THE ROLE OF CBRN LIVE AGENT TRAINING IN EDUCATION OF FIRST RESPONDERS

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Abstract: In the modern security architecture, CBRN threats represent one of the most dangerous and devastating threats with immediate and prolonged effects both on people and the environment with additional security and economic consequences. The prompt and professional response has a key role in the management of the crisis caused by CBRN agents. That is why the first responders need to be trained and qualified individuals with special equipment and working methods. The aim of this paper is to present the importance of a holistic approach in training, through the integral CBRN activities that include chemical, biological, and radiological field detection and decontamination procedures, medical response and personal protection, sampling, and laboratory analytical methods as well as adequate security procedures and protocols. Having in mind that time of reaction and adequacy of responses are the key factors for crisis management, as the main conclusion of this paper a necessity to improve the skill of the first responders through comprehensive training during which trainees must be familiarized with different types of threats, respond protocols, techniques, and equipment is recognized. Due to the complexity of the research subject, which requires knowledge from different scientific fields, qualitative research design has been applied which includes a literature review, qualitative content analysis, and scenario methods.

Key words: CBRN threats, CBRN agent training, security, the first responders

INTRODUCTION

In contemporary security studies, the use of CBRN agents is perceived in several ways: as an asymmetric threat (Lambakis, 2015), as a weapon that defines a type of war (Lele, 2014), as well as an emergency situation caused by accidental release or exposure to toxic industrial material (also known

as Hazmat) and deliberate release of hazardous material (Calder and Bland, 2015). The institutional efforts are directed in two ways: focusing on the prevention of the hostile misuse of CBRN agents, materials and knowledge, and building proactive and reactive capacities in case of an accident.

The origin of these threats can be different, starting with accidents during the transport of dangerous goods, then accidents that occur during the work processes in industry, nuclear plants, or laboratories, as well as accidents that happen as a result of weather disasters such as earthquakes and typhoons. However, the origin of CBRN threats can also be found in the activities of terrorists and organized criminal groups, whether they pretend to use or resell these agents. The effects of CBRN agents are varied and dependent on the agent involved, impingement area, incident conditions (weather, terrain, time), and exposures to life, systems, and environment (Bhardwaj, 2010:157). Common for all CBRN accidents is that they leave serious health, environmental, economic, and security consequences, have large psychological impact on the population and require an integral response from different institutions.

Individuals and teams who are the first sent to the site of CBRN accidents to gather information, isolate the scene and mitigate consequences are the first responders. Their primary task is to apply the basic identification methods to adequately recognize and classify the type of threat and organize activities to prevent the spread of agents and to protect people and the environment. This complex task does not require expertise, but an approach based on multidisciplinary knowledge from different fields of science with the aim of shortening the response time. For this reason, the first responders must know methods such as sampling, analytical methods, in order to define zones of action (hot, warm, and cold) in the shortest possible time, and take over all necessary activities in the chain of custody. The more professionally they undertake these activities, the faster and more efficient the work in the laboratory will be, and the response to the CBRN threat will be faster and more comprehensive.

The aim of this paper is to present, analyze and explain the importance of a holistic approach in CBRN live agent training of the first responders. This education includes an integral approach in CBRN activities that should harmonize treatment in chemical, biological, and radiological field detection and decontamination procedures, medical response and personal protection, sampling and laboratory analytical methods as well as adequate security procedures and protocols. CBRN live agent training requires participants to gain specific skills and knowledge through participation in lectures, demonstration exercises, and scenario-based simulations.

CHARACTERISTICS OF CBRN AGENTS

The risk of CBRN incidents has increased in recent years, due to advances in technology, wider use of these materials in industry, and medicine and increased willingness of terrorists to use unconventional weapons. CBRN threats fall into the category of 'dread' risks because they are often invisible, the consequences of contamination unknown, and they may have catastrophic potential (Carter, Drury & Amlôt, 2020). In security science, CBRN threats are perceived as complex, highly unpredictable events that are of low probability but of potentially very high impact. The main properties of CBRN agents – toxicity, latency, persistency and transmissibility (ICRC, 2020:6-7) - make the CBRN threats complex and with a multiple adverse effects. These threats can also have various manifestations, can be combined with other threats, and be carried out by different perpetrators. Therefore, an effective response to these threats require special readiness, knowledge, organization and interoperability between relevant institution and a cross-sectoral approach.

