SMUGGLING RADIOACTIVE MATERIAL – A DEMONSTRATION EXERCISE IN THE FRAMEWORK OF EU-PROJECT EDEN

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Abstract

In the framework of project EDEN – a European FP7 Demonstration Project with 36 partners from 15 countries - different field demonstration exercises were performed to present countermeasures against attacks or accidents involving chemical, biological, radioactive, nuclear or explosive materials (CBRNE). During each exercise a number of tools provided by project partners and external suppliers were demonstrated in action. The present presentation focuses on such a demonstration simulating the smuggling of radioactive material, which was organized by Fraunhofer INT and executed at ENEA Research Centre in Frascati, Italy. The demonstration comprised two scenarios: First the attempt to smuggle a radioactive source at a border crossing station equipped with different detection systems and secondly a blackmailing attempt, where the source was hidden in a car in a public parking place and covert search was necessary. In both cases it was demonstrated that the radioactive material could be remotely detected, localized and identified successfully.

Keywords: Field demonstration exercise, RN material, covert search, radiation portal monitors, EU FP7 demonstration project.

1 INTRODUCTION

The EDEN (End-User Driven Demo for CBRNe) Demonstration Project is a European Union-wide collaborative project which is funded within the 7th framework program and involves a consortium of 36 members from 15 countries, including practitioners, corporate stakeholders, universities and research institutes [1]. In the three-year project, which will be finalized at the end of 2016, a central question is, how and with which tools one can counteract deliberate attacks or accidents involving chemical, biological, radioactive, nuclear or explosive materials. The aim of the project is the demonstration of a comprehensive system of systems of measures against such events that require prevention before they can happen, response if they occur, and recovery afterwards. In the framework of the project different related methodological and technical tools were compiled into systems, further developed, tested and demonstrated in exercise scenarios. The tools include for example protocols, measuring devices, communication systems or simulation programs. The EDEN solutions matured during the project give the opportunity to evaluate large scale integration of CBRNE Security and Counter-Terrorism techniques whilst improving cross border cooperation and interoperability. A sustainable impact will be achieved by an open and secure internet platform, the EDEN Website, where a database with tools and expert services etc. can be addressed by selected suppliers and practitioners - also after the project has ended.

Aside from large scale demonstrations regarding biological and chemical risks in a food facility, multi-chemical attacks in chemical plants and public areas, and a radiological accident in a nuclear power plant, several medium size demonstration exercises were executed. The present presentation focuses on a medium sized thematic demonstration, which was organized by Fraunhofer INT and executed at the ENEA Research Centre in Frascati, Italy in 2015, together with another demonstration organized by ENEA. During these exercises tool suppliers which were not a member of the EDEN consortium, but were associated to EDEN via the so called "EDEN supplier platform" or the "EDEN SME platform" had the opportunity to get their tools involved, too.

The demonstration with the topic "Smuggling radiological material and subsequent blackmailing attempt" comprised two parts: In part one – a 'border crossing scenario' – a radioactive source was hidden in a car and then it was simulated that the driver tried to smuggle the material across a border, where different types of detector systems were deployed. In part two – a 'parking place scenario' – it was assumed that another group of the fictitious smugglers had been successful in transporting the radioactive material across the border and that there were hints, that the material was hidden at a public car park. In this case a covert search was necessary.

2 THE BORDER CROSSING SCENARIO

The border crossing scenario was demonstrated at an area inside the ENEA site, where several deployable radiation portal monitors (for vehicles as well as for pedestrians) were installed to simulate a border crossing station equipped with detectors out of the EDEN store. While doing so the high flexibility of the vehicle monitors could be shown: It was possible to set up the systems within 20 minutes, even by a technical team without previous experience with the tools.

