident was covered – securing the crime scene, radiation detection, assessing hazard, contamination control, crime investigation and contaminated evidence management. The course was designed with realistic scenarios and participants had the opportunity to deal with genuine radioactive sources using radiation detection equipment. It also covered the required response to such incidents, including intensive inter-agency interaction and seeking crucial input from radiation experts. Finally, there was also a forum where participants could exchange experiences and

compare national procedures to find ideas for improving them.

EU Guide on CBRN-E Units

The *EU Guide on CBRN-E Units* contains up-to-date information on all Member State law-enforcement agencies with a role in CBRN-E security and response. The current (2014) version includes a list of authorities and their contact details, responsibilities, competences, structure and logos.

Emergency preparedness

The new BSS Directive, to be transposed into the national legislation of EU Member States by 2018, strengthens the provisions for emergency preparedness and response, in particular through a comprehensive emergency management system, and enhancing cooperation between countries, taking account of lessons learnt from the Fukushima accident. The amendment to the Nuclear Safety Directive (2014/87/Euratom) also contains enhanced measures for on-site EP&R.

The ECURIE system, which is used for exchanging urgent information during a radiological emergency, has been upgraded and modernised. It includes arrangements for the swift release of national emergency information, the rapid exchange of monitoring data and facilitating urgent audio-conferencing between Member States to assist the prompt and coordinated management of emergencies at European level. EURDEP gathers measurement data from national radiological monitoring stations across the European continent.

CBRN

As regards public health protection, the Commission and the Member States meet in the EU Health Security Committee to coordinate activities on preparedness and response to CBRN events and health threats. In order to improve this coordination, Decision No 1082/2013/EU[22] streamlines and strengthens EU capacities and structures for effectively preparing for, providing early warning of and responding to major cross-border public health emergencies.

EU CBRN resilience in civil protection

Union Civil Protection Mechanism

Since 2001, when the UCPM[23] was established to foster cooperation among national civil protection authorities across Europe, the EU has developed a robust set of instruments for disaster response, preparedness and prevention.

The UCPM was set up to enable participating countries to give coordinated assistance to victims of natural, technological and man-made disasters in Europe and elsewhere, improving overall response effectiveness. Under the Mechanism, a number of preparedness and prevention measures also address risk assessment, risk management capabilities and planning.

The current participating countries are the 28 EU Member States, Iceland, Montenegro, Norway, Serbia and the former Yugoslav Republic of Macedonia. Turkey has recently signed an agreement to join.

Emergency Response Coordination Centre

The central operational hub of the UCPM is the Commission's ERCC, which was opened on 15 May 2013.

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[22] Decision No 1082/2013/EU of the European Parliament and of the Council of 22 October 2013 on serious cross-border threats to health and repealing Decision No 2119/98/EC (OJ L 293, 5.11.2013, p. 1).

[23] Decision No 1313/2013/EU of the European Parliament and of the Council of 17 December 2013 on a Union Civil Protection Mechanism (OJ L 347, 20.12.2013, p. 924).

Any EU or non-EU country affected by a disaster that overwhelms its capacity to respond can contact the ERCC for assistance.

The ERCC aims to provide a more effective and faster EU response, whenever and wherever a disaster strikes, and on call around the clock. It collects real-time information on disasters, monitors hazards, prepares plans for the deployment of resources (experts, teams and equipment), works with participating countries to map available assets and ensures overall coordination of the EU's disaster response efforts.

It was in this framework that the Commission established the EERC, a voluntary pool of assets available for EU emergency response to different scenarios, so that sufficient capabilities are available to deal with CBRN and other incidents. Member States can voluntarily pre-commit response capacities for EU missions, building up deployable 'civil protection modules' or pre-defined sets of response resources (teams and means). These modules are self-sufficient, interoperable and can be dispatched at very short notice (generally within 12 hours of a request for assistance). Two of the 17 types of module at European level are CBRN-specific: 'CBRN detection and sampling' and 'search and rescue in CBRN conditions'.

The quality of the assistance is ensured through the use of quality criteria and a certification process.

Additional civil protection resources and expertise may be requested and mobilised to support authorities' overall response efforts. If requested, the Commission may co-finance 55 % to 85 % of the transport costs.

Due to its 27/7 capacity, the ERCC is tasked to play an important role in the ECURIE system[24]. The ERCC is receiving relevant urgent radiological information (alert notifications) from the ECURIE system and communicating it in real time through the ECURIE duty officers based in DG ENER.

In the framework of the UCPM, the Commission (DG ECHO) coordinates relevant full-scale and module exercises to test EU-level cooperation between relevant organisations, particularly first responders and health, security, radiation protection and judicial authorities. Member States contribute by participating at international level and organising local, regional and national exercises to test preparedness and response to health threats in the EU. In total, 42 large-scale pan-European simulation exercises have been financed and organised since 2002.

The UCPM also requires Member States to develop national or appropriate sub-national risk assessments, including relevant information on their risk management capability, and make them available to the Commission every three years. This process contributes to a better understanding of risks and disaster prevention in the EU and is likely to improve off-site preparedness to manage the consequences of radiological incidents or nuclear accidents.

EU CBRN Resilience Programme in civil protection

As part of its work to implement the CBRN Action Plan, the Commission launched a CBRN Resilience Programme in civil protection to support preparedness and enhance effective coordination in response to CBRN incidents. The main objectives of the Programme are to:

- streamline the work of the UCPM;
- review progress and identify gaps in civil protection programmes;
- establish suitable priorities and methods of operation; and
- identify areas of support to complement Member States' efforts.

As mentioned above, large-scale exercises, including scenarios involving radiological or

[24] In accordance with a MoU concluded between DG ENER and DG ECHO for enhancing the cooperation in case of a nuclear/radiological emergency.

nuclear incidents, are organised regularly on the basis of Member States' proposals and with the support of the Commission. To enhance the interoperability of CBRN responders, the Commission has improved the UCPM training programme by including specific CBRN components. Exchanges between experts in this area are also regularly organised via the EU Exchange of Experts in Civil Protection programme.

EU customs as a key player in the field of radiation and nuclear detection

The increase in global threats has raised the profile of EU customs as a major player in the field of external border and supply-chain security.

In August 2014, the Commission adopted a new strategy and comprehensive action plan for better customs risk management.[25] The strategy seeks to ensure that customs systems are more coherent, efficient and cost-effective in identifying and supervising supply-chain risks, so as to reflect today's realities. It identifies priority areas in which action is needed to achieve more effective and efficient EU-wide customs risk management. For each area, the action plan sets out specific action and deliverables, with clear deadlines and responsibilities. The Commission, the Member States and economic operators all have important and clearly defined roles to play in ensuring successful implementation of the strategy.

The deployment of detection technologies is central to EU customs administrations' efforts to meet their strategic challenges of effectively managing risk with available resources, combining effective and efficient controls with the facilitation of legitimate trade. DG TAXUD encourages Member States to take advantage of emerging technologies to enhance security in global supply chains. Non-intrusive inspection and radiation detection equipment is needed to inspect high-risk cargo quickly without disrupting the flow of legitimate trade.

EU customs officers operate radiation and nuclear detection portals in the main European ports and at the EU's external borders. As this requires specific knowledge and skills, DG TAXUD has launched an intensive training campaign, together with EUSECTRA in Karlsruhe and Ispra. These centres seek to be the cornerstones of an EU and international training network and to help Member States integrate such training into their own law-enforcement curricula. Customs experts from all Member States will attend five sessions between June 2015 and February 2016. The training programme is largely based on the BMWG curriculum and has been designed to meet the needs of European customs officers responsible for detecting radioactive and other nuclear materials at border-crossing points. However, the aim is to benefit all EU customs administrations in terms of preparedness, detection and response for radiation and nuclear detection and safety.

DG TAXUD seeks to ensure that all EU customs officers have access to adequate resources, equipment and training, bearing in mind the responsibilities they share with other law-enforcement agencies at external borders.

DG TAXUD, DG TRADE and the JRC have jointly reinforced export procedures for strategic (dual-use) goods, in particular through greater cooperation between competent authorities. They worked with 13 Member States to develop the SIMEX 2015 simulation exercise, which was designed to identify loopholes in current arrangements. The complex exercise focused on the EU dual-use export control regulation, as implemented in national licensing and customs services. It proved highly effective in fostering understanding, enhancing cooperation, identifying challenges and encouraging the exchange of best practices between export control stakeholders.

The SIMEX 2015 exercise complemented existing commodity identification training and initial training curricula such as the World Customs Organisation's (WCO) and coordinated operations such as the recent WCO Cosmo exercise, which was supported by an EU Priority Control Area (PCA). With the experience gained, the approach could be usefully adapted to other situations in which control processes have to accommodate trade facilitation and various work communities have to learn to cooperate, e.g. dual-use trade controls between countries granting each other licence exceptions and global licences, or CBRN border detection and response by frontline officers.

[25] COM(2014) 527.

Export control on dual-use goods in the EU

Dual-use items represent a significant proportion of EU trade with strategic partners. EU dual-use industries are made up of thousands of small, medium-sized and large companies providing high value-added jobs across a wide range of key sectors.

Dual-use controls in a nutshell

The EU's export control regime is based on Regulation (EC) No 428/2009,[26] which lays down common EU control rules and a common EU control list. The Regulation governs the export, transfer, brokering and transit of dual-use items. It is binding and directly applicable in all Member States.

