BEST PRACTICES IN CBRN WASTE MANAGEMENT IN MILITARY OPERATIONS

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Abstract: *Dangerous wastes are solid, liquid or gaseous materials that may be lethal or dangerous to humans and the environment. Such wastes can be toxic chemicals and flammable or radioactive substances, including industrial waste from chemical plants or nuclear reactors, agricultural waste, pesticides, fertilizers, medical waste or hazardous household waste such as toxic dyes or solvents. CBRN waste should be safely recycled without harm to the environment. Toxic chemicals, radioactive substances or biological materials should be concentrated for final disposal.*

Keywords: CBRN, ENVIRONMENT

1. Introduction

CBRN waste management is perceived as a set of actions toward the achievement of certain organizational goals through impacts on people and available but limited resources. In order to provide more opportunities with fewer resources, environmental management systems should be built. In their work in the performance of their assigned tasks of defending the political and economic interests of NATO member states, they interact with each other as well as with a number of external factors of political, economic and environmental nature.

Chemical, biological, radiological and nuclear (CBRN) risks represent a new dimension of possible terrorist attacks, accidents and / or pandemics due to their transnational character and mass scale of damage. An appropriate response to such a threat involves not only follow-up programs, but starts much earlier - dealing with such materials, their proper storage, limited access, checks, and so on. At same time, the interference subsequently requires wide-ranging cooperation between the different national authorities in a Member State (civil protection, military, law enforcement, etc.) as well as between national authorities of different Member States and EU instances. Therefore, a coordinated approach covering all risks is needed. [19]

2. CBRN Waste Management

Radioactive Waste Generation:

- Military programmes;
- Hospitals and research laboratories;
- Nuclear Energy Industry
  - Mining and milling of uranium ores;
  - reprocessing of fuel discharged from reactors;
  - decommissioning;

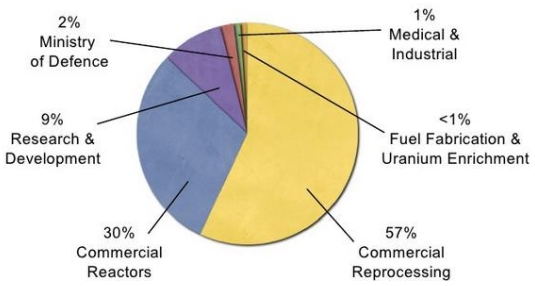

Fig. 1 *Total conditioned waste volumes from each business activity*[5].

On fig. 1 there are a total conditioned nuclear waste volumes from each business activity. During the air strikes in 1999 NATO used ammunition with depleted uranium (DU) in FRY. It is known that the DU has a long time of semi-disintegration; actually its effect is ever lasting. More than few years after the end of conflict, particles of DU dust can be detected in a soil samples, as well as in some air samples. Also DU was found in the sensitive bio-materials. In this material cytogenetic and clinical laboratory investigations in persons, who lived in Southern Serbia (Vranje) and on the Kosovo have been presented. The population of the contaminated regions should be subjected to annual screenings according to the program of the targeted examination aimed at detection of internal contamination in order to enable early diagnosis and treatment of the diseases. The particular attention should be paid to children and pregnant women, due to their increased radio-sensitivity. [1, 2, 20, 21]

In recent years, there has been growing concern that many of the most likely threats of chemical terrorism involve so - called "agents of opportunity." Both common and unusual industrial agents may pose a considerable threat as potential terrorist weapons. While an understanding of the traditional military chemical weapons (e.g. nerve agents) remains essential, an appreciation of the myriad of other potential toxic chemicals readily available in our society is crucial if we are to optimally prepare, identify and defend against chemical threats. Many toxic industrial chemicals are easily obtainable from multiple sources in our communities and pose a serious threat to health if accidentally released or intentionally disseminated. [3, 4]

In that context in military operations, everyone knows the pollution of environment with bio-waste. The environmental pollution is carried out during non-warfare, and even more so in combat operations. The management of bio-waste should not be overlooked for both radiological and chemical waste. The North Atlantic Treaty Organization (NATO) refers to "medical waste" as "healthcare waste." NATO's guidance on how such waste should be handled is contained in Annex C of NATO Standardization Agreement (STANAG) 2581 Environmental Protection (EP), Ed. 1, Allied Joint Environmental Protection Publication (AJEPP)-1 Environmental Protection Standards and Norms for Military Compounds in NATO Operations, 7 September 2011.