Since the devices had to be tested with real radioactive sources, for safety reasons only the technical teams who had to operate the tools were allowed to be present at the demonstration area. All the observers – experts and end users - were accommodated in a conference room 300 meters away. Therefore streaming video into the conference room was necessary, where a facilitator explained and commented the scenario and the tools. To give insight in the functionality and the quality of the tools and the demonstrated procedures simultaneously the visual display of the measurement devices was shown on another screen. This demonstrated at the same time the capability to transfer the data directly to a control centre or another reach back unit.

During the border crossing scenario the following tools to prevent illicit trafficking of radioactive material were demonstrated (provider in brackets):

1. Portal Monitor JANUS (Indra) [3]
2. Radiation Portal Monitor PM 5000 C (Polimaster Europe) [4]
3. Deep Discovery Pedestrian Portal (Symetrica) [5]
4. Handheld device VeriFinder (Symetrica) [6]
5. Spectroscopic Personal Radiation Detector PM 1704 M (Polimaster Europe) [7]

The radioactive source, a Co-60 source shielded with lead, was hidden in the boot of a car. When the car approached the simulated border and passed the installed portal monitors with low velocity, the portal monitors instantaneously gave an alarm (optically and acoustically) and the measurement results could be seen on the related displays. The assignment to the car in question was unique.

The driver then was separated from the car and checked via the portal monitor for pedestrians. He pretended to have had a medical treatment and this would be the reason for the radiation alarm. Indeed the pedestrian monitor could detect this – it was simulated with a weak Ba-133 source. This source could not only be detected but also identified by the system via a unique spectral processing system that enhances the native resolution of the used NaI scintillation detectors in the pillars to a high quality performance. The capability to identify real medical isotopes was already proved with the system in the former EU FP7 project, SCINTILLA [2], with real patients in a nuclear medicine department of a hospital.

Parallel to the investigation of the person the car was checked systematically with the handheld devices VeriFinder and PM 1704 M and in this way the hidden source was found. Also an identification of the isotope could be demonstrated. So the simulated attempt to smuggle and mask the radioactive source with another one was elucidated successfully.

3 THE PARKING PLACE SCENARIO

The second part of the demonstration was performed at a parking place inside the ENEA site close to the area where the first part was conducted. A number of cars were parked and in one car a shielded radioactive source was hidden. The task was to find the source via covert search. Two different ways of search were demonstrated: First a search with a measurement system, installed in an ordinary car, and then a search by foot with a backpack detector was performed. Again the visitors could participate via streaming video.

During the parking place scenario the following tools were demonstrated (provider in brackets):

1. Generic Ground Station (BAE Systems) [1]
2. First Responder Equipment (BAE Systems) [1]
3. DeGeN measurement car (Fraunhofer INT) [8]
4. Backpack detector (Symetrica) [9]

The actions were conducted in a coordination post, where the measurement data were transferred and the mission could be planned and supervised. This was done amongst others with the help of the Generic Ground Station, a work station for the Incident Commander, which allows real-time tasking, location tracking and display of surveillance data from multiple assets. One of these assets was the First Responder equipment (FR). The latter is a man-portable equipment consisting of an android mobile phone application linked to sensors (e.g. radiation sensors) with Bluetooth interface. First responder tasking and safety hazard information were transmitted to the first responder, and location and data was transmitted back. The real-time data communications were transmitted between the Generic Ground Station and first responders using personal role radios in this demonstration, however the system is also designed to work with WiFi networks.

The first search was performed with the car-borne measurement system DeGeN that consists of an array of gamma and neutron detectors, powered by a specific energy management system. Neutron slab counters filled with He-3 and 12 litres plastic scintillation detectors are placed on both sides of the car, allowing directional measurements of the gamma dose rates and neutron counts. With this capability it was possible to identify the car with the hidden radioactive source already during the first passing and verified during a second passing. The scintillators are so called NBR (natural background rejection) detectors which enable the user to distinguish between natural and artificial radiation. For the latter it distinguishes between artificial low and middle energy region, which was indicated in the demonstration. Those regions are consistent with the energy regions for Cs-137 (low energy) and Co-60 (middle energy). The measurement results were displayed on a touch screen monitor mounted at the instrument board. The position of the car is recorded by GPS synchronized with the measurement data. All measurement results could be seen remotely on a screen in the conference room in real time.