The export authorisation requirement applies to items listed by multilateral export control regimes: the Australia Group (AG), the Nuclear Suppliers Group (NSG), the Wassenaar Arrangement and the Missile Technology Control Regime (MTCR).

Non-listed items may also be checked under the 'catch-all' clause if there are concerns as to their potential use in connection with a biological, chemical, nuclear weapons or ballistic missile weapons programme, or in violation of an arms embargo.

Member States may exceptionally impose additional controls on non-listed dual-use items for reasons of public security or on the basis of human rights considerations.

Dual-use items are traded freely within the EU, with the exception of the very sensitive items listed in Annex IV to the Regulation.

Types of export authorisation

The EU's export control regime provides for four types of export authorisation:

- *EU general export authorisations* (EUGEAs), which allow for export to certain destinations under certain conditions; there are currently six EUGEAs;
- *national general export authorisations* (NGEAs) issued by Member States provided that they are compatible with EUGEAs and do not refer to Annex IIg;
- *global licences* granted by Member States to individual exporters for the export of multiple items to multiple destinations or end-users; and
- *individual licences* granted by Member States for the export of one or more items to one country of destination or end-user.

Additional restrictions on the export of dual-use items may be imposed in the context of sanctions, as currently applied to North Korea, Iran, Russia and Syria.

Recent developments

The EU export control regime is dynamic and constantly adapts to developments. The list of dual-use items subject to export restrictions is updated annually; the 2015 list was adopted on 12 October 2015 and reflects decisions under multilateral export control regimes in 2014.

In addition, the Commission is conducting an export control policy review with a view to adjusting the export control regime to evolving CFSP, trade and economic, and scientific and technological developments. The Commission held a public consultation between July and October 2015 to collect stakeholder and public input on the review's objectives, the options and their likely impact. It is currently assessing the results in order to identify the most pressing issues and decide whether to propose amendments to the Regulation in 2016.

[26] Council Regulation (EC) No 428/2009 of 5 May 2009 setting up a Community regime for the control of exports, transfer, brokering and transit of dual-use items (OJ L 134, 29.5.2009, p. 1).

Nuclear and radiological security R&D activities

The Security Research programme

Under the Seventh Framework Programme (FP7: 2007-2013), about €200 million was used to fund CBRN activities. Over 50 projects were financed and implemented by consortia of Member States, scientific and technical organisations and SMEs. Horizon 2020[27] (the framework programme for research and innovation for 2014-2020) will contribute to the implementation of EU policy goals, including the Europe 2020 strategy, industrial security policy, the Internal Security Strategy, the Cyber Security Strategy and the UCPM.

The primary aim of the Horizon 2020 work programme on 'Secure societies — protecting the freedom and security of Europe and its citizens' is to enhance the awareness, preparedness and resilience of our society against natural and man-made disasters. Crisis management (including CBRN-E, natural and man-made disaster risk management) will be covered in various research topics focusing on new tools and novel solutions for protecting critical infrastructure and fighting crime and terrorism, including forensics. In the radiological and nuclear areas, control measures are covered in several topics relating to radioactive sources, including the causes and consequences of sources falling out of regulatory control, the current status of used and discarded sources in the EU and transport patterns for legal uses of radioactive sources. These objectives are backed up by the Communication on *An EU approach to the detection and mitigation of CBRN-E risks*, which addresses shortcomings in detection technology (in particular, gap analysis on the detection of CBRN materials and explosives) and encourages practical trials in areas that laboratory environments cannot reproduce. The Communication also clearly highlights the need to ensure that research takes policy and end-user needs into account.

Security is addressed in four different calls for proposals:

- Disaster-Resilient Societies (DRS), including crisis management, civil protection and critical infrastructure protection;
- Fight against Crime and Terrorism (FCT), including forensics, law enforcement capabilities and the ethical/societal dimension;
- Border and External Security (BES), including border crossing points, information management and supply-chain security; and
- Digital Security (DS), including privacy, access control, trust e-services and secure information sharing.

Towards EU CBRN-E standardisation

In 2011, the Commission issued the European Committee for Standardization (CEN), the European Committee for Electrotechnical Standardization (CENELEC) and the European Telecommunications Standards Institute (ETSI) with programming mandate 487 in response to the need to establish appropriate standards to ensure effective cross-border security within the EU, including Europe-wide interoperability of security technologies and protocols. This led to the setting-up of a CEN technical committee (TC391), with working groups on CBRN-E, crisis management and healthcare facilities. Work items for standardisation are taken mainly from the results of FP7 and H2020 research projects, but also from the JRC's applied research and the thematic areas fostered by the European Reference Network for Critical Infrastructure Protection (ERNCIP).

The JRC conducts substantial work in pre-, peri- and co-normative research, with about

[27] Council Decision 2013/743/EU of 3 December 2013 establishing the specific programme implementing Horizon 2020 — the Framework Programme for Research and Innovation (2014-2020) and repealing Decisions 2006/971/EC, 2006/972/EC, 2006/973/EC, 2006/974/EC and 2006/975/EC (OJ L 347, 20.12.2013, p. 965).

70 % of these activities relating directly or indirectly to standardisation. Particularly in standardisation for RN technologies and processes, this work is providing the European standardisation organisations with valuable input in a wide range of fields, including test protocols and performance evaluation of detection equipment (e.g. ITRAP+10), identifying and sharing good practice, and developing reference materials and calibrated samples. This expertise is being applied in the development of harmonised and reliable training resources (EUSECTRA). The Commission's work also contributes to the application of European security standards to activities linked to the EU's external security policy, e.g. through the CBRN CoE initiative.

Examples of JRC nuclear security R&D projects and activities

Euratom research and training programme

Through the Euratom framework programme for nuclear research and training activities[28] and Horizon 2020 Euratom,[29] the JRC has acquired significant expertise in various aspects of nuclear security, such as the detection of undeclared activities, the detection of the diversion of nuclear material or theft of radioactive sources associated with illicit trafficking of such material or sources, and related training. Some examples are given below.

ITRAP+10: testing radiation detection equipment to be used in the fight against illicit trafficking

The Illicit Trafficking Radiation Assessment Programme (ITRAP+10) was launched in 2009 to support a cross-cutting action in the EU CBRN Action Plan on 'establishing trialling, testing and certification schemes for CBRN detection in the EU'. The project was jointly implemented by the Commission and the US Department of Homeland Security

Domestic Nuclear Detection Office (US-DHS DNDO), in cooperation with the IAEA and the US Department of Energy (US-DoE). Its overall aim was to help EU Member State organisations to detect illegal imports, exports or transit shipments of radioactive materials by producing recommendations on the technical and functional requirements of border-monitoring equipment, so that limited resources could be deployed efficiently.

ITRAP+10 involved testing, evaluating and comparing the performance of available radiation detection equipment relevant to nuclear security against international consensus standards that would be highly beneficial to the global mission of combating illicit trafficking.

More than 70 instruments from eight families of equipment were tested. The results provided an independent assessment of the available radiation detection equipment on the market. They serve as a reference whereby regulatory and other authorities in the Member States can identify (families of) equipment to address their particular needs, and help to ensure common standards at European and international level.

Thanks to close cooperation between the partners, the programme provided a number of joint comprehensive reports describing the performance of the industry as whole against the requirements of standards. These covered

[28] Council Decision 2012/95/Euratom of 19 December 2011 concerning the specific programme, to be carried out by means of direct actions by the Joint Research Centre, implementing the Framework Programme of the European Atomic Energy Community for nuclear research and training activities (2012-2013) (OJ L 47, 18.2.2012, p. 40).

[29] Council Regulation (Euratom) No 1314/2013 of 16 December 2013 on the Research and Training Programme of the European Atomic Energy Community (2014-2018) complementing the Horizon 2020 Framework Programme for Research and Innovation (OJ L 347, 20.12.2013, p. 948).

the instruments' capabilities and limitations and showed proper usage and deployment. In addition, manufacturers received recommendations as to how to improve the performance, reliability and user-friendliness of the equipment.

ITRAP+10 Phase 2, a follow-up project that started in January 2014, involves the testing of mobile detection equipment not previously covered in the European part of ITRAP+10 and the validation of testing procedures geared to real usage conditions.

Building on the very valuable experience gained through ITRAP+10, Phase 2 paves the way to establishing a European certification scheme for border-monitoring radiation detection equipment and a network of recognised European testing laboratories. By supporting the capacities of selected Member State laboratories that could be responsible for testing and evaluating equipment, it will foster know-how and knowledge transfer in the testing of detection equipment acquired through ITRAP+10.

Phase 2 will also contribute to the development of international and European standards based on the results of Phase 1. The objective is to ensure that the suggested improvements are acknowledged by the corresponding working groups of the standardisation organisations and to maximise feedback to those organisations as they improve their standards.

EUSECTRA: strengthening nuclear security through ongoing professional development and training

Over the past two decades, the international community has noted growing security concerns with respect to the illicit trafficking of nuclear and other radioactive materials. As part of a set of measures to address these concerns, the Commission (DG HOME) asked the JRC to set up a dedicated European nuclear security training centre (EUSECTRA), as recommended in the EU CBRN Action Plan.

