European Commission

Information sharing in a nuclear security event

Consultation of Member States on the report
Remote expert support of field teams — Reachback services for nuclear security

Erncip Thematic Group for Radiological and Nuclear Threats to Critical Infrastructure
Task 3B Deliverable 2

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Abstract

The European reference network for critical infrastructure protection (Erncip) has a Thematic Group for Radiological and Nuclear Threats to Critical Infrastructure (RN thematic group). It produced, in its 2014 work programme, a report on radiological and nuclear information sharing between the European Union Member States in case of a nuclear security event. As part of its 2015 work programme, the group collected views from the EU Member States regarding this report as a key step in the work towards future European format and protocol standardisation to be implemented for technical reachback and other analysis purposes.

The RN thematic group designed a simple questionnaire, which was sent to the relevant authorities in the Member States. The answers (10 out of 28) came from very different organisations working in the domains of security, safety or the military. The different backgrounds of the responding organisations show that responsibility for nuclear and radiological matters, including information sharing in a nuclear security event, varies strongly between different Member States. This knowledge alone is an important outcome of the questionnaire.

Some replies showed that much work needs to be done in raising European awareness regarding the prevention and detection of and the response to nuclear security events, including information sharing nationally and internationally. Some Member States have not yet identified the need for cooperation in sharing nuclear spectrometric data and analysis results.

One of the basic requirements of the proposed new information-sharing system for nuclear security is that advanced national analysis resources be provided for Member States that do not have such capabilities. Even though the future arrangements for information sharing would be based on a standard technological structure, all data exchange would be voluntary and bilateral between the Member States.

Introduction

In support of EU efforts to protect critical infrastructures, the Joint Research Centre (JRC) coordinates Erncip, which was first established by the Institute for the Protection and Security of the Citizen (IPSC) in 2009 ([1]). This took place under the mandate of the the Directorate-General for Migration and Home Affairs (DG HOME), in the context of the European programme for critical infrastructure protection (EPCIP).

Erncip's mission is to 'foster the emergence of innovative, qualified, efficient and competitive security solutions, through the networking of European experimental capabilities'. In order to achieve this, Erncip maintains an online inventory of experimental capabilities for critical infrastructure protection in Europe, and supports thematic networks of experts (thematic groups) that identify and promote good practices as the basis for common European testing standards, aiming at the harmonision of test methodologies and test protocols where practical.

The RN thematic group looks at issues such as the certification of radiation detectors, the standardisation of deployment protocols, response procedures and communication to the public, for example in the event of criminal or unauthorised acts involving nuclear or other radioactive material out of regulatory control. The work is closely related to the opportunity, opened up by current developments in technology, to utilise the remote support of field teams (reachback) for radiation detection.

The RN thematic group has worked with the following three issues.

1. **List-mode data acquisition based on digital electronics.** The time-stamped list-mode data format produces significant added value compared to the more conventional spectral data format. It improves source localisation and allows signal-to-noise optimisation and noise filtering, with some new gamma and neutron detectors actually requiring list-mode data to function. The list-mode approach also allows precise time synchronisation of multiple detectors enabling simultaneous singles and coincidence spectrometry such as singles gamma and ultraviolet-gated gamma spectrometry, among other applications.
2. **Expert support of field teams, i.e. data moves instead of people and samples.** A faster and more appropriate response can be achieved with fewer people. Optimal formats and protocols are needed for efficient communication between frontline officers and reachback centres.
3. **Remote-controlled radiation measurements and sampling using unmanned vehicles.** There are several measurement and sampling scenarios that are too risky for humans to carry out. The applications envisaged are: dirty bombs before and after explosion; searches for nuclear and other radioactive material out of regulatory control; and reactor and other accidents.

([1]) The JRC is the European Commission's in-house science service, providing policy areas with independent, evidence-based scientific and technical support throughout the whole policy cycle. Within the JRC, IPSC provides scientific and technology advice on safety, security and stability within and outside the EU, collaborating with European and international expert communities.