THE ORIGIN OF CBRN THREATS

A CBRN incident is defined as "any occurrence, resulting from the use of CBRN weapons and devices; the emergence of secondary hazards arising from counterforce targeting; or the release of toxic industrial materials (TIMs) into the environment, involving the emergence of CBRN hazards" (Joint Publication 3-41, 2016:I-1). Therefore, the origin of the CBRN usage differs and includes situations where it may be released during work processes unintentionally, as well as situation in which intentional releases and deliberate use of CBRN agents occur. ICRC recognizes many situations that can result in unintentional releases of CBRN agents:

- industrial accidents involving fire or explosion at a chemical plant or storage facility, an accident at a nuclear power plant, or a leak from a biological containment facility;
- accidents at military research, production, and storage facilities for chemical, biological or nuclear weapons;
- conflict situations in which a CBRN agent is released because of collateral damage to an industrial plant or a research, manufacturing or military facility;
- accidents during transport of CBRN agents for industrial or military purposes;
- natural outbreaks of a human, animal or plant disease, e.g. pandemic influenza in humans, foot and mouth disease in cattle and fungal blight in plants;
- natural disasters, such as an earthquake or tsunami, leading to damage of an industrial plant or a military or storage facility;
- contamination from previous incidents, e.g. sites of industrial accidents, or from locations formerly used for the production, storage or testing of CBRN weapons;
- remnants of war, such as lost, abandoned or unexploded CBRN weapons, or residual contamination from their use (ICRC, 2020:10).

Those situations of sudden and uncontrolled release of CBRN contaminants are mostly the result of non-compliance with working procedures or violations of security procedures by employees, inadvertency, technical-technological flaws, and obsolescence of infrastructure, natural factors or causality. The fact that in those cases the release of the CBRN agent is not deliberate does not have impact on the extent of the consequences, or lethality of accident, and requires the same activity in response and recovery as in any other CBRN event.

The second event that can occur is the situation in which CBRN agents have been intentionally released with the intention to cause injury and death and/or to generate fear and panic in population. Some of those situations are:

- the dispersal of CBRN agents as gases, liquids, aerosols, or solids in the air, or on the ground using munitions, explosives or other means of dispersal (e.g. spray devices), leading to contamination of widespread areas or within confined spaces or buildings;
- the use of CBRN agents in armed conflict or other situations of violence through purpose-built military weapons or improvised devices, with or without explosives;
- the use of CBRN agents for small or large-scale contamination of food or water supplies

- the targeted delivery of CBRN agents to individuals or groups, e.g. by post, leading to contamination of individuals and buildings (e.g. anthrax spores), or the use of CBRN agents to poison individuals (ICRC, 2020:10-11).

The perpetrators of such attacks can be both state, and non-state actors, including terrorists and organize criminal groups. The motivation for using this type of threat is different, but it is based on the fact that the use of this weapon has destructive power, destabilizes entire states, and leaves great political consequences. Unlike most other security threats where the consequence is in direct correlation with the number and organization of perpetrators, financial resources, availability of weapons, proximity to the target, etc., in the case of CBRN attacks even relatively small attacks with a limited number of direct casualties could have a significant impact on society. It could induce fear and panic, major socio-economic disruptions, and paralyze certain areas over a long time. So, one of the security imperative of any state is to prevent CBRN agents from getting into terrorists' hands. Because of the nature of CBRN threats, great attention is paid not only to the activity of terrorist organizations but also to lone wolves.

Concern about dual-use of goods and technologies is also present in security discussion on CBRN. This refers to those products that were designed to be used for peaceful and legitimate civilian or commercial purposes, but also have potential applicability in the development or enhancement of weapons' programs, including CBRN (Galatas, 2020:561). Many technical solutions improve different aspect of human life, but at same time increase CBRN insecurity as drone technology that improved delivery of CBRN agents, cyber-attacks targeting critical infrastructure and facilities.