EUSECTRA was designed to complement national training capabilities as identified in a survey of the Member States. It offers hands-on training using a wide variety of radioactive and nuclear materials and of equipment and measurement instruments. One of the indoor training areas simulates airport conditions, with a pedestrian portal monitor and an x-ray conveyor. Outdoors, training is provided on a variety of scenarios using four different types of radiation portal monitor. Overall, more than 30 measurement and detection tools are used in the training.

Located at the JRC facilities in Karlsruhe and Ispra (Institute for Transuranium Elements), EUSECTRA serves as a platform for knowledge transfer and networking between experts. It provides a unique combination of scientific expertise, specific technical infrastructure and a wide range of nuclear material. The training programme offers a unique opportunity for trainees to handle actual materials and equipment in realistic scenarios. In particular, 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 hands-on training in detection, categorisation and analysis.

EUSECTRA courses include border detection, 'training the trainers', equipment maintenance, national response plans, core and advanced nuclear forensics capabilities, radiological crime scene management and nuclear security awareness. In addition, EUSECTRA continues to run training on safeguards.

The Centre was inaugurated on 18 April 2013 and its unparalleled facilities attract a steadily increasing demand for training. Since its official launch, it has hosted trainees from over 70 countries. It has been used by various institutions, including DG TAXUD (frontline officers training on radiation detection techniques; five sessions for customs experts from all Member States between June 2015 and February 2016) and DG ENER, and also for courses under the US Second Line of Defence programme. DG HOME is planning to organise a EUSECTRA training course for law-enforcement officers. Most Member States have taken part in EUSECTRA courses.

EUSECTRA benefits from the experience and cooperation of BMWG and ITWG experts in drawing up comprehensive training programmes, comprising practical and tabletop exercises, for frontline officers, first responders, measurement expert support teams and nuclear forensic experts. Reference and standardised training materials have been developed in close cooperation with international experts (e.g. from the IAEA, the US-DoE, the Netherlands' Nuclear Forensics Institute and France's *Commissariat à l'énergie atomique et aux énergies alternatives* (CEA)) to integrate available modules into a coherent and comprehensive set of courses covering both detection and response.

With the support of Member States and international partners, EUSECTRA constantly adapts its approach to combine national and regional capabilities as effectively as possible. The trainers are from Commission services, Member State authorities, international organisations and non-EU countries. EUSECTRA can help Member States by integrating nuclear security related training into established law-enforcement curricula.

Some jointly developed curricula (e.g. in nuclear detection), already used in regular training provided by BMWG members, target cascade ('train the trainer') systems involving training of a small group who then pass their know-how on to the national workforce. This cooperative approach to joint training and dissemination of expertise contributes directly to nuclear security capacity-building under the Nuclear Security Summit process.

Nuclear forensics

The JRC became involved in the first cases of illicit trafficking of nuclear material 25 years ago, essentially due to its unrivalled expertise and unique facilities for handling and analysing such material and its in-depth knowledge of the nuclear fuel cycle. The branch of science dealing with the investigation of nuclear security events and the thorough examination of the intercepted material is often referred to as 'nuclear forensics'. Over the years, significant effort has been put into advancing this discipline and analytical and interpretational techniques have been developed or optimised. The JRC is now a leader in this area, with activities including R&D, actual case work, international cooperation and capacity-building measures (including training).

Member States continue to detect nuclear and other radioactive material not covered by regulatory control. Nuclear materials pose not only a radiological hazard, but are indicative of nuclear proliferation or (potentially) terrorism. Therefore, such incidents often require detailed nuclear forensic investigation in order to determine the history, origin and intended use of the material. This information provides investigative leads to law enforcement in response to criminal acts and serves as a basis for action by the IAEA and the Member State(s) in which the seizure occurred.

Overall, nuclear material detected and seized in more than 50 incidents has been examined, providing support to competent authorities in Member States and beyond. In the past two years, JRC (Institute for Transuranium Elements) laboratories have analysed samples of uranium (of various degrees of enrichment) arising from 10 nuclear security events.

The toolset and methodology for nuclear forensic analysis have been steadily improved through a dedicated R&D programme. Recently, the JRC established that some trace elements (neodymium and sulphur) and their isotopic composition could be used as indicators of the origin and chemical processing of natural uranium. A detailed study on samples from uranium mining and milling facilities (conducted under the Commission's programme of support for the IAEA) showed which characteristic trace element patterns are propagated when uranium is chemically processed.

A comprehensive investigation was carried out on a large set of uranium ore concentrate samples from mines around the world. This cooperative effort resulted in a unique compilation of data characterising 'yellow cake' samples. The data were passed on to the IAEA (again in the framework of the Commission's support programme).

The JRC continues to support the IAEA by sharing its expertise in consultant group meetings on specific technical or conceptual topics. It also contributes to the IAEA's coordinated research programme on nuclear forensics. Most importantly, in the framework of the CBRN Action Plan, the Commission funded a project for improving the usefulness of the ITDB, which the JRC implemented in close consultation with Member States and the IAEA. The project resulted in an improved secure web-based reporting tool and a 'best practice document' for national ITDB contact points.

The JRC, together with the United States, continues to co-chair the ITWG, aiming to develop a common approach and effective technical solutions for unlawful or criminal incidents involving nuclear or other radioactive material (see p. 37). In 2015, the ITWG completed its fourth 'collaborative material exercise', in which 20 laboratories from around the world demonstrated their nuclear forensic capabilities, with the JRC hosting the data evaluation meeting.

Another important international activity to which the JRC is contributing is GICNT, in particular its nuclear forensics and nuclear detection working groups. In this framework, in 2015, the JRC hosted the nuclear detection and forensics workshop and tabletop exercise 'Radiant City' (see p. 42).

Capacity-building and knowledge-sharing remain important fields of activity, funded by CBRN CoEs (for non-EU countries) and the CBRN Action Plan (for Member States). A number of workshops, seminars and training sessions have been held to improve partner countries' nuclear detection and response capabilities.

Improving the interface between science and policy in nuclear security and across the disaster risk management cycle has led to the development of dedicated Commission's initiatives: the Disaster Risk Management Knowledge Centre[30], launched in 2015, serves as a reference for strengthened science-policy interface in an all-hazards approach to disaster risk management. A dedicated Community of Users on disaster risk and crisis management focuses on improving access and dissemination of security research, building on Horizon 2020 Research in this field.

[30] http://dmkc.jrc.ec.europa.eu/

EU nuclear security activities outside Europe

Activities under the Instrument contributing to Stability and Peace

Since the mid-1990s, the EU has developed an increasing number of tools to help preserve peace and enhance international security. Today, there is a general consensus in Europe and elsewhere that the EU should continue to strengthen its role in these areas, *inter alia* by helping its partner countries with capacity building.

Through the IcSP, the EU provides direct assistance and runs long-term capacity-building projects to improve response to situations of crisis or emerging crisis, prevent conflicts, contribute to peace-building and crisis-preparedness, and address global, trans-regional and emerging threats that have a destabilising effect (e.g. terrorism, organised crime, illicit trafficking, threats to critical infrastructure, climate change, sudden pandemics and CBRN risks).

CBRN risks, be they of natural, accidental or criminal origin, represent a key threat to the security and health of human beings, the environment and critical infrastructures. They are likely to transcend national and regional frontiers. Promoting a culture of CBRN safety and security, from prevention to consequence management, is a prerequisite for development and stability.

The EU has adopted a series of policy decisions that focus on enhancing nuclear security and non-proliferation worldwide. These are closely connected to the EU's CFSP and reflect international developments in this area. In line with these policies, the EU has funded a significant number of outreach, support and capacity-building projects in the area of nuclear safeguards, non-proliferation and nuclear security.

EU CBRN Centres of Excellence initiative

The security threat being of a global, multi-dimensional and cross-border nature, CBRN risks cannot be dealt with in isolation. Areas of concern for the EU and its partner countries include disease surveillance, waste management, emergency planning, early warning, civil protection, export controls on dual-use goods and the cross-border trafficking of CBRN materials. The shift in the nature of risks and threats calls for a comprehensive approach to CBRN risk mitigation to ensure an adequate response.

The EU promotes a culture of CBRN safety and security within the EU and internationally. Accordingly, the IcSP contributes to international efforts to mitigate CBRN risks, whether of natural (e.g. pandemics, volcanic eruptions), accidental (Fukushima) or criminal (trafficking, terrorism) origin, following a consistent 'all hazards' approach. The aim is twofold: to prevent CBRN incidents and to build partners' capacities for emergency responses to such incidents.

In order to ensure the necessary consistency in the approach, particularly due to the highly specialised nature of CBRN-related cooperation, IcSP assistance in this area will continue to be primarily (but not exclusively) delivered through the EU CBRN CoE — an EU initiative that has been welcomed by the UN Security Council and the G7 Global Partnership.

Through the CoE initiative, the EU contributes to CBRN capacity-building in other countries (with eight regional secretariats covering 56 states and another 25 countries looking to join) in order to mitigate risks resulting from criminal, industrial or natural accidents. The initiative is being taken forward jointly by the European External Action Service (EEAS) and the Directorate-General for International

Cooperation and Development (DG DEVCO), and implemented by the JRC and the UN's Interregional Crime and Justice Research Institute (UNICRI). Lessons learned from Fukushima, the Ebola crisis in western Africa and the destruction of chemical weapons in Syria have demonstrated the advantages of regional cooperation. Thanks to the CoE initiative, needs assessments are being carried out and national action plans are being established that help to strengthen countries' capacity to mitigate current and future CBRN risks and threats.