The RN thematic group has published a number of reports that can all be found at:

https://erncip-project.jrc.ec.europa.eu/download-area/category/7-radiological-and-nuclear-threats

Information sharing during a nuclear security event or emergency is of vital importance for an appropriate response by the authorities, including international data exchange and support. The principle of information sharing is widely agreed upon, but its implementation has proved difficult. The RN thematic group has identified a potential approach to improving data exchange at the technical level, which is outlined in the report *Remote expert support of field teams — Reachback services for nuclear security* (December 2014) (available at the link above).

In summary, the Erncip report on reachback proposes the development of a new data-handling format and protocol based on existing data structures and open-source databases, whereby each instrument or user would communicate with the database, either with their own database or with a remote database shared with other relevant users. These databases would all have similar table structures, while the data and the analysis results would be well protected. The use of similar data structures in different EU Member States would facilitate cooperation between them. Through such an approach, not all Member States would need to develop sophisticated analysis and data-handling methods to benefit from the information gathered, as these could be shared, either in the form of software sharing or as a service provided across borders. As part of its 2015 work programme, the RN thematic group seeks to collect views from the EU Member States regarding this report as a key step in the work towards future European reachback protocol standardisation.

The RN thematic group designed a questionnaire, which was sent to the relevant authorities in the Member States. In order to maximise the response, it was decided to limit the consultation to the following three high-level questions.

> **Q1: Is the recommendation to develop a European standard for data storage protocols on nuclear and radiological data exchange, particularly with regard to reachback, feasible for information sharing on radiological and nuclear events? Please elaborate the reasons for your response.**
>
> **Q2: Are there other means of achieving improved information sharing that you think should be considered?**
>
> **Q3: Please share any additional thoughts you may have on this topic.**

In order to manage costs and time it was decided to use email as a means to collect these views. An email was therefore sent out to the EPCIP points of contact from the Erncip Office on 12 June 2015 (see full email in Annex) with a deadline of 31 July. This deadline was later extended to 12 September. Attached to the email was the report (*Remote expert support of field teams — Reachback services for nuclear security*).

Furthermore, the EPCIP points of contact were encouraged to forward the questionnaire to other relevant authorities or organisations with a focus on nuclear and radiological information-sharing mechanisms. The consultation email was also sent to the Erncip Group of CIP Experts, which is an Erncip advisory body and consists of representatives of the different Member States. By 21 October, responses had been submitted from 10 of the 28 EU Member States.

The answers came from very different organisations working in the domains of security, safety or the military, as shown below.

Security, counter terrorism, non-proliferation or policymaking	3
Emergency or disaster management	4
Regulator	2
Military advisor	1

Summary of responses to the questionnaire

A summary of the various responses follows. Where similar responses were given by different Member States, these have been merged into a single point below. At the request of survey participants, the responses are presented in such a way that no individual Member State may be identified.

Question 1:
Is the recommendation to develop a European standard for data storage protocols on nuclear and radiological data exchange, particularly with regard to reachback, feasible for information sharing on radiological and nuclear events? Please elaborate the reasons for your response.

1. The standardisation of spectral data-exchange structures and protocols, i.e. a joint data format and a database supporting the format, will facilitate efficient information sharing within the Member State and between Member States. In addition, this will improve the use of limited resources. Operationally this will improve situation awareness and information-driven decision-making.
2. Major radiological and nuclear events always have an international dimension, and sharing the spectral data would support timely responses, particularly regarding actions related to the protection of the public.
3. Standard data formats and exchange protocols would eliminate the need for conversion software and avoid the potential risk of errors associated with such data conversions.
4. Such data would necessarily stem from a wide range of technologies from various manufacturers, who would need to cooperate in the development of data formats and data transfer protocols. It is not easy to obtain new standardised protocols for equipment that has already been deployed.
5. Any proposed data format should allow for the optional inclusion of additional fields.
6. Some Member States with mature reachback systems already in place currently utilise fixed data formats, which cannot be adjusted, as they must remain compliant with existing analysis systems. These Member States expressed a reluctance to adapt their existing formats, citing inefficiencies and loss of available manpower in an already difficult situation.
7. Some Member States have existing bilateral treaty obligations on radiological matters, including such data-sharing activities, and asked that any additional EU-wide measures complement these already existing formats.
8. Some Member States pointed out that there is certain information that they may wish to remain private (due to security issues) and that the provision of such data should be on a voluntary basis.
9. Continued consultation with existing data-sharing projects should be undertaken.
10. Member States with mature reachback systems and analysis capabilities could assist Member States with less developed (or non-existent) capabilities. However, such assistance should remain on a voluntary basis, and suitable bilateral arrangements should be made in advance of an incident.
11. After the Chernobyl incident, the decision was made to share data from national monitoring networks for detecting nuclear fallout using a standard data-exchange format, the European radiological data-exchange platform (Eurdep). It was suggested that a similar agreement could be reached for information sharing in a nuclear security event, including the exchange of spectrometric data and analysis results if there is the political will to do so (or a Council decision to require it).