Planning environmental protection when managing CBRN waste should include: prevention, detection, preparedness and response. The importance recognizing of each of these four steps in dealing with CBRN materials is crucial to ensuring the proper implementation of risk assessment, response and countermeasures as a whole. It is also highlights need for a horizontal and cross-border approach to handling CBRN materials, resulting from the proper allocation of measurable objectives and actions in each of the three parts to which the action plan is divided.

It's should be emphasized that CBRN risks arise not only from countries but also from non-state actors, which is why the strengthening of the non-proliferation and disarmament regime is of the utmost importance through the universal and full implementation of all relevant treaties and international agreements, namely the Non-Proliferation Treaty, the Convention on Chemical

Weapons, the Convention on Biological Weapons, and by agreeing on a treaty banning the production of fissile materials for weapons of mass destruction.

In the conduct of military operations, it is influenced by various elements of the environment. To prevent the negative consequences of this impact, it is necessary to plan and implement a variety of procedures under the Alliance's policy in this area. Environmental protection activities should be organized in a way that does not interfere with the balance between the objectives of the operation and capabilities of the formations. The organization's policy requires commanders to provoke understanding of environmental issues in their subordinates and to organize the process effectively. The responsibilities of the Armed Forces to environmental issues are both the responsibility of society and of themselves.

Contemporary operations are they a peculiar challenge and radically different from the peacetime activities of troops. Although operational requirements are paramount in planning, it is imperative to take into account the need for nature conservation as it is important to ensure the health and well-being of the forces and the local population. Planning of environmental protection and subsequent management of the environmental risk of CBRN waste is essential to prevent damage to sites of natural, cultural or historical importance that will complicate the achievement of the mission's objective. Most military operations are characterized by clearly defined phases of varying lengths, depending on the nature of the operation, its intensity and complexity:

- Planning;
- Pre-deployment;
- Deployment involving task execution and rotation;
- Redirection;
- After conflicting recovery.

For the individual phases, applicability of the environmental protection standards that may effect on participants is determined. In this way, it is clarified how the extent of the deployment of the voices will affect performance of the CBRN events and how to best deal with the planning of the mission. It turns out that the degree of deployment has a direct impact on the applicability of environmental standards. [20]

Military environmental protection is not a stand-alone process, it is an integral part of operations. Inclusion in standard operating procedures also increases the level of force protection, and effective risk management can be seen as a factor in preserving the fighting potential of forces.

Releases of CBRN agents may negatively impact human health through respiratory exposure (breathing it in), contact with skin or mucous membranes (eyes or nose), or ingestion through food or liquids. Property can also be affected because if it is contaminated, it will not be available for use. Areas of the environment (for example wetlands, fishing areas, agriculture areas, or groundwater sources) can be contaminated from releases of waste. The commander is necessary to provide clearly defined environmental protection guidelines for conduct of a drill or operation as early as possible during planning. They are basis for defining the main purpose and specific tasks of environmental protection. They must comply with the requirements set out in regulatory documents and be defined as events before and after approval of the plan. They are regulate order of movement along the area, peculiarities of overcoming water basins, wetlands and water catchment areas, prohibited activities in disguising and engineering equipment of deployment areas and positions. The requirements for setting up field bearings, parks, food points and outposts, field stations for maintenance, repair and storage of armaments and equipment, fuel stations, ammunition storages and other types of property, as well as the order of action for the occurrence of accidents. Any restrictions on the actions of the formation aiming at the protection of the environment are given on a map or scheme. [5]

NATO's joint doctrine on environmental protection and environmental protection during NATO-led military action provides guidance on the ecological planning of military activities. It sets out requirements for all commanders to effectively implement environmental events in organizing and conducting exercises and operations by NATO forces. It analyzes the operational activities to be carried out and their potential impact on environmental components, including various possibilities and contingencies.

3. CBRN Waste Management Capabilities

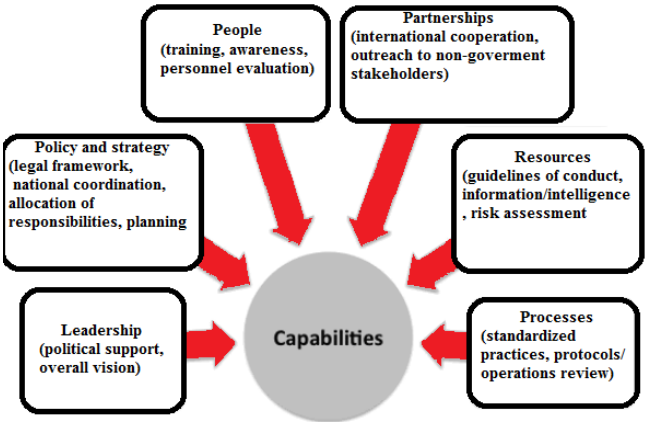

Fig. 2 *Directions of developing capabilities for managing CBRN waste.*

On the basis of an analysis of information related to waste management of radiological, chemical and biological origin there are on the Fig. 2.