The Foreign Affairs Council called for the CoE network to be used to implement other EU external assistance programmes and instruments. It also noted the importance of reinforcing existing links between the EU's internal and external policies on CBRN. The consistency between the EU CBRN Action Plan and the CoE initiative can only help in the fight against illicit trafficking and terrorism.

Building global CBRN risk mitigation capacities

The CoE initiative provides a platform for voluntary regional cooperation on all CBRN-related hazard issues. Participating countries work bottom-up to identify risks, assess gaps and needs, draw up national CBRN action plans and collectively agree on activities or projects to be taken forward at regional level. Regional secretariats, national focal points and CBRN teams, representing most of the relevant governmental stakeholders, work towards enhancing this cooperation.

Use of the CoE network will reinforce the synergies between CBRN risk mitigation and related topics such as nuclear safety, security, climate-change mitigation and export controls on dual-use items.

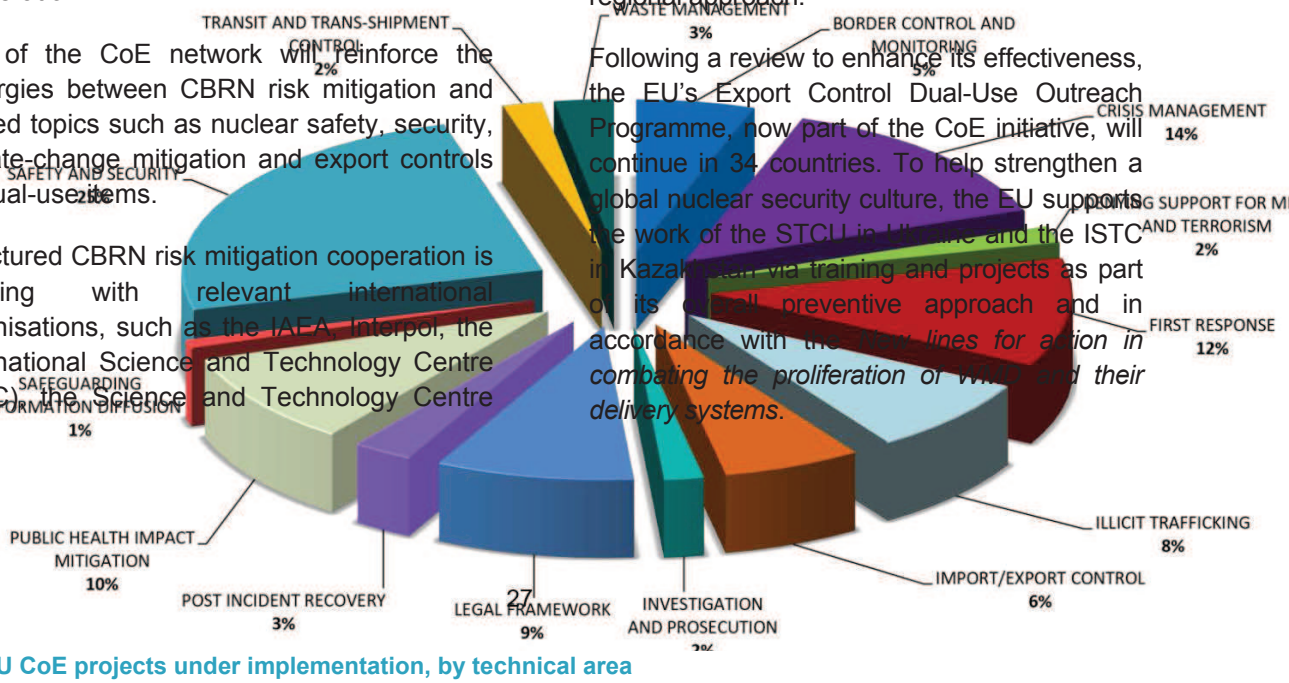
Structured CBRN risk mitigation cooperation is ongoing with relevant international organisations, such as the IAEA, Interpol, the International Science and Technology Centre (ISTC), the Science and Technology Centre (STCU), the Organisation for Security and Cooperation in Europe (OSCE), the World Health Organisation (WHO), the World Customs Organisation (WCO), the Organisation for the Prohibition of Chemical Weapons (OPCW) and other fora such as the UN 1540 Committee, the Global Health Security Initiative (GHSI), the Association of South-East Asian Nations (ASEAN) Regional Forum (ARF), particularly where their geographical reach exceeds that of the CoE. Such cooperation aims to involve these organisations in capacity-building to mitigate CBRN risks, enhance complementarity and avoid duplication of effort.

Export control and the fight against trafficking in dual-use technologies and CBRN materials

The EU is committed to strengthening export control policies and practices within the EU and beyond, *inter alia* by providing non-EU countries with technical assistance in the field of export controls on dual-use goods and technologies, including CBRN materials.

Reinforcing the fight against the illicit trafficking of CBRN materials and deceptive financial practices is also an IcSP objective. Dual-use export control cooperation programmes under the previous instrument (the IfS), involved about 30 countries around the world, in areas such as legal and regulatory framework, institutional capacity-building, import/export licensing and border control. This cooperation is extended and reinforced under the IcSP, moving from a country-oriented to a wider regional approach.

Following a review to enhance its effectiveness, the EU's Export Control Dual-Use Outreach Programme, now part of the CoE initiative, will continue in 34 countries. To help strengthen a global nuclear security culture, the EU supports the work of the STCU in [illegible] and the ISTC in Kazakhstan via training and projects as part of its overall preventive approach and in accordance with the *new lines for action in combating the proliferation of WMD and their delivery systems*.



EU CoE projects under implementation, by technical area

Other RN outreach activities

EU support for RN security in South-East Asia

The JRC is tasked with a large border-monitoring project in South-East Asia, the objectives of which are to enhance detection at border crossings, support capacity-building in the selected countries (Cambodia, the Philippines, Thailand and Laos) and involve the other ASEAN countries (Indonesia, Myanmar, Singapore, Malaysia, Brunei and Vietnam) in regional initiatives. Under the project handheld detectors for nuclear security detection have been deployed to Cambodia, the Philippines, Thailand and Laos and a contract has been concluded for the installation of radiation portal monitoring (RPM), supplied by US-DoE, at the Philippines Nuclear Research Institute's training centre. Firstline operators at Phnom Penh Autonomous Port (Cambodia) and their trainers will be trained following the installation there of new RPMs by the US-DoE. Two 'train the trainer' courses have been conducted (in 2014 and 2015) to ensure the sustainability of the nuclear security detection architecture. Also, support has been provided for the development of standard operating procedures (SOPs) in the form of site surveys, stakeholder meetings and theoretical and practical SOP reviews (using realistic scenarios). Four First Line Officers hands-on training sessions and two awareness seminars have been conducted in the region. Finally, the Commission co-funded a joint Malaysian-Thai field training/tabletop exercise, supporting the involvement of all six Thai participants and inviting observers from seven countries in the region (Cambodia, Indonesia, Laos, Myanmar, Singapore, Vietnam and the Philippines) in order to strengthen regional collaboration and promote a harmonised regional approach. For 2016, the JRC is preparing COSINUS, a simulation exercise involving 10 countries in the region that will use various scenarios to test and improve internal (i.e. inter-authority) and external (i.e. international) communications/cooperation during nuclear security detection events (see p.42).

EU support for nuclear security capacity-building in the Democratic Republic of Congo

The main objective of this EU project, launched in 2013, is to help the Democratic Republic of Congo (DRC) build capacities to counter the illicit trafficking of nuclear and radioactive materials. The main activities have included assessing the country's nuclear security needs, technical visits, awareness-raising meetings for senior officials and supplying equipment for the detection of nuclear and other radioactive materials. The latter included the necessary training for the proper use of the equipment and delivery of relevant documentation, certification of instruments, and warranty and after-sales services. The equipment falls into two categories:

- 150 personal radiation dosimeters (PRDs or pagers) that will allow duty officers to detect radioactive and nuclear materials (i.e. both gamma and neutron) and provide a timely indication of the level and type of radiation for the safety of persons; and
- 15 radiation isotope identifiers for locating sources of emitted (neutron and gamma) radiation and categorising the sources (e.g. as industrial, medical and naturally occurring radioactive materials).

In December 2013, a training course was held at the JRC in Ispra for 20 senior DRC officials, to raise their awareness of nuclear security.

In June 2014, the manufacturers officially handed over the equipment at a media-covered event attended by the head of the private office of the Minister for Education and Research and strongly supported by the EU Delegation. The EU will maintain its efforts to develop sustainable nuclear security arrangements in DRC and the wider region in cooperation with other international donors.

Nuclear security support in Central Asia: example of the Republic of Tajikistan

EU-Tajikistan cooperation in this field started five years ago and has been closely coordinated with other international organisations and partners such as the IAEA and the US Government.

The Commission (JRC) has implemented a nuclear security project in Tajikistan in support of the EU's security initiatives and peace-building activities. The project started with a needs assessment, technical field visits and prioritising borders to be equipped, in cooperation with the Tajik authorities. Six road and railway border crossings with Uzbekistan and Afghanistan are now equipped with RPMs, supported by a mobile laboratory, which will allow customs authorities to detect radioactive materials. JRC experts have provided Tajik customs officers with advanced nuclear security training at JRC premises in Ispra and at the Tajik borders, including a workshop at national level.