An electrically cooled germanium detector is included in the measurement system and can be used for identification of the nuclear or radioactive material. Since it is a hand-held device this can be done either on-site after the radioactive material has been located by means of the car's built-in detectors or from inside the car as the detector can be remote controlled from the monitor in the front. Also this capability was demonstrated in the scenario and the Co-60 source was identified.

The second covert search was performed on foot with the backpack detector, where the software is similar to the software used for the pedestrian portal monitor by Symetrica. During the demonstration the backpack device was carried by an expert and operated with a tablet as an operation unit. The final version of the tool shall be equipped with an ergonomic readout which enables the carrier to do covert search measurements. In contrast to the measurement shown with measurement vehicle DeGeN the backpack enables one to do measurements at positions which cannot be reached with a car. The display was also transferred into the conference room. When the count rate increased beside the car with the hidden source the measurement situation was optimized in that way that the person pretended to tie the shoelaces and did an identification measurement, where again Co-60 could be identified.

4 CONCLUSION

The demonstration was observed by 110 visitors, experts and stakeholders from 9 countries. Since the visitors were not allowed to be present in the exercise area in person for safety reasons, the streaming video was the only possibility to let them take part in the event and it turned out that the simultaneous presentation of the video of the activities together with the visual display of the measurement results on another screen was a good way to let observers get insight in the quality of the tools and the procedures. Also the presence of a facilitator who explained everything in detail was acknowledged. The visitors had the opportunity to have a closer look at the involved tools and to use them after the scenarios were finished and the radioactive sources were removed. An evaluation showed that an added value was attested to most of the tools. In the border crossing scenario as well as in the parking place scenario with the covert search it was demonstrated that the radioactive material which was even shielded could be detected, localized and identified successfully and also a simulated masking attempt could be elucidated.

REFERENCES

[1] EDEN Security [online] [viewed 20 June 2016]. Available from: https//eden-security-fp7.eu

[2] SCINTILLA Project, 2012. SCINTILLA - Welcome to the SCINTILLA Project website || a pan-European research collaboration funded by the European Union [online] [viewed 20 June 2016]. Available from: http://www.scintilla-project.eu

[3] Security Systems JANUS [online] [viewed 20 June 2016]. Available from: http://www.indracompany.com/sites/default/files/janus_2.pdf

[4] Deployable Radiation Portal Monitor - PM5000C-05M [online] [viewed 20 June 2016]. Available from: http://www.polimaster.com/products/radiation_portal_monitors_/pm5000c-05/

[5] Symetrica Security Pedestrian Portal Data Sheet Handheld [online] [viewed 20 June 2016]. Available from http://www.symetrica.com/contact by email to info@Symetrica.com

[6] Symetrica Security VeriFinder Handheld [online] [viewed 20 June 2016]. Available from: http://www.symetrica.com/verifinder-2

[7] Spectroscopic Personal Radiation Detectors PM1704/M/GN [online] [viewed 20 June 2016]. Available from: http://www.polimaster.com/products/spectroscopic_personal_radiation_detectors/_1704/

[8] Risse, M.; Berky, W.; Chmel, S.; Friedrich, H.; Glabian, J.; Köble, T.; Ossowski, S.; Rosenstock, W.; Schumann, O.; Kronholz, H.-L.: Car-borne measurements of radioactive material, 3rd International Symposium on Development of CBRN Defence Capabilities, Bonn: German Association for Defence Technology, Centre for Studies and Conferences, 2015, S. 1216-1251. – URN:nbn:de:0011-n-3673179

[9] Symetrica Security Backpack Data Sheet Handheld [online] [viewed 20 June 2016]. Available from http://www.symetrica.com/contact by email to info@Symetrica.com