As security paradigm evaluates, societies confront with new, transformed and combined threats. One of the newest kind of threats is hybrid threat defined as "any adversary that simultaneously and adaptively employs a fused mix of conventional weapons, irregular tactics, terrorism, and criminal behaviour in the battle space to obtain their political objectives" (Hoffman, 2010:443). In the constellation of hybrid threats, special attention should be merited on hybrid threats that involve the use of unconventional means and CBRN agents such as the use of toxic chemical agents (the assassination of Kim Jong Nam with VX in 2017, as well as the poisoning with Novichok of Sergei and Yulia Skripal in 2018 and Alexei Navalny in 2020) (Novossiolova and Martellini, 2021:8).

CLASSIFICATION AND EFFECTS OF CBRN AGENTS

CBRN is the acronym for nuclear, radiological, biological and chemical agents. These agents include a wide spectrum of materials and substances that have the potential to affect human health. Important characteristics of the agents include agent class, physical properties and onset of effects (latency) (Bland, 2014). The most usual classification of CBRN agents is listed below:

- Chemical agents: The main classes of chemical agents are:
- Nerve agents (organophosphorus compounds);
- Blistering agents (vesicants);
- Cyanides (also known as blood agents);
- Pulmonary agents (choking or lung damaging agents);
- Incapacitants (mental and physical);

- Toxic industrial chemicals (TICs). While this class of agent is used, there is significant overlap with other classes of chemical agents especially cyanides and pulmonary agents;
- Riot-controlled agents (RCAs). These agents used by law enforcement agencies are not prohibited by international conventions but may still have harmful effects;
- Pharmaceuticals. This class includes illicit and commercial drugs usually at supra-therapeutic or toxic doses.
- Biological agents: The two classes of biological agent are:
- Live agents such as bacteria including rickettsia and chlamydia, viruses and fungi;
- Toxins – chemical agents that are of biological origin and include those derived from bacteria, fungi, plants and animals (venom).
- Radiological material: This hazard can be classed by the type of ionising radiation present:
- Alpha – a relatively large subatomic particle (similar to a helium nucleus) with limited range in air (millimetres) but significant damaging effects;
- Beta – a small subatomic particle similar to an electron with a range in air of centimetres;
- Gamma/X-ray – high-energy photons with no mass but highly penetrating;
- Neutrons – normally associated with nuclear material and the fission (nuclear) process which are highly penetrating and with variable damaging effects.
- Nuclear material: The term nuclear material is generally used to describe material involved in the nuclear power or weapon industry, or as having fissile properties, i.e. the potential for the nucleus to be split and therefore generate energy, fission products and further neutron emissions.

Delivery methods strongly depend on physical properties and stability of agents as well as on vulnerable routes of absorption. The two types of delivery are overt or covert. Overt releases are likely to follow a conventional major incident response, while a covert release may go unrecognized for a period of time.

There are four major types of effects of CBRN agents on human health. Those are intoxication (due to an exposure to TIC, CWA or toxins), irradiation (due to exposure to ionizing radiation), infection (due to exposure to biological agents) and different types of injuries caused by subsequent trauma. Depending on the type of agent and the route of exposure, they can cause severe effects ranging from incapacity, through different types of damage, to lethal outcome. The time period between exposure and occurrence of the first medical symptoms is called latency period for chemical and radiological agents, or incubation period for biological agents. Proper recognition of symptoms and knowledge on latency and incubation periods is of profound importance in protective and medical response to a crisis. Figure 1 shows an onset of effects of some common CBRN agents.