Question 2:
Are there other means of achieving improved information sharing that you think should be considered?

1. Data exchange is not the only issue. Other topics could be addressed, including equipment characterisation, methodology of use and training.
2. It might be necessary to include in the scope of reachback how the data was obtained; i.e. include characterisation of the equipment and the procedures used.

3. Mechanisms used in conventional emergency planning might help where there is already a network of competent authorities who would meet regularly, develop EU-level protocols and participate in emergency exercises.
4. Liaising with the JRC-ITU (Institute for Transuranium Elements) and the JRC-IRMM (Institute for Reference Materials and Measurements) on CBRNE (chemical, biological, radiological, nuclear and explosives) detection standardisation.
5. Workshops, programmes and courses on methodology and result reporting could be useful for raising awareness on nuclear security and information sharing.

Question 3:
Please share any additional thoughts you may have on this topic.

1. The reachback arrangements could include the national radiological measurement authorities — while they may not have the capability to analyse/interpret complex nuclear security data, they are familiar with nuclear/radiological concepts, should already have a working relationship with the national police force/military (or other organisation operating the field equipment) and if a radiological or nuclear device is discovered they will have an ongoing role in advising and supporting the local/national response which will be facilitated by being involved from the start of the event.
2. The Council of the Baltic Sea States has an Expert Group on Nuclear and Radiological Safety. This group works on the harmonisation of gamma spectrometry measurement protocols for exchange in the case of an emergency. Furthermore, the expert group is working on the harmonisation of environmental radiological monitoring data exchange. An initiative has been put forward to adopt a database as the basis of the data-exchange protocol. However, the actual work has not been started due to lack of funding.
3. Collecting the best practices from different Member States is a good starting point and will facilitate the process.
4. The immediate focus should be on a preparedness phase, including crisis prevention.

International systems to share nuclear and radiological data and information

Some answers to the questionnaire suggested that radiological data-exchange schemes already exist, and therefore there is no need for new initiatives. However, none of these international schemes sufficiently address the need for information sharing for nuclear security, nor are they sufficient to store data and analysis results for efficient cooperation between national and international organisations. A brief review is given below.

Data format of the Comprehensive Nuclear-Test-Ban Treaty Organisation

The gamma spectrometry data format of the Comprehensive Nuclear-Test-Ban Treaty Organisation allows the transfer of data on airborne contamination. Different types of information can also be added, and can be in a different order. The format has served its original purpose well.

Comment

The format has acaused some problems because there were no means to check the validity of the messages. Also, applying this format to other applications turned out to be problematic. The specification was not clear enough for expansions. The messages must contain enough information about the data itself. In addition to a well-defined data format, an approved protocol is necessary for efficient information management.

ANSI and IEC standards

There are XML-based standards (published in ANSI and IEC) that are intended to define the data format produced by radiation detection instruments:

- ANSI/IEEE N42.42 — data format for radiation detectors used for homeland security;
- IEC 62755 radiation protection instrumentation — data format for radiation instruments used in the detection of the illicit trafficking of radioactive materials.

These standards consider radiation measurement systems that have several types of components (e.g. video or occupancy sensors). The radiation detectors are the primary components. They generate the raw measurement data in response to a radiation field. Radiation measurements are sequentially recorded and metadata (e.g. photos, specific types of data, bar scans or notes) can be incorporated into the XML file. This standard covers most of the items needed for data transfer from a radiation measurement instrument to the nuclear analyst for review in detail.