The project was funded by the EU's IfS and has enhanced the Tajik authorities' capacity for radiological and nuclear risk mitigation. The IcSP continues to provide short-term assistance in countries struck by unfolding crisis, or long-term support to mitigate risks, addressing global and trans-border threats, and building capacity for lasting socio-economic development. The JRC support for Tajikistan is also informed by the EU's strategy against the proliferation of WMD, which assists non-EU countries and strengthens the international system of non-proliferation.

Support for Mediterranean countries

TaskMED is a €4 million IfS project that aims to combat the illicit trafficking of nuclear material and other radioactive material in the Mediterranean basin. The beneficiary countries are Algeria and Morocco.

The main activities under TaskMED are:

- deployment of a stationary RPM, mobile detection systems that can be loaded onto vehicles or planes and are suitable for special events (e.g. sports or political gatherings) and hand-held detection equipment; these complement the national detection architectures and response plans developed under TaskMED. The airports of Algiers and Casablanca and the port of Algiers will also be equipped with RPMs and other complementary equipment;
- the training of trainers of frontline officers, to ensure sustainability; and
- the training of end-users and experts on the use and maintenance of each category of equipment.

The activities will be completed by July 2016, when high-profile inaugurations are expected to take place.

EU support for the IAEA

Support to the Nuclear Security Division

The EU has stepped up its support for the IAEA, *inter alia* through the promotion of nuclear security worldwide. It remains a key donor to the Nuclear Security Fund, with nearly €40 million committed since 2004 to strengthen nuclear security in over 100 IAEA member states.

The Council of the EU adopted its strategy against the proliferation of WMD in 2003. The EU has signed six contribution agreements with the IAEA to provide CFSP financial support for its nuclear security and verification activities. These help the countries in question to strengthen their nuclear security infrastructure. The EU and the IAEA closely coordinate their support in this field (provision of detection equipment and training) via several channels, including the BMWG (see p. 37).

The latest Council Decision for EU support for the IAEA (2013/517/CFSP) commits €8.05 million in support for nuclear security measures all around the world, including:

- sustainability and effectiveness of support provided through earlier joint actions and Council decisions;[31]
- strengthening countries' nuclear security support infrastructure; establishing national nuclear security support centres;
- strengthening countries' legislative and regulatory framework as regards nuclear and other radioactive material to enable them to fulfil their national and international obligations;
- strengthening nuclear security systems and measures for the use, storage and transport of nuclear and other radioactive materials and their related facilities;
- strengthening countries' institutional infrastructure and capabilities for dealing with nuclear and radioactive materials not covered by regulatory controls;
- supporting awareness of, and strengthening countries' response and resilience to, cyber-crime impacting nuclear security; and
- developing additional laboratory capacity to support the evaluation of industrial control and electronic system-level technologies to identify vulnerabilities to nuclear-related cyber-crime, exploiting and increasing awareness of such issues (including through participation in regional exchanges) and the use of compensatory or remedial measures.

With EU support, the IAEA has been active *inter alia* in helping countries improve their ability to control radiation sources and bring lost, missing or stolen sources back under institutional control, by training staff in regulatory bodies and law-enforcement organisations in checking the use of sources in all types of activity, from medicine to industry.

Source recovery has been a theme in all EU-IAEA joint actions, underscoring the continuing need to improve control and regulatory measures. Source recovery projects have been implemented since 2005, with a wide variety of facilities and involving highly radioactive sources being transported either to national safe and secure storage or repatriated to their countries of origin.

All joint actions have involved significant protection upgrades of installations and facilities to ensure that radioactive material is kept safe and secure.

With EU funding, RPM or hand-held detection equipment has been provided for border

[31] 2004/495/CFSP (IAEA I), 2005/574/CFSP (/IAEA II), 2006/418/CFSP (IAEA III), 2008/314/CFSP (IAEA IV) and 2010/585/CFSP (IAEA V).

controls and, backed up with appropriate training, has helped many countries make their nuclear security measures more robust.

To encourage more countries to sign up to the CPPNM, as amended, or to develop and adopt comprehensive and coherent legislation, the EU also supports the provision of expert advice through IAEA appraisal services such as the International Nuclear Security Service (INSServ), the International Physical Protection Advisory Service (IPPAS) and the International Advisory Service on Systems of Accounting for and Control of Nuclear Material (SSAC).

In addition, the EU provides the IAEA with technical support through numerous consultancies, technical guidance on nuclear detection and forensics, contributions to IAEA training activities, the development of training syllabi, approaches such as 'core capabilities in nuclear forensics' and participation in coordinated research on the detection and analysis of seized samples.

In illicit trafficking control, the EU and the IAEA implemented a joint project aimed at improving the usability of the ITDB. Follow-up activities will focus on training, capacity-building and further improving data security and communication protocols.

The EU and the IAEA have continued to coordinate their support for other countries in the field of nuclear security. The first EU-IAEA annual senior officials' meeting (SOM) was held on 25 January 2013 in Brussels. The EEAS, Commission/Euratom and IAEA representatives decided *inter alia* to coordinate their action further, in particular in the field of nuclear security. The overall goals are to ensure and exploit complementarity and avoid overlap between the parties' activities, including the EU's CoE initiative. In December 2013, the EU and the IAEA concluded a Practical Arrangement on Nuclear Security, which deals with technical aspects of their cooperation. Further EU-IAEA SOMs were held in Luxembourg on 4 February 2015 and Vienna on 21 January 2016.

Support for IAEA nuclear safeguards and other security activities

Multilateral nuclear assurances

To support multilateral nuclear assurance initiatives, a contract has been signed with the IAEA on a €20 million IfS contribution to the procurement of Low Enriched Uranium for the Bank for the Utilisation of Nuclear Energy. The LEU Bank in Kazakhstan, owned and managed by the IAEA, will supply countries introducing civil nuclear programmes with secure nuclear fuel, thus limiting proliferation risks. For the participant countries, the scheme will reduce the risks of politically motivated fuel supply disruption.

The idea of taking a multilateral approach to the nuclear fuel-cycle is decades old. An IAEA-controlled nuclear fuel bank is essential to reducing global nuclear dangers, because the same enrichment technology (e.g. centrifugation) can be used to produce both LEU for nuclear power reactors and HEU for nuclear weapons. Thus, multilateral approaches to the nuclear fuel-cycle in general and the creation of a nuclear fuel bank in particular could promote the peaceful use of nuclear energy. They also provide the international community with additional assurance that the sensitive parts of the nuclear fuel-cycle are not unduly disparate and are thus less vulnerable to misuse for non-peaceful purposes.

EU support to the nuclear fuel bank is subject to its compliance with basic criteria such as market compatibility, security of supply, consistency with existing international non-proliferation treaties and agreements, and the absence of any proliferation impact.

Based on a Council decision, a further CFSP contribution of up to €5 million for security-related costs (e.g. containers for secure transport and storage) will be provided.

EU contribution to enhancing the capabilities of IAEA safeguards analytical services (ECAS project)

On 23 September 2013, the IAEA's new nuclear material laboratory (NML) was inaugurated in Seibersdorf (Austria). The 'NML – enhancing the capabilities of safeguards analytical services' (ECAS) project comprises the IAEA clean laboratory extension, the construction of the NML and the Seibersdorf site infrastructure, and security upgrading.

The NML will bring together, in a single building, analytical activities currently carried out in various buildings at Seibersdorf. It will have state-of-the-art facilities for the analysis of uranium, plutonium, spent fuel and high-activity liquid waste samples, and for archiving samples safely and securely. In addition, the project will provide training facilities for safeguards inspectors and visiting Member State laboratory staff.

The Commission (DG DEVCO and JRC) and the EEAS have cooperated closely and successfully on the ECAS project since 2010. A €10 million IfS donation has supported the construction and equipping of:

- a plutonium laboratory area;
- a thermal ionisation mass spectrometry laboratory area;
- a trace and impurities laboratory area;
- a hot environmental samples laboratory area;
- a low-level laboratory area; and
- sample logistics areas.

At the request of the EEAS and DG DEVCO, the JRC provided technical and scientific advice within its area of expertise to identify the appropriate activities and the most efficient way to use the EU contribution.

The European Commission's cooperative support programme (EC-SP)

The European Commission Cooperative Support Programme (EC-SP) was established in 1981 and continues to provide a framework for technical support to the IAEA in the field of nuclear safeguards. The EC-SP has been involved in over 134 tasks in various technical and application areas, with 40 tasks ongoing in 2015.

Work areas include:

- measurement techniques, including destructive analytical techniques, particle analysis and non-destructive assays;
- development of reference materials and particles targeted to safeguards needs;
- containment, surveillance and sealing/identification techniques;
- process monitoring techniques;
- concepts, approaches and methodologies;
- information collection and treatment, including analysis of trade data; and
- training of inspectors, jointly with Euratom inspectors or targeted to IAEA needs.