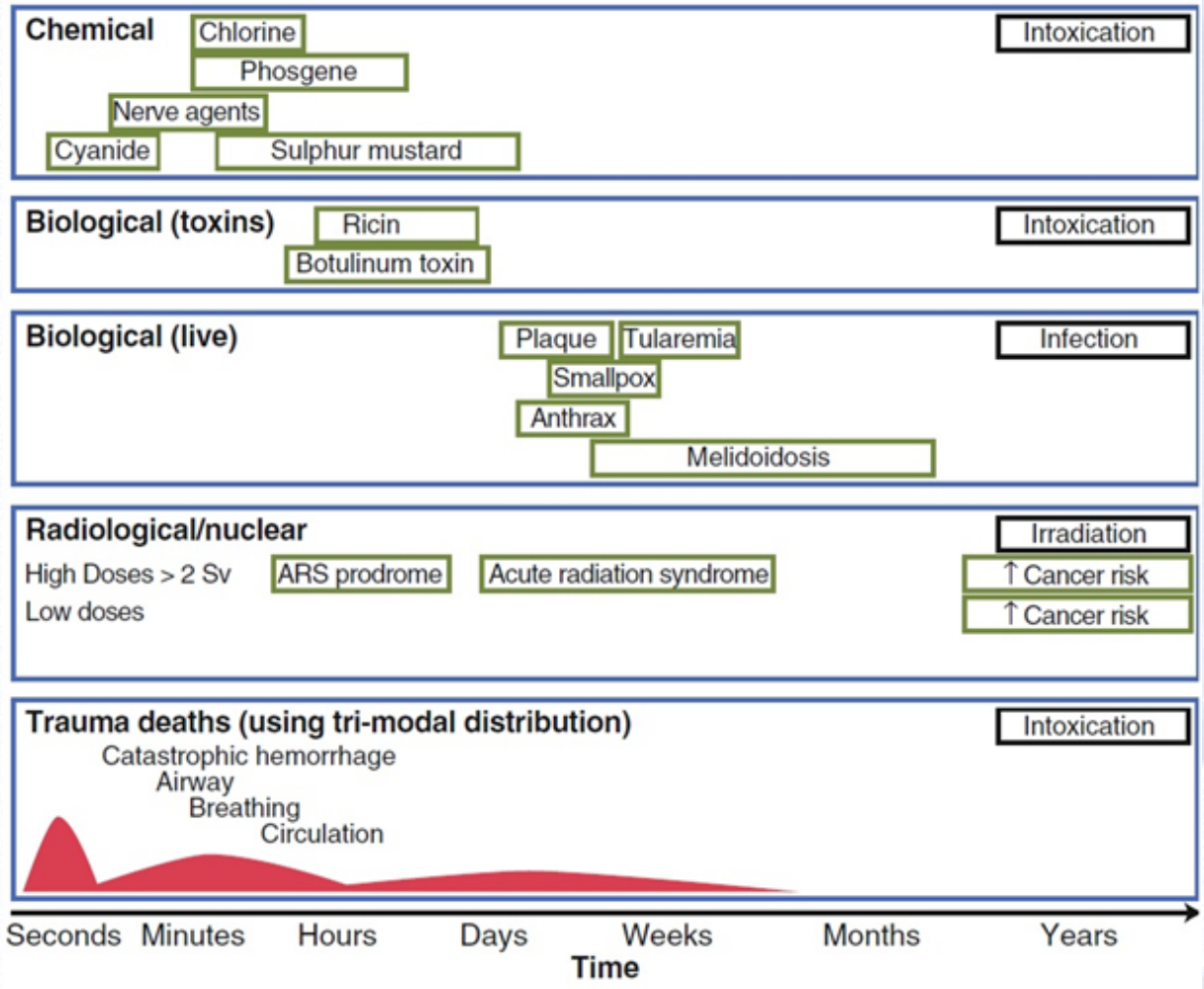

Figure 1: *Onset of effects of some common CBRN agents (Bland, 2014:752)*

INTEGRAL RESPONSE TO THE CBRN CRISIS

The first two decades of the 21st century are characterized by growing economic globalization, new technological advances, and emergence of the non-state actor with great influence on international politics. The new technological discoveries are advancing human society, but at the same time, they can be abused and become a security threat. In order to provide adequate countermeasures to those threats, it is necessary to establish the best response strategy on a national and international level. In the security strategies of most modern countries, the proliferation and misuse of CBRN agents is identified as a special risk. By reconsidering the risk management principles in the context of CBRN agents, it is possible to establish an integral response to the CBRN crisis.

Risk management is defined as "a process of identifying opportunities and avoiding or mitigating losses. To achieve these ambitious stipulations, it must be a structured and systematic process. In this process it is necessary to establish an understanding of the risks associated in a way that enables an organization to minimize losses and maximize opportunities" (Blum, et al. 2013:434). The main purpose of risk management is to prepare stakeholders for potential problems that can occur unexpectedly and

to facilitate anticipating problems in advance. Phases of risk management arise from two basic activities – risk assessment and risk evaluation (Figure 2).