Comment

The ANSI/IEEE format is insufficient regarding urgent information needs in a nuclear security event. For example, it is important to link several measurements and analyses to one event (or sample) and then perform a synthesis of all results available. This process is continuously updated during the event. In addition, alarm handling and reliability of information need to be addressed in a much more detailed manner. A further insufficiency is the lack of means to handle list-mode data, either as a set of binary files or via continuous data streaming. List-mode data acquisition is the rising trend in nuclear measurement.

The International Atomic Energy Agency and radiological consequence management

The International Atomic Energy Agency (IAEA) has developed the international radiological information exchange (IRIX) ([2]) as the recommended standard for exchanging information between emergency response

([2]) http://www-ns.iaea.org/downloads/iec/info-brochures/13-27431-irix.pdf

organisations at national and international levels during a nuclear or radiological emergency. The standard addresses both data content and format (XML), and the system interface specification. Data can include status information about a nuclear installation, information about any radioactive releases into the environment, information on protective actions taken or planned by affected Member States and environmental radiation monitoring data. The system interface specification (or web-service specification) enables organisations to interconnect their emergency information systems to automate their information exchange in an emergency. The IRIX standard allows the information to be processed, summarised and presented quickly, for example on status boards in emergency response centres.

The IAEA and the JRC-ITU are working together to join the Eurdep system (see below) to the IAEA's unified system for information exchange in incidents and emergencies (USIE) ([3]). The main purpose of the USIE is to exchange urgent information during nuclear and radiological incidents and emergencies and to post information on events rated using the international nuclear and radiological event scale.

The IAEA operates a response and assistance network (RANET) ([4]) to provide international assistance, upon request from a state, following a nuclear or radiological incident or emergency. The RANET mainly deals with actions when something has happened, i.e. distributing international resources.

Comment

The IRIX, the USIE and the RANET are crisis or consequence management systems; they are not intended for nuclear security, and are therefore insufficient means for information sharing on the prevention and detection of a nuclear security event, including alarm adjudication and a consequent response to the event by the competent authorities.

The Eurdep platform

Eurdep ([5]), hosted by the JRC, focuses on acquiring dose-rate data from automatic measurement stations installed in every Member State of the European Union. Eurdep is a network for the exchange of radiological monitoring data between Member States. Council Decision 87/600/Euratom and Commission Recommendation 2000/473/Euratom regulate the participation of EU Member States in Eurdep.

Eurdep provides the possibility to export results in various formats, but this only includes dose-rate measurements. Eurdep has a website where measurements are shown on a map. Since the Fukushima accident, Eurdep has been developed to incorporate data from air sampling.

Comment

Eurdep does not incorporate spectral data and does not focus on the detection of a nuclear or radiological event with security implications, including subsequent nuclide identification and threat assessment. Eurdep was not built to obtain measurements from mobile teams and its architecture is not at present suited to handling the large quantities of data that mobile measurements with spectral data will produce, nor to discriminating between data requiring immediate attention and further data. The Eurdep dose-rate exchange system is technically simple compared to the requirements of nuclear security with spectrometric data exchange. For example, for environmental purposes, a dose rate is typically measured once per hour whereas a spectrometric portal could produce 3 600 observations per hour, each of them containing thousands of times more data.

NATO formats and protocol

The 2014-2015 work programme of Horizon 2020, protecting the freedom and security of Europe and its citizens, expresses very clearly the need for cooperation between civilian and military efforts in security. When new technical solutions are envisaged for nuclear security, it is wise to consider civil and military needs simultaneously. One such common area of interest is reachback.

([3]) https://iec.iaea.org/usie/actual/LandingPage.aspx
([4]) http://www-ns.iaea.org/tech-areas/emergency/ranet.asp?s=1&l=65
([5]) https://eurdep.jrc.ec.europa.eu/Basic/Pages/Public/Home/Default.aspx

In the military domain, cooperation between different field troops is of vital importance. The principle of cooperation between different partners through common data structures has turned out to be powerful. One such military standard is allied tactical publication 45 (ATP-45) developed by the North Atlantic Treaty Organisation (NATO) ([6]). Furthermore, NATO has built a system called Majiic ([7]) which works at operational, architectural and technical standard levels for the interoperability of a wide range of assets. The idea is to use common interfaces for data exchange, keeping modifications to any given system very minor. The key principle is to upload data to a shared data server which gives services to all relevant partners, i.e. the users exchange data through the server, not directly with each other. Majiic 2 is the successor of the successful Majiic project ([8]). Under the new programme, current technologies will be further developed and applied in a wider context, for example in support of civil authorities.