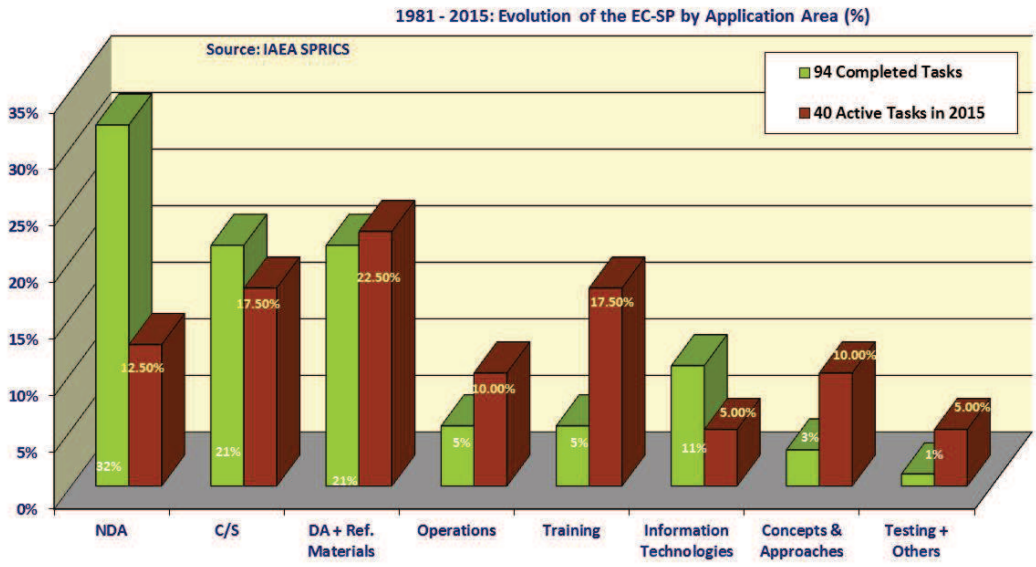
The JRC operates the EC-SP in close cooperation with DG ENER, which is in charge of implementing the Euratom safeguards system.

Cooperation with other support programmes

The EC-SP fosters active cooperation with Member States' support programmes with a view to addressing the needs expressed by the IAEA. This can take the form of joint tasks or organising dedicated technical meetings together. Around 30 % of EC-SP tasks are executed jointly or in close cooperation with Member States, that are also regularly invited to participate in EC-SP annual review meetings.

Areas of activity

The chart below shows the development of the EC-SP over the years, comparing the technical/application profile of all completed tasks with the current ongoing tasks. There is a substantial increase in tasks associated with supporting IAEA operations, training, and safeguards concepts and approaches.



Distribution of EC-SP ongoing and completed tasks in the safeguards technical and application areas

Recent highlights

In recent years, six JRC-developed technological systems have been approved for IAEA safeguards use under 'category A equipment' technologies, which is a major achievement for the EC-SP. These are:

- the 'combined procedure for uranium concentration and enrichment assay' (COMPUCEA);
- the 3D laser range finder (3DLR);
- ultrasonic seals;
- the laser item identification system (L2IS);
- 3D laser surface mapping of canister closure welds (LMCV); and
- the ultrasonic optical sealing bolt (UOSB).

EU special effort in support of the Comprehensive Nuclear Test Ban Treaty

The Comprehensive Nuclear Test Ban Treaty (CTBT) plays a central role in underpinning international non-proliferation arrangements and the EU's global disarmament efforts. The EU is therefore strongly committed to its entry into force and universalisation, and supports the activities of the Preparatory Commission of the CBTO Organisation (CTBTO). The EU is one of the largest providers of voluntary funds to the CTBTO, with total contributions of around €19 million since 2006, benefiting its work mainly as regards:

- technical assistance and integrated capacity-building to allow beneficiary regions to establish and increase expertise in their own national data centres and contribute to the CTBT verification system;
- education and outreach activities;
- enhancing its atmospheric transport modelling capabilities;
- support for the improvement of on-site inspection capabilities;
- characterisation and mitigation of radioxenon to help make the CTBT;
- monitoring and verification system more robust; and
- maintaining a network of certified auxiliary seismic stations.

IAEA and the implementation of JCPOA with Iran

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On 14 July 2015, the E3/EU+3 (China, France, Germany, the Russian Federation, the United Kingdom and the United States, with the High Representative of the European Union for Foreign Affairs and Security Policy) and the Islamic Republic of Iran reached an agreement on a Joint Comprehensive Plan of Action (JCPOA). The full implementation of this JCPOA will ensure the exclusively peaceful nature of Iran's nuclear programme.

The IAEA has an essential and independent role and is requested to monitor and verify the implementation of the voluntary nuclear-related measures as detailed in the JCPOA.

Other international cooperation

International cooperation is crucial in nuclear security and the EU carries out a wide range of initiatives in close cooperation with key partners in the field, such as the G7 Global Partnership Programme against the spread of weapons and materials of mass destruction, the GICNT, the UNSCR 1540 Committee and (with the United States and the IAEA) the BMWG.

The JRC is a key pillar of EU´s technical expertise in the field of nuclear safeguards and the fight against the illicit trafficking of radioactive and nuclear materials. It also develops training programmes for first responders and experts in EU and non-EU countries in the field of safeguards, nuclear detection, forensics and response.

UNSCR 1540 (and 1977)

In line with the EU strategy against the proliferation of WMD, which seeks to foster the role of the UN Security Council and enhance its expertise in meeting the challenges of proliferation, the EU supports the implementation of UNSCR 1540 (2004) and its extension decision 1977 (2011).[32] In this context, it has implemented Council Decisions 2006/419/CFSP (EU contribution of €195 000), 2008/368/CFSP (€475 000) and 2013/391/CFSP (€750 000).

The UNSCR 1540 Committee plans to devote this EU funding to a number of activities, including:

- support for relevant national and regional efforts and capabilities, primarily through capacity-building and assistance facilitation;
- contributing to the implementation of specific recommendations in the 2009 comprehensive review of the implementation status of UNSCR 1540, in particular in the areas of technical assistance, international cooperation and raising public awareness; and
- initiating, developing and implementing national action plans at countries' request.

G7 global partnership

The EU continues to be an important contributor to the G7 Global Partnership. Under the IfS (2007-2013), it spent around €300 million with various other countries on chemical, biological, radiological and nuclear risk mitigation. Global Partnership activities include assistance on nuclear security, engaging qualified scientists, export controls, border monitoring, fighting illicit financing, biosecurity and, more generally, countering the illicit trafficking of nuclear and radiological materials.

Global Initiative to Combat Nuclear Terrorism (GICNT)

The EU and its Member States remain active on the international stage in the field of nuclear security. One example of this is the GICNT, which aims to strengthen global capacity to prevent, detect and respond to nuclear terrorism through multilateral action to strengthen partner nations' plans, policies, procedures and interoperability.

The GICNT is chaired by the United States and Russia. EU Member States play a significant role by chairing working groups or organising exercises (e.g. the Mystic Deer workshop and tabletop exercise in Hungary, October 2014; the Glowing Tulip international conference and mock trial on nuclear forensics in the Netherlands, March 2015; the Blue Raven workshop and exercise in the UK, November 2015).

Since its launch, the GICNT has grown into a partnership of 86 nations and five official observers: the IAEA, the EU, Interpol, the UN Office on Drugs and Crime (UNODC) and UNICRI.

[32] As adopted by the Security Council at its 6518th meeting (20 April 2011); http://daccess-ods.un.org/access.nsf/Get?Open&DS=S/RES/1977 %20(2011)&Lang=E&Area=UNDOC.

The GICNT has a unique ability to combine policy, technical and operational resources to enhance partners' capabilities to address difficult and emerging nuclear security challenges.

The EU is strongly committed to making a tangible and constructive contribution to GICNT activities in order to improve international cooperation so as to advance technical nuclear forensics capabilities, information-sharing mechanisms and the training and education of personnel working in the field of nuclear security. In support of GICNT objectives, the EU has made remarkable progress through the CBRN Action Plan (EUSECTRA, Radiant City, ITRAP+10, ITDB), its support on UNSCR 1540, the CBRN CoE initiative, Euratom safeguards and cooperation with the IAEA, support for the IAEA Nuclear Security Fund, and the adoption of the 2013 BSS Directive. It has also been active in all areas covered by the GICNT Implementation and Assessment Group (IAG), i.e. nuclear detection, nuclear forensics, and response and mitigation.

Euratom agreements

Euratom's international nuclear cooperation agreements, covering trade in nuclear materials and equipment, require the parties to adhere to the strictest international standards in physical protection and nuclear export controls. This reflects Euratom's policy of encouraging the responsible use of nuclear energy by countries that choose to include nuclear power in their energy mix.

In 2010, Euratom and US-DoE signed a new agreement in the field of R&D on nuclear safeguards and security, replacing the previous (1995) agreement. New areas of cooperation were identified (in addition to aspects of nuclear safeguards R&D), such as export control, border monitoring and nuclear forensics. Cooperation in nuclear forensics includes plutonium and uranium chronometry and morphology, and joint training and workshops. Cooperation in export control focuses on visual taxonomy tools and strategic capacity-building. In addition, US-DoE and Euratom decided to enhance coordination to cooperate with other countries and relevant international organisations to improve nuclear security.

Close cooperation has been developed with Russia, mainly under the EU Technical Assistance to the Commonwealth of Independent States (TACIS) programme. This has led to the implementation of many projects in the fields of nuclear material accountancy and control, and combating the illicit trafficking of nuclear materials, including nuclear forensics.