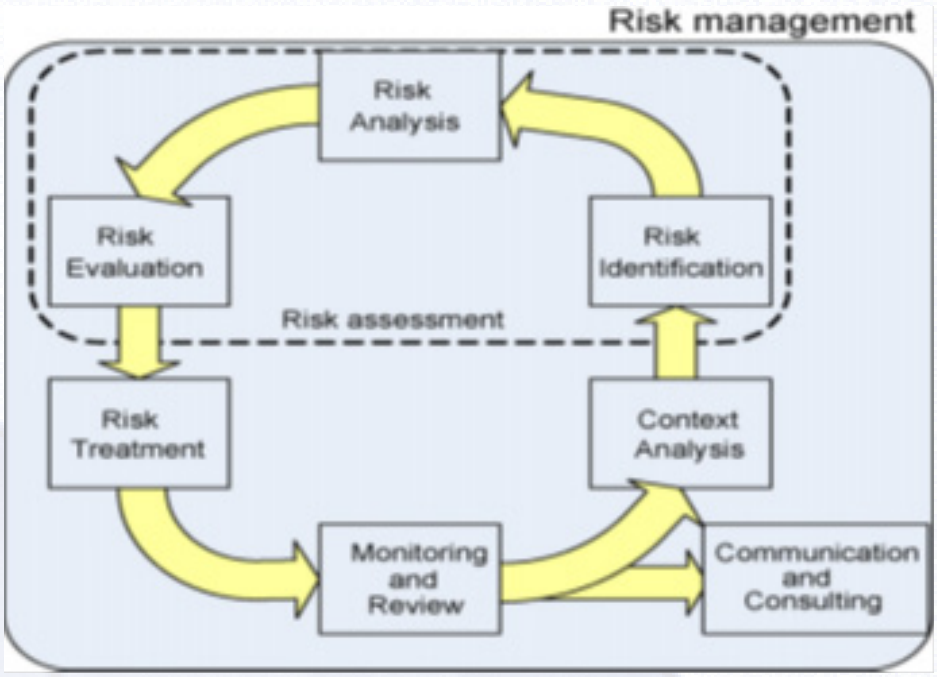

Figure 2: *Risk management phases (Aloini et al., 2007:548)*

Risk assessment is the function of identifying the threats and vulnerabilities for a given resource, articulating the risk, and rating that risk on a given scale. Risk evaluation is the function of determining the proper steps to manage the risk, whether they be to accept, mitigate, transfer or avoid the risk exposure (Wheeler, 2011:47). The presented matrix is generic and applicable to different types of risk areas – production, marketing, financial, legal, and human, etc. The complexity of security risks, their interdependence, and the context in which they occur require a comprehensive risk management approach that includes various specific elements. Lemyre et al. have identified four interrelated elements of risk management that should provide scientifically sound, cost-effective, integrated actions that reduce or prevent risks:

1) issue identification, including understanding the social, cultural, ethical, political, and legal context of the problem;

2) risk assessment - that is, hazards identified, likelihood of adverse outcomes estimated, risks and benefits characterized;

3) the identification, selection, and implementation of risk management options; and

4) the on-going monitoring of risk management interventions (Lemyre et al., 2005:318).

Security risk management requires a comprehensive approach that includes the establishment of adequate context, understanding the nature of security threats, identifying relevant stakeholders, analysing the characteristics of potential perpetrators, the causes, contributing factors and actual or potential consequences, and many other factors. Due to these specific elements, certain activities of crisis management are modified, while the basic phases remain unchanged.

CBRN RISK MANAGEMENT

In order to prevent and reduce the risk of CBRN incidents modern states establish integrated CBRN risk management which includes preventing, detecting, preparing for, and responding to the deliberate misuse of CBRN. Numerous actors with clearly defined roles participate in mitigating and providing a response to this kind of incident. NATO has developed the Guidelines for First Responders to a CBRN Incident (2014) that provide guidance in procedures, capabilities, and equipment required to implement an effective response incorporated in a matrix with four sections. Each section gives detailed advice, but for the purpose of this research, we summarize that matrix in one process shown in Figure 3.