Comment

ATP-45 is not designed to handle nuclear security events; the prevention and detection phases in particular are omitted. Majiic was initially designed for other types of sensors than those used in the CBRNE domain. However, this is not a limitation, as Majiic 2 can deal with any type of sensor or data. The logic of Majiic for military communication is exactly the same as that proposed by the RN thematic group for nuclear security. Civil and military cooperation would be useful for both parties.

Conclusions

The different backgrounds of the responding organisations show that responsibility in nuclear and radiological matters, including information sharing, varies in different Member States. Some expressed the view that the priority should be nuclear security and crime prevention. The RN thematic group agrees, however it recognises that the other radiological and nuclear domains should also be involved to create a technical system that can be applied to various applications and situations.

Nuclear and radiological information-sharing mechanism

Many Member States said that the idea of generating a standard data format for nuclear security is a good one, and should help with mutual cooperation in the event of a nuclear incident. In general, the Member States agreed that standardisation of data formats and exchange protocols are critical components in enabling a Europe-wide collaboration on nuclear and radiological data exchange. The establishment of a European resource pool to efficiently analyse the events would be technically possible if standard formats and protocols to share the data were created. There was however some reluctance to implement controls on database and data storage formats.

Not all Member States have the capability to process data provided by operational spectrometric instruments, particularly in security applications. Joint data structures would lead to a more efficient and comprehensive approach in responding to future nuclear emergencies. However, views on the methods of implementation of the information-sharing mechanism varied. Most Member States agreed that a development should be initiated in a format that would cover nuclear and radiological data, analysis results and other relevant data regarding the measurement and the event itself. However, small Member States with limited nuclear capabilities favoured a wider development, covering not only the joint data exchange formats, but also the joint data structures of a database which the Member States then could implement within their jurisdiction. These countries do not have the resources to develop such data management systems, and also feel that this would send a clear message to the industry on how to store measurement data for operational usage.

One of the basic requirements of the new information-sharing system is that advanced national analysis resources be made available for Member States that do not have such capabilities. Although the technological arrangements would be based on a standard structure, all data exchange would be voluntary and bilateral between the Member States.

([6]) NATO/PfP, *Warning and reporting and hazard prediction of chemical, biological, radiological and nuclear incidents (operators manual), ATP-45(D),* 2010.

([7]) MAJIIC stands for 'Multi-sensor aerospace-ground joint intelligence, surveillance and reconnaissance interoperability coalition' (http://www.nato.int/docu/update/2007/pdf/majic.pdf).

([8]) NATO nations deepen cooperation on intelligence, surveillance and reconnaissance' (http://www.nato.int/cps/en/SID-F3AF6544-59A62A26/natolive/news_71562.htm?selectedLocale=en).

Awareness raising

Some of the Member States' replies showed that much work needs to be done in raising awareness regarding information sharing on radiological and nuclear security events. The concept is understood very differently in different Member States; some have not yet identified the need for cooperation in sharing nuclear spectrometric data and analysis results. Some answers refer to utilising the Europe-wide dose-rate exchange Eurdep, which was implemented in the aftermath of the Chernobyl accident. However, Eurdep is designed for the exchange of fallout information; it has nothing to do with the prevention of a crime where radiological and nuclear materials are used. A European awareness-raising campaign is needed to provide correct information on nuclear and radiological risks, including spectrometric measurements and the benefits of information sharing in a nuclear security event.

Involvement of international organisations

Several Member States emphasised the commitment of existing international bodies that are already involved in information sharing regarding nuclear or radiological events. It was suggested that the experience of the existing data-exchange mechanism should be utilised to migrate from stationary dose-rate measurement to a more complex domain of spectrometry which could be performed anywhere, depending on the nature of the nuclear or radiological event.