The scope of cooperation with the Japan Atomic Energy Agency has been widened to include (in addition to nuclear safeguards) activities in the field of nuclear security detection and forensics. Nuclear security training, mainly in relation to Japan's recently established nuclear security support centre, represents an important area of cooperation. Euratom and the Japan Atomic Energy Agency have agreed to enhance their joint outreach cooperation.

Reinforced cooperation on nuclear security (strengthening international non-proliferation and related export control arrangements, and combating the smuggling of nuclear material) is identified as an objective in the EU-China 2020 Strategic Agenda for Cooperation, which was adopted in 2013. In 2011, Euratom and China started implementing the Euratom/China research cooperation through the R&D PUNE (Peaceful Uses of Nuclear Energy) agreement. Under the activities of the Subcommittee on nuclear security and safeguards (one of the four subcommittees implementing the aforesaid agreement), several areas of cooperation have been defined, including in the context of the China Centre of Excellence for Nuclear Security focusing on testing of detection equipment and provision of joint training courses.

Furthermore, there are Euratom research Cooperation Agreements focused on nuclear safety with Russia (2002), Ukraine (2002), Kazakhstan (2003) and the US Nuclear Regulatory Commission (2009), which also include security in their scope. Finally, the European Safeguards Research and Development Association (ESARDA)[33] and the Institute of Nuclear Materials Management

[33] http://esarda2.jrc.it/about/index.html.

(INMM)[34] provide platforms for technical cooperation, exchange and convergence on nuclear safeguards and nuclear security, including nuclear forensics.

[34] http://www.inmm.org/About_INMM.htm.

International working groups on nuclear issues

Border Monitoring Working Group

The BMWG is an important international forum for discussion on strengthening global capacity to combat the illicit trafficking of nuclear and other radioactive materials.

It was formally established in 2005 in order to promote cooperation between the IAEA, the EU (represented by the JRC and the EEAS) and the US Government. It serves as a forum for discussion and the exchange of information on nuclear security capacity-building plans, helping to optimise the use of resources and coordinating projects in cooperation with involved countries.

More recently, the BMWG's mission has shifted towards the implementation of joint projects in the specific area of nuclear forensics.

The BMWG is a proven framework for cooperation and the coordination of assistance on nuclear security. Its main activities are:

- sharing information on individual support programmes;
- coordinating activities in the areas of equipment deployment, training and sustainability;
- conducting joint assessment missions in various regions to ensure common approaches to assistance and support;
- implementing joint projects in various regions in the world; and
- cooperating on certain R&D aspects of radiation technologies.

Nuclear Forensics International Technical Working Group

Founded in 1995, the ITWG gathers nuclear forensics practitioners (including scientists and law enforcement and regulatory authorities) from over 35 countries and international organisations, including the IAEA, Euratom, Interpol, Europol and UNICRI.

It is open to all countries interested in nuclear forensics. The G7 has encouraged the ITWG to extend its international membership to countries directly affected by the illicit trafficking and proliferation of nuclear and radiological materials.

The ITWG develops guidelines and conducts intercomparison exercises and outreach is a primary goal. In addition, exchanging experience and international cooperation are very important for advancing nuclear forensic science and thus for sustainable success in combating nuclear trafficking, terrorism and proliferation.

Synergies between nuclear safety, security and safeguards

Nuclear safety

Euratom currently addresses nuclear safety through three main directives:

- the BSS Directive;
- the Nuclear Safety Directive; and
- the Nuclear Waste Directive.

The BSS Directive, the precursor of all Euratom secondary legislation on nuclear safety, was adopted in 1959. Its latest (2013) update, which Member States have to transpose into national law by 2018, represents state-of-the-art legislation to ensure the highest level of health protection for 'nuclear workers', members of the public and medical patients against the dangers arising from ionising radiation. It is based on the most recent scientific findings in the field of radiation protection.

The first Nuclear Safety Directive, adopted in 2009, made international safety principles legally binding and enforceable by EU Member States. It was amended in 2014 to reflect lessons learned from the Fukushima accident, the results of 'stress tests' on EU nuclear installations and recent technical developments. More specifically, it:

- introduces a high-level EU-wide safety objective to prevent accidents and avoid radioactive releases;
- establishes a European system of peer reviews on specific safety issues every six years;
- further strengthens the independence of national regulatory authorities;
- increases transparency on nuclear safety by informing and involving the public;
- regulates on-site EPR; and
- promotes an effective nuclear safety culture.

Member States have to transpose it by August 2017.

The "Nuclear Waste" Directive on Responsible and Safe Management of Radioactive Waste and Spent Fuel applies a comprehensive approach to the safety of radioactive waste and spent fuel, including management of disused sealed sources that are not returned to the supplier and are declared as radioactive waste. It sets legally binding and enforceable requirements for managing radioactive waste and spent fuel. Member States are to establish national policies and national legislative and regulatory frameworks for responsible and safe management of spent fuel and radioactive waste and ensure transparency. National programmes have to be set up to implement these policies and adequate financial resources must be made available. Concepts or plans and technical solutions for spent fuel and radioactive waste management from generation to disposal have to be defined and implemented by the Member States. The national framework, competent regulatory authority, national programme and its implementation have to be assessed at least every 10 years and international peer-reviews should be invited.

Also, the directive introduces strict control of exports of spent fuel and radioactive waste for disposal in third countries. It highlights the ultimate responsibility of Member States and of third countries for the safe disposal of the radioactive waste and by-products originating from processing and reprocessing of radioactive waste and spent fuel abroad.

Nuclear security

Nuclear security centres on the prevention and detection of, and response to, criminal or intentional unauthorised acts involving or directed at nuclear material, other radioactive material, and associated facilities or activities.

The possibility that nuclear or other radioactive material could be used with malicious intent

has been recognised as a serious threat to peace and global security in various formal documents, including IAEA General Conference resolutions, the Ministerial Declaration from the 2013 International Conference on Nuclear Security and communiqués from the Nuclear Security Summits. This has highlighted the need to adopt a holistic and vigorous approach to protecting nuclear and other radioactive materials, and associated facilities and activities so as to strengthen nuclear security worldwide and ultimately to protect people, society and the environment from the potential consequences of such malicious acts.

The legal framework on nuclear security currently comprises a number of binding and non-binding instruments:

- the CPPNM, which has 152 parties and only applies to material in international transport. The amended CPPNM covers the protection of nuclear facilities, thus establishing a clear link between physical protection and safety. It will take effect once ratified by two thirds of the original signatories;
- the International Convention for the Suppression of Acts of Nuclear Terrorism (ICSANT), which has 115 signatories and 99 parties and covers both nuclear and other radioactive material; and
- the voluntary Code of Conduct on the Safety and Security of Radioactive Sources, which has been signed up to by 125 countries.

Within the EU, the physical protection of nuclear installations and radioactive materials is mostly within Member States' competence and covered by their security and defence policies.

Nuclear safeguards

The Euratom Treaty gives the EU a clear role in ensuring the safe and sustainable use of nuclear energy across Europe. It also introduced a strict system of safeguards throughout the EU to ensure that nuclear materials are used only for declared, peaceful purposes. Chapter 7 of the Treaty requires the Commission to verify that ores, source materials and special fissile materials are not diverted from their intended uses as declared by the users.

Chapter 7, together with Chapters 6 and 8 of the Euratom Treaty, sets up a comprehensive primary law framework for the control of nuclear materials within the European Atomic Energy Community.

In addition to Euratom safeguards, EU Member States are signatories of the Treaty on the non-proliferation of nuclear weapons (NPT) and therefore subject to safeguards agreements with the IAEA.

The JRC provides the IAEA with technical support by developing instruments, tools and methodologies for safeguards verification.

Improving '3S' synergies

Every nuclear energy programme has to ensure the highest possible standards of nuclear safety, security and safeguards (the '3 Ss'). Given the plethora of legal frameworks, actors and responsibilities involved, achieving greater synergies between the 3 Ss is key to improving a fourth 'S': the *sustainability* of the programme.

With its estimates of supply and demand, ESA establishes an outline of the nuclear fuel market balance that can support the efforts in the nuclear safeguards and security.

Synergies at national framework level

At political level, the 3 Ss are in separate hands. Safeguards are implemented by international and national authorities through international treaties, while security is an important national responsibility. Safety is also a national competence, but primary responsibility rests with the operator of a facility.

Within their respective remits, national authorities have to ensure the application of the three legal frameworks at national level. The early and ongoing involvement of all relevant (policy, scientific, technical, operational) players in designing the national

implementation framework would ensure better understanding of all related needs and potential challenges. This could lead to national regulations and procedures being formulated in a cohesive and mutually beneficial way, thus ensuring more effective and efficient implementation.

Synergies at technical level

At technical level, the exchange of experience and expertise across the 3 Ss could highlight more synergies, leading to a better use of resources.

If measures relating to the 3 Ss are designed and managed in a coherent and coordinated manner, the activities themselves can be integrated so as to take advantage of the synergies. An uncoordinated approach will result in overlaps, duplication and potential conflict.

