Contribution ID: **54** Type: **Oral**

EXPERIENCE IN THE APPLICATION OF FORENSICC EXAMINATION TECHNIQUES IN THE IAEA REGIONAL EXERCISES ON NUCLEAR FORENSICS

Introduction

The need for joint investigations of seized radioactive samples by both NRM specialists and forensic experts, who study these samples using traditional forensic techniques is no longer in doubt. However, the most significant steps in identifying the problems arising from the interaction of specialists from different scientific schools and different departments, in finding ways to solve these problems, can be made in the process and during recognizing the results of the exercises. This understanding has been reflected in exercises organized by the International Technical Working Group on Nuclear Forensics [1], as well as in the recent IAEA regional nuclear forensics exercises for the CIS and Eastern Europe countries. It should also be noted that the need for coordinated actions by these specialists, as well as investigators, arises before the start of samples analyses in laboratories. It arises at the crime scene. Therefore the main goal of the exercise in 2021 was to develop the interaction of investigators, forensic experts and NRM specialists at different stages of a crime investigation.

The specifics of the exercises

The exercises organized by ITWG and the IAEA regional exercises have very different implementations. The first includes familiarization with the scenario of the incident and the subsequent analysis of samples sent by the organizers in different national laboratories. Duration of analysis is two months. Regional exercises are held for a week and include a simulation of an incident with NRM dispersion, which differs from the real one in that instead of real radiological dispersible devices (RDDs), their mock-ups are used, in which NRM are replaced by their non-radioactive simulators. And the participants in the exercises perform the roles of both: members of the investigative and operational teams, taking items and environmental samples at the scene of incidents, and participants of expert groups, taking part in the analysis of some of the items and samples and answering questions of the "investigative authorities". The limited exercise time necessitates some simplification of the items and samples analysis procedure, however, the used research methods must fully ensure the logic of the incident investigation.

Methods and results of investigation

Lead powder as well as powder of tungsten with altered isotopic composition, imitating NMR powders, and a solution of non-radioactive cesium, imitating a solution of cesium-137, were dispersed over certain areas in the conducted exercises. Traces of the same powders contaminated some items in the room that played the role of a workshop in which RDDs were manufactured. The following analytical methods have been used in laboratory studies: inductively coupled plasma mass spectrometry (ICP-MS), scanning electron microscopy (SEM) in combination with energy dispersive X-ray microanalysis (EDX), and secondary ion mass spectrometry (SIMS). These methods were used in the analysis of items and samples taken at the site of dispersion of the NRM simulators and in the workshop. In addition to physical and chemical analysis, the exercise included traditional forensic fingerprints research. These fingerprints were left on one of the items found in the area of cesium dispersion, as well as on one of the items in the workshop.

The variety of objects at the incident scene and diversity of the research methods made it necessary the interaction of different specialists and determination of the sequence of research techniques - the study of some evidence on the surface of an object can damage or destroy other evidence. The exercises showed:

• Analysis of environmental samples by ICP-MS revealed the area covered by sputtered cesium;

• Studies of the morphology and elemental composition of powder particles by the SEM-EDX techniques as well as measuring of isotopic composition of tungsten in particles by SIMS methods showed the identity of the powders collected at the site of their dispersion and in the workshop;

• Investigations of the fingerprints left on the drone, from which the cesium was sprayed, and on the objects in the workshop, showed that they were left by the same person.

Conclusions

The paper shows that the analysis of objects, collected during the exercise, using ICP-MS, SEM-EDX and SIMS, as well as the study of fingerprints left on the objects, allow to achieve the goal of the exercise –practicing joint actions of the investigation participants.

References

1 J.Schwantes, O.Marsden, F.Taylor. Sixth Collaborative Materials Exercise After Action Report, ITWG, 2021.

2. IAEA incident and trafficking database (ITDB) Incidents of nuclear and other radioactive material out of regulatory control 2020, https://nusec.iaea.org/portal/User-Groups/Nuclear-Forensics

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Session Classification: Oral Session #4 –International Cooperation and Exercises

Track Classification: 3. Nuclear Forensics Sustainability and Cooperation: 3.4 Inter-laboratory Exercises and International Cooperation on Nuclear Forensics