4. Tasks in the CBRN Waste Management

Waste management is an integral part of environmental protection in the areas of operations. All waste is required to be managed in accordance with their hierarchy. Managing and handling is a logistical task. It requires pre-planning and appropriate financial support. To accomplish the task, all waste should be categorized. There must be places for storage of them by building temporary sites and equipping places for hazardous waste. Waste recycling opportunities are sought in local facilities.

The CBRN management plan can be part of an integrated waste management plan. Whether it is a stand-alone document or is part of an integrated plan covering the full range of wastes, the keys to a successful CBRN management plan are:

- Understanding what wastes are hazardous;
- Safeguarding waste throughout collection, transportation, and disposal;
- Assigning responsibilities and establishing procedures and standards for each aspect of the plan (segregate, collect, transport, recover, and dispose);
- Establishing the means to enforce standards through training, supervised execution, and inspections.

The CBRN waste management plan and standard operating procedures (SOP) must collectively address the proper characterization of CBRN waste as well as requirements for accumulation areas, container management, labeling, documentation, and recordkeeping instructions.

During operations, environmental specialists, medical staff and logistics specialists should consult the commander on a case-by-case basis. As before and during the deployment of NATO troops,

data on the ecological situation should be collected and documented. At the end of the military activities or during the re-appointment of the troops, the changes and the adverse consequences must be documented. [6, 9]

The commander bears all responsibility for the proper implementation of the waste activities. The aforementioned specialists must be assisted in assessing the situation when planning and conducting the training. Waste management plans and orders are drafted, indicating activities that prevent waste from spreading into the areas where the exercise is conducted. The plan reflects the order of organization of the interaction with the Regional Inspectorate of Environment and Waters and ensures full control of the waste management process.

At the waste management planning, account should be taken of the factors affecting CBRN waste such as geographic and topographic conditions, climate, population, waste management infrastructure, industry, industry and agriculture, as well as the quantity and nature of waste that would the factors of the Environment were generated. The impact of specific ecological problems, the existence of risk areas and their adverse impact on the performance of the activities and the fulfillment of the tasks are also affected. [9]

Due to the nature of the combat operations and the CBRN environment, the forces must make efforts to collect, preserve, or otherwise dispose of the CBRN materials properly. Every effort can be made, but the situation may not allow that.

Recycling CBRN waste should be done in an appropriate and safe place to reduce the risk to the environment. If there is a CBRN waste, NATO operations must be reported to local authorities. The staff involved in managing CBRN waste must have sufficient knowledge and skills. They should be informed about the minimization of the harmful impact of the waste and its proper management. Suppliers of hazardous substances also play a role in waste minimization programs. On the regulations, it is permissible to assign functions of a radiation protection officer responsible for the storage, reporting and control of ionizing radiation and the accountability officer for incidents and accidents to an official such as the CBRN officer. He is assigned to act as a radiation protection officer. [18]

The ecologist of the formation is responsible for the waste management plan. He coordinates with:

• The lawyer of military formation;

• Logistics department;

• Engineers;

• The receiving nation;

• Different supporting countries;

• All services producing any kind of waste (for CBRN waste it would be a CBRN officer);

• Political leadership - on strategic waste management.

The ecological officer (EO) does not bear all these responsibilities unassisted. Examples of other officers and their responsibilities include the following:

- The health (medical) officer is responsible for medical waste management. The EO should coordinate closely with the health officer to ensure proper disposal of medical waste. (Note that a medical waste incinerator is included in the "disposal options" section of the solid waste technical module.)

- The logistics officer (who may be at a higher level rather than within the unit) is usually responsible for distributing, transporting, storing, and recovering (turning in) waste; the EO works with the logistics officer to ensure that subordinate units have the necessary equipment and materials needed to establish proper hazardous waste accumulation points (HWAPs) and/or hazardous waste storage areas (HWSAs).

- The engineer staff officer, as the primary staff integrator for the environmental program which includes waste management, is responsible for integrating waste into the unit's overall waste management plan and incorporating the necessary tasks within operation orders and plans to ensure waste is effectively managed.