The early design stages of current nuclear energy systems did not take account of the requirements of the 3 Ss and allow for only limited technical synergies. There are at least three types of technical synergy between nuclear safety and security in both new and existing installations:

- the technologies and design architecture used to ensure nuclear safety are also used to ensure security by prevention or mitigation of the consequences of malicious acts;
- the techniques and methods developed to ensure protection against ionising radiation are applicable to nuclear safety and nuclear security issues; and
- similar effective EPR procedures need to be in place regardless of the origin of the emergency.

The requirements of the 3 Ss can lead to synergies, but also to conflicts. Taking them into account from the early stages in the design of future nuclear energy systems ('3S by design') could lead to better integration of the various technical aspects, thus maximising the potential for synergies and minimising the impacts of apparent conflicts. The Generation IV International Forum (to which Euratom is party) identifies safety, proliferation resistance and physical protection robustness as priority objectives for Generation IV reactor designs, together with economy and sustainability.

Fostering a 3S culture

A key factor in promoting synergies between safety, security and safeguards is the fostering of a common '3S culture', including more human resources and training. This means acknowledging that the successful and sustainable operation of a nuclear energy programme requires excellence in all three areas. This is more likely to be achieved if there is appropriate communication, cooperation and coordination in the conception, design and implementation of frameworks, from regulatory, procedural and technical points of view. Such a culture would need to permeate all aspects of the programme, from education and R&D to policy-making, implementation and enforcement.

In particular, R&D and training could play a pivotal role by inspiring and nurturing academic activities in the area of nuclear safety, security and safeguards, to prepare the next generation of professionals in these highly multi-disciplinary fields.

Synergies between safety, security and safeguards are not improved by integrating them *ex post*, but by building a system to manage them in the most effective and efficient way and embedding it in the nuclear energy programme from the start.

EU contribution to global nuclear security awareness

The EU organises and participates in events to help foster a worldwide nuclear security culture by increasing international awareness and commitment to nuclear security. Below is a general overview of the most representative events.

International cooperation to enhance a worldwide nuclear security culture — contribution to global nuclear security discussions (Amsterdam, 20 March 2014)

At the last Nuclear Security Summit in 2014, political leaders called on countries to build and sustain a strong nuclear security culture to combat nuclear terrorism and other criminal threats more effectively. In the margins of the Summit, the Commission and the EEAS held an EU high-level event on 'international cooperation to enhance a worldwide nuclear security culture'.

Over 100 representatives from around 40 countries, including EU Member States, the United States, Japan, the Republic of Korea and Canada, and international organisations such as the IAEA and the UN took part in the event.

The Summit expressed support for greater international and regional cooperation on education, awareness-raising and training, and welcomed the expansion of the international network of nuclear security training and support centres (NSSC) and the International Nuclear Security Education Network (INSEN).

In the discussion, participants identified three major enablers for a strengthened nuclear security culture:

- culture and people;
- legal framework and best practice; and
- knowledge and technological advancement.

Cooperation at all levels and an integrated, holistic approach were singled out as the main drivers for improving nuclear security.

Nuclear Futures? seminar (Alpbach, Austria, 23-25 August 2014)

This EU-funded event held in conjunction with the European Forum Alpbach was an opportunity to discuss future developments impacting the peaceful use of nuclear energy and traditional nuclear non-proliferation policies with a view to preparing input for EU policy-making. The seminar addressed various aspects of projected medium- to long-term changes in the global energy market and supply and related security issues. The 3 Ss of peaceful nuclear energy (safety, security and safeguards) were addressed, as was the need to adapt export controls on dual-use items in view of intangible technology transfers, the growing industrialisation of middle-income countries and south-south trade.

Conference on International cooperation for enhancing nuclear safety, security, safeguards and non-proliferation (Rome, 30-31 March 2015)

This XIX Edoardo Amaldi Conference, organised by the *Accademia Nazionale dei Lincei* and the JRC, was a forum for experts and scientists to discuss how to improve nuclear safety, security, safeguards and non-proliferation.

The Conference addressed the political, institutional and legal dimensions of the 3 Ss and non-proliferation, identifying current challenges and seeking to propose possible solutions and future improvements.

Scientific developments contributing to the more effective implementation of international arrangements (particularly in critical areas), emerging technologies and the ongoing

evaluation of current capabilities were also discussed by eminent scientists and diplomats and policy-makers from the EU, the IAEA, the academic world, the CTBTO, the Nuclear Suppliers Group, NGOs, EU Member States,

Japan, the United States, the Russian Federation, China, Israel, India, Pakistan and Iran.[35]

GICNT nuclear detection and forensics workshop (Karlsruhe, Germany, 5-7 May 2015)

The EU co-organised Radiant City, a joint Nuclear Detection Working Group / Nuclear Forensics Working Group workshop and tabletop exercise at the JRC premises in Karlsruhe. The three-day event focused on the technical application of nuclear forensic science in support of an investigation into the illicit trafficking of nuclear materials on a state's territory. It was attended by 70 experts from 27 partner countries.

The event featured presentations, panel discussions, workshops, tabletop exercises and hands-on demonstrations, taking advantage of the unique opportunities offered by the EUSECTRA facility. Participants were provided with key information and background on nuclear detection and forensics activities. Hands-on demonstrations using nuclear material and radioactive sources enabled them to apply the lessons learned.

The Commission and the Member States have continued their activities in the field of nuclear forensics for the basic characterisation of intercepted nuclear material, using advanced nuclear forensic investigation at the JRC's nuclear facilities.

The EU as a global actor in the field of nuclear safety and security — side event at the 9th NPT Review Conference (New York, 14 May 2015)

At the 2015 NPT Review Conference, the EU organised a side event, *inter alia* to present its security strategy, its strategy against the proliferation of WMD, its CBRN Action Plan, its CBRN CoE initiative in support of non-EU countries, export controls, its financial and technical support to the IAEA, and its international cooperation on nuclear security.

Promoting detection standards in nuclear and radiological security — ITRAP workshop (Brussels, 30 November-1 December 2015)

This workshop was organised as part of the Illicit Trafficking Radiation Detection Assessment Programme (ITRAP+10), which is making a significant contribution to mitigating the threat and risks associated with RN materials in the international security context, in line with European and international efforts.

20th BMWG meeting (Brussels, 1-3 December 2015)

The BMWG, which recently celebrated its 10th anniversary, is an important international forum of discussion to strengthen global capacity to combat the illicit traffic of nuclear and other radioactive materials; it was formally established in 2005 to promote cooperation between the IAEA, the US Government and the EU, represented by the Commission (JRC) and the EEAS.

Falcon — inter-Arab nuclear detection and response exercise (Abu Dhabi, UAE, 23-25 February 2016)

This three-day exercise was developed under the CoE initiative, in cooperation with UNICRI, the JRC, the governments of the UAE, Jordan and Morocco, the United States, the GICNT and other relevant organisations.

Cooperation Simulation of Nuclear Security exercise (COSINUS) for the region of South East Asia (Ispra, Italy, 7-11 March 2016)

In the frame of enhancing Nuclear Security Detection and Response Capabilities and

[35] International cooperation for enhancing nuclear safety, security, safeguards and non-proliferation — proceedings of the XIX Edoardo Amaldi Conference (*Springer Proceedings in Physics* 172, 2015).

funded under the IcSP project of the European Commission on Border Monitoring activities in Southeast Asia (SEA), the COSINUS exercise is held at the JRC premises in Ispra (Italy), with the full participation of IAEA. The last day of the exercise is an International Reporting, Evaluation and Feedback session, open to wider audience of nuclear security specialists.

The COSINUS exercise is the first of its kind and it aims to address a key issue in nuclear security in general and border security more in particular i.e. enhancement of communication, coordination and collaboration between national and regional organisations and agencies with responsibilities in nuclear security. More specifically COSINUS promotes the harmonization and exchange of good practices in SEA countries and provides a platform for testing internal (i.e. Front Line Officer-Technical Support organisations) and external (i.e. among countries) communications and information exchange channels.

Counter nuclear smuggling (CNS) workshop (Karlsruhe, Germany, 8-10 March 2016)

Recognising the need for strengthened international cooperation to counter nuclear smuggling, the JRC and the US Department of State co-hosted the 2016 CNS workshop at the JRC Institute for Transuranium Elements, in Karlsruhe, Germany. Experts from several relevant countries and IAEA, Interpol and GICNT representatives shared best practices and lessons learned in leveraging investigative and technical capabilities to counter smuggling of nuclear and other radioactive material.

Regional cooperation to enhance a worldwide nuclear security culture — contribution to global nuclear security discussions (Amman, Jordan, October 2016)

The Commission and the Japan Atomic Energy Agency are co-organising a seminar on 'regional cooperation to enhance a worldwide nuclear security culture' in cooperation with the Middle East Scientific Institute for Security (MESIS)/Middle East Secretariat of the EU CoE initiative, the NSSC network and the INSEN. The seminar is a follow-up to the 2014 EU high-level event in Amsterdam.

The main objective is to further promote the nuclear security culture in the Middle East and Gulf Cooperation Council region and increase awareness on the importance of ensuring nuclear security through regional cooperation among NSSC and INSEN members.

Algeria, Egypt, Iran, Iraq, Jordan, Lebanon, Morocco, Oman, Qatar, Saudi Arabia, Turkey, the United Arab Emirates (UAE) and Yemen are invited to debate and share views on lessons learnt and future initiatives and means to strengthen nuclear security culture worldwide.