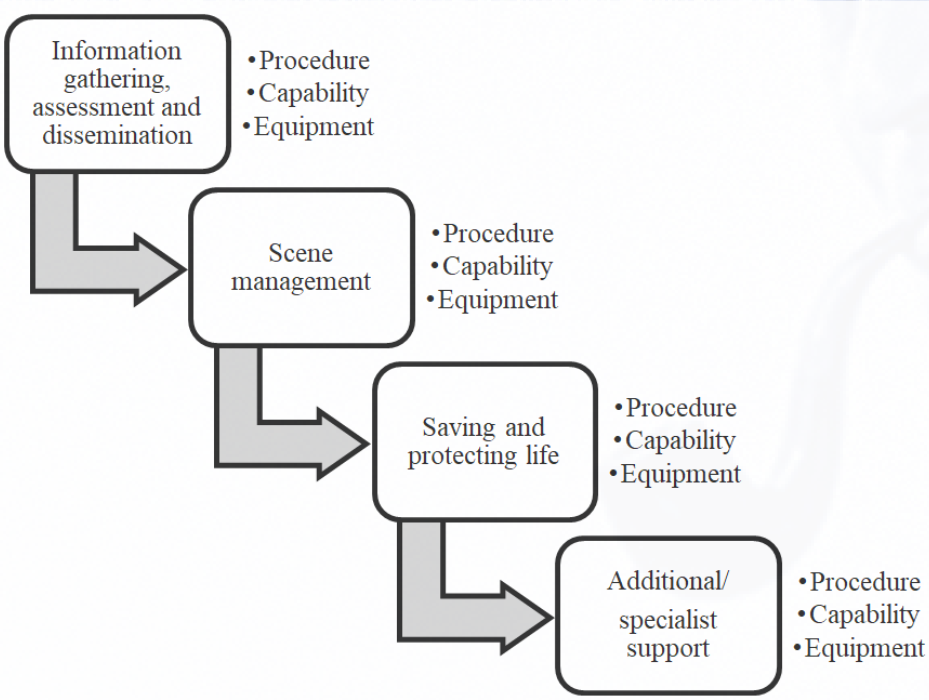

Figure 3: *Alternative representation of steps in response to a CBRN Incident*

In each of the identified phases, a large number of different actors are involved, applying special procedures in order to ensure effective and coordinated response to CBRN crisis. All actors involved need to have a common understanding of actions required during the initial response phase. It is crucial that activity of stakeholders be fully integrated with high level of cooperation and coordination. The precondition for that is CBRN live agent training, especially of first responders.

The term "first responders" refers to individuals and teams that are involved in activities which address the immediate and short-term effects of a CBRN incident (Guidelines for first responders to a CBRN incident, 2014). This includes personnel from police, fire brigades, health services, security services and private security providers, environmental specialists, solders, and scientists and laboratory specialists (Kaszeta, 2013:5) acting to minimize the consequences of a CBRN incident. First responders have different basic skills, education and experience that need to be unified during CBRN live agent training.

THE EDUCATION OF FIRST RESPONDERS

In order to secure a proper respond to different CBRN threats, the first responders should go through large-scale trainings which cover a wide variety of lectures, practical demonstrations and complex exercise scenarios. The personnel involved in all stages of an incident response and post incidental recovery should be familiar with the whole process, protocols and rolls of other involved teams. They should gain both theoretical and practical knowledge in possible CBRN threats and agents, the use of PPE (personal protective equipment), the application of safe work practices, the chain of custody protocols, the proper identification and decontamination methods, medical emergency, as well as applicable legislation.

The stated especially concerns all emergency and security personnel that will directly respond to possible CBRN incidents. For these teams, the CBRN live-agent training courses should be designed in order to provide them with knowledge, skills and abilities to work confidently in protective clothing in a toxic environment containing chemical agents, toxic industrial chemicals, biological agents and radiological or nuclear materials (Stolar, 2012).