The CBRN Officer is responsible for the CBRN waste management process, which seeks assistance for the analysis of samples from a specialized CBRN Laboratory for Chemical, Dosimetric and Biological Analysis and Control or a link to the Military Medical Hospitals. In military operations, except for an active combat operation, all formations releasing CBRN waste are responsible for:

• Spill prevention;

• Proper collection of CBRN waste;

• Limiting the separation of CBRN waste;

• Locating / preserving containers storing CBRN waste;

• Control of leakage of CBRN waste;

• Marking of CBRN waste;

• Reporting when detecting the presence of CBRN waste;

• Transportation and disposal of CBRN waste as a logistical responsibility;

• Landfilling. [7, 8, 9]

The principle planning considerations for the location and storage of CBRN waste are:

- Being far enough away from sensitive environmental areas
- Avoiding areas that are subject to flooding
- Minimizing (or eliminating) adverse waste management operations risks

In making planning decisions about CBRN waste facilities, it is important to use all available information, such as the Environmental Baseline Survey (EBS), so that the necessary environmental information is taken into consideration.

The EO should coordinate with the safety officer so that there is ample space for expedient and unobstructed movement of personnel, material handling equipment, firefighting equipment, decontamination equipment, and spill control equipment.

The location, size, and number of hazardous waste accumulation points (HWAPs) within base camps and hazardous waste storage areas (HWSAs) within the theater will depend on: the amount of and location where waste is being generated; the availability of qualified contractors; and safety, security, terrain, and environmental considerations identified during the EBS. In terms of numbers, one HWAP will generally suffice for small base camps, depending on how much waste can be accumulated (based on final disposal procedures). In larger base camps with multiple large-sized units, there may need to be more than one HWAP. HWAPs are situated near where CBRN waste are generated in small quantities for a limited time, and are then moved to a consolidated HWSA as required.

As the EO, you have a responsibility to ensure that personnel are properly segregating different kinds of CBRN agents. He should know where to look for information about how substances should be segregated (such as SDSs), and ensure this information is conveyed to appropriate personnel, including training them on this issue. Segregation information can be found in a number of places. EO can obtain them from supply officer, the Safety Data Sheets (SDS), the manufacturer or from various websites, such as Internet.

SDSs list the hazardous characteristics for CBRN waste and are material- and manufacturer-specific. A Safety Data Sheet (SDS) is a document that provides information on the properties of hazardous chemicals/materials and how they affect health and safety in the workplace. They are material and manufacturer-specific. An SDS (also known as a material safety data sheet (MSDS), or product safety data sheet (PSDS)) is an important component of product stewardship and occupational safety and health. It is intended to provide workers and emergency personnel with procedures for handling or working with that substance in a safe manner, and includes information such as physical data (melting point, boiling point, flash point etc.), toxicity, health effects, first aid, reactivity, storage, disposal considerations, appropriate protective equipment, and spill-handling (emergency) procedures. It is important to have spill response plans in place, to have people trained in what to do in the event of a spill, and to ensure that these instructions are clearly posted in the storage areas. Even when people are well trained, having a poster that can quickly be reviewed in the event of an accident helps guarantee that proper procedures will be followed. [14, 15, 16]

The purpose of Allied Joint Environmental Protection Publication (AJEPP-2) is to provide NATO commanders and environmental protection (EP) officers with best EP practices and standards for military camps in NATO operations. The agreement of nations to use this publication is recorded in STANAG 2582.

Chemical, biological, radiological, and nuclear (CBRN) decontamination is the removal of CBRN material from equipment or humans. The objective of the decontamination is to reduce radiation burden, salvage equipment, and materials, remove loose CBRN contaminants, and fix the remaining in place in preparation for protective storage or permanent disposal work activities. Decontamination may be carried out using chemical, electrochemical, and mechanical means. Like materials, humans may also be contaminated with CBRN contamination. Changes in cellular function can occur at lower radiation doses and exposure to chemicals. At high dose, cell death may take place. Therefore, decontamination of humans at the time of emergency while generating bare minimum waste is an enormous task requiring dedication of large number of personnel and large amount of time. General principles of CBRN decontamination are discussed in this review with emphasis on radio decontamination. [10, 11, 12, 13]

5. Conclusion

Good CBRN waste management can be:

- Enhance mission accomplishment
- Contribute to force health protection by preventing
  - Direct health problems
  - Contamination of the environment
- Promote good relations with the host nation (HN)
- Free up resources for the mission (camp space, transportation, funds, etc.)

Military operations generate CBRN waste whose mismanagement can have people and environmental consequences. Although there are best practices have been found to present a health risk to personnel, they persist because they are viewed as expedient. Poor waste management practices on bases can lead to air and water pollution that affect communities living in proximity to installations, as well as military personnel and civilian contractors.

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