The involvement of the IAEA was seen as crucial for the development of a new technical information-sharing system for nuclear security that could also be applied to other domains, such as nuclear crisis and consequence management.

List of acronyms

ANSI	American National Standards Institute
CEA	Commissariat à l'énergie atomique et aux énergies alternatives (French atomic and alternative energies commission)
CSIC	Consejo Superior de Investigaciones Científicas (Spanish national research council)
DEMA	Danish Emergency Management Agency
EPCIP	European programme for critical infrastructure protection
Erncip	European reference network for critical infrastructure protection
Eurdep	European radiological data exchange platform
FKIE	Fraunhofer-Institut für Kommunikation, Informationsverarbeitung und Ergonomie (Fraunhofer Institute for Communication, Information Processing and Ergonomics)
IAEA	International Atomic Energy Agency
IEC	International Electrotechnical Commission
IPSC	Institute for the Protection and Security of the Citizen
IRIX	international radiological information exchange
JRC	Joint Research Centre
NATO	North Atlantic Treaty Organization
NPL	National Physical Laboratory (United Kingdom)
RANET	response and assistance network
RN	radiological and nuclear
STUK	Säteilyturvakeskus (Finnish radiation and nuclear safety authority)
USIE	unified system for information exchange in incidents and emergencies
XML	Extensible Markup Language

List of standards

ANSI/IEEE N42.42	data format for radiation detectors used for homeland security
IEC 62755 radiation protection instrumentation	data format for radiation instruments used in the detection of illicit trafficking of radioactive materials
IRIX standard	International Radiological Information Exchange
ATP-45	allied tactical publication

Annex

Dear EPCIP POC/Member of the Erncip Group of CIP Experts (previously referred to as the 'Erncip expert group'),

One of the thematic groups of the European Reference Network for Critical Infrastructure Protection (Erncip) is the **Radiological and Nuclear Threats to Critical Infrastructure** thematic group. This group focuses on the following three current issues: (1) list-mode data acquisition based on digital electronics; (2) remote expert support of field teams; and (3) remote-controlled radiation measurements and sampling using unmanned vehicles.

The purpose of this email is to collect the views from around the EU regarding the second issue (remote expert support of field teams) as a key step in our work towards future European 'reachback' protocol standardisation. **This consultation consists of only three high-level questions** that we ask you to answer. We would also encourage you to forward this to the other relevant authorities or organisations within your Member State.

Information sharing during a nuclear security event or emergency is of vital importance for a correct response by the authorities, including international data exchange and support. The principle of information sharing is widely agreed but its implementation has proved to be difficult in practice. Now we have identified a potential approach to improve data exchange at the technical level. We would be very grateful to hear your opinions about this proposal produced by the Thematic Group detailed in the following document:

Remote expert support of field teams — Reachback services for nuclear security (December 2014) (attached and available online at https://erncip-project.jrc.ec.europa.eu/networks/tgs/nuclear).

In summary, the report proposes the development of a new data-handling protocol based on open-source databases, whereby each instrument or user would use the protocol to communicate with the database, either to their own or to a remote database shared with other relevant users. These databases would all have similar table structures, while the data and the analysis results would be well protected. The use of similar data structures in different EU Member States would facilitate cooperation between them. Through such an approach not all Member States would need to develop sophisticated analysis and data-handling methods to benefit from the information gathered, as these could be shared, either in the form of software sharing, or as a service provided across borders.

We would be very grateful if you could consider the following questions, and reply to the Erncip Office as soon as possible, and by 31 July 2015 at the very latest please.

1. **Is the recommendation to develop a European standard for data storage protocols on nuclear and radiological data exchange, particularly with regard to reachback, feasible for information sharing on radiological and nuclear events? Please elaborate the reasons for your response.**

2. **Are there other means of achieving improved information sharing that you think should be considered?**

3. **Please share any additional thoughts you may have on this topic.**

Thank you for your support! If you have any questions about this request, please don't hesitate to contact me.

Sincerely yours
The Erncip Office through

Carl-Johan Forsberg

Scientific Support Officer

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