Every kind of training has its advantage. It can be cost-efficient, fast or practical, but only genuine theoretical education, paired with usual training tasks and live agent training can bring responders as close as possible to the problems they will have in reality. It is possible to use simulations or films and past experiences in the training, or to use materials which can simulate an agent in practical exercises. Unfortunately, these types of training carry one evident problem: there is no real CBRN danger and, therefore, they create less stress. When it is time for the real incident, everything looks a lot different. That is why the live agent trainings have paramount importance in preparation of the first responders for real life situations. These trainings can be tailored to meet specific customer needs and can be conducted with the use of chemical or biological agents, radiological materials and explosive devices.

For instance, Coughlin states the main advantages of live agent training (Coughlin, 1992, Appendix I p.4):

a. Toxic/live agent training is more stressful and builds confidence more effectively than training with stimulants.

b. A soldier who has trained with toxic agents is a more credible expert/trainer than a soldier who has trained with stimulants alone.

c. No existing stimulant adequately replicates a chemical agent physically, physiologically or psychologically for training purposes.

d. Live/toxic agent training, by increasing the confidence and credibility of Chemical Corps soldiers, increases the readiness of those soldiers and of their units. Our current level of NBC readiness cannot be sustained without live agent training.

The course program should be designed to ensure that participant develop high level of proficiency in application of operational equipment – the detectors and their operational modes, sampling packs, auto injectors, decontamination equipment, etc. Furthermore, they need to understand and experience all the factors that influence the effectiveness of CBRN equipment, e.g. they should be capable to recognize how the use of PPE affects their psychological and physiological abilities during a real crisis situation. It is shown how it looks in practice in Figure 4.

Figure 4: *Photographs of outdoor training excersises at Vinca Institute, Serbia*

The on-going challenge for instructors is to expose their trainees to the full range of potential CBRN threats in a way that is *safe, realistic and easily repeatable* (Pike, 2020) and to gain a common level of knowledge to work safely and effectively in a toxic environment.

The comprehensive approach in CBRN live agent training includes three consecutive phases. During the first phase the trainees get introduction in theoretical knowledge on the subject. The aim of the second phase is to provide a practical demonstration by highly educated and experienced personal, i.e. instructors. In the final stage, the trainees are involved in practical application of gaining knowledge from the previous phases in both indoor and outdoor simulations and complex scenarios.

CONCLUSION

The very fact that a CBRN agent has been released would cause a high level of fear and stress in the exposed population. This is a direct consequence of both the ignorance to the characteristics of this threat, and the lack of knowledge on protection behaviour, which are common to the general public. Additionally, there are other aggravating factors such as the seriousness of the consequences which include even death of people and long-lasting destruction of the environment. For this reason, states are making great efforts in developing adequate and comprehensive CBRN crisis management as one of the best proactive/reactive solutions for this type of crisis.

CBRN crisis management is a very complex activity because at the same time several very demanding tasks need to be realized. The following activities need to be implemented simultaneously: urgently gather relevant information in difficult conditions, isolate the scene of a CBRN event in order to mitigate consequences, protect contaminated victims and provide an operational response that includes identification and confirmation of used agents, establishing the level of contamination, providing medical support, treatment of casualties and other activities in the chain of custody.

In the case of a CBRN event, time and adequacy of responses are key factors for crisis management. For this reason, the expert approach of the first responder must not be questioned. First responders must have adequate theoretical and practical knowledge in order to apply properly timed and professional response. Such skills can be acquired only as part of comprehensive training during which the trainees must be familiarized with different types of threats, response protocols, techniques and equipment. After this initial stage of the training they should systematize the existing knowledge in the field by observing the trained instructors on how to act in certain situations, and, as the last step of the training, the trainees should practice all the necessary procedures under the supervision of highly educated instructors. In this way, the trainees will acquire the necessary knowledge and skills to behave in real situations which leave no room for improvisation.

ACKNOWLEDGMENT

The research was funded by the Ministry of Education, Science and Technological Development of the Republic of Serbia, as the part of topic "Fundamental and applied aspects of electrocatalysis in energy systems and green technologies", within the program Energy and energy efficiency, which are realized in the Vinča Institute of Nuclear Sciences - National Institute of the Republic of Serbia, University of Belgrade, Belgrade, Serbia.

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