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CLIMATE CHANGE AND CBRN DEFENSE

Absztrakt/Abstract

A globális klímaváltozás ténye ma már tagadhatatlan. Számos elmélet született az okairól, melyekkel a cikk szerzői nem kívánnak vitatkozni. Pusztán a megfigyelhető tényekből kiindulva rávilágítanak a társadalom biztonságát érintő legfontosabb következményekre, a hatások várható erősödésére és ezen belül a katonai erőt, a katonai műveleteket is befolyásoló tényezőkre. A cikk részletesen elemzi a klímaváltozás lehetséges ABV védelmet érintő következményeit és bemutatja a szennyezés elkerülésének, az egyéni és kollektív ABV védelemnek, az ABV felderítésnek és mentesítésnek azokat a problémáit, melyeknek a hatások erősödésével egyre sürgetőbbé válik a megoldása. A klímaváltozás okozta kihívások bemutatása mellett a szerzők számos javaslattal is élnek az ABV védelmi képességek javítása érdekében

The fact of global climate change is undisputable nowadays. There are certain theories about the causes, and the authors of this paper do not want to argue with any of them. What they want is to start with the observable facts and highlight the most important consequences concerning the safety of the society, and with the threat increasing in the future to show the challenges concerning military forces and military activities. The paper describes the possible consequences of climate change concerning CBRN defense in details and the main problems of contamination avoidance, individual and collective CBRN protection, CBRN reconnaissance and decontamination, which need urgent solutions. Besides the presentation of challenges of climate change, the authors make some proposals to improve CBRN capabilities.

Kulcsszavak/Keywords: *globális klímaváltozás, katonai erő, ABV védelem, egyéni és kollektív védelem, ABV felderítés, ABV mentesítés ~ global climate change, military force, CBRN defense, individual and collective protection, reconnaissance, decontamination*

INTRODUCTION

The global climate change or as formerly called "global warming" is a widely accepted meteorological process all over the World. Of course there are a number of scientists denying its existence, but some facts are undisputedly proving climate change as follows [1]:

- The average temperature of the Earth increased by 0.7 °C from the beginning of the 20th Century and heat waves frequency increases over most land areas,
- Heavy precipitation events, especially their frequency increases over most areas,
- Area affected by drought increases,
- The Arctic ice volume decreased by 40 % in late summer periods in the last 30 years,
- Sea level rose 1-2 millimeters/year in the 20th Century,
- Plant and animal species moved towards the poles in the past decades,
- Frequency of floods, draughts, storms, tornadoes, hurricanes, forest fires rose recently.

The opinions about causes of the climate change are different, but most of the scientists accepted that the increase of the emission of greenhouse gases which generated by the human activities is the main reason. Let as list here the most "popular" arguments pro and contra concerning the causes:

1. Majority of researchers say that the primary cause is the increasing amount of so called "greenhouse gases" in the atmosphere from human origin [1].
2. By "climate skeptics" this explanation is not adequate, because there were already some warming periods in the Earth's history previously, and were times, when even larger concentration of CO_2 did not caused climate warming [2].
3. There is a theory that extra amount of water vapor emanating from human activities is the main cause of global warming [3].
4. Some say that greenhouse effect has a definite range independent from the concentration of gases [4].

While some areas in Northern Europe, Russia, and the Arctic may experience more positive effects of a warming climate in the short run (e.g. fertility of soils increase and agriculture can benefit from it), the long-run net consequences for all regions are likely to be negative (e.g. desertification) if nothing at all is done to reduce emissions of greenhouse gases. Africa and parts of Asia are particularly vulnerable, given their locations and their limited governmental capacities to respond to flooding, droughts, and declining food production.

For example, the 2006 U.S. National Security Strategy (NSS) notes that the Department of Defense has been charged to plan for *"deadly pandemics and other natural disasters"* that *"can produce WMD[1]-like effects."* It also notes that *"environmental destruction, whether caused by human behavior or cataclysmic mega-disasters such as floods, hurricanes, earthquakes, or tsunamis ... may overwhelm the capacity of local authorities to respond, and may even overtax national militaries, requiring a larger international response"*. Like armed attacks, some of the effects of climate change could swiftly kill or endanger large numbers of people and cause such large-scale disruption that local public health, law enforcement and emergency response units would not be able to contain the threat [5].

The first factor is the temperature, or more precisely the increased frequency and strength of heat and cold waves. A large percent of the population is sensitive for higher temperatures, children, the elderly, pregnant women or patients with heart and vascular system problems. As the personal defense against heat is more difficult than against cold, heat waves can cause

[1] WMD – Weapons of Mass Destruction, means CBRN (Chemical, Biological, Radiological and Nuclear) weapons

a lot of casualties especially in underdeveloped areas, where air condition capabilities are limited. However, climate change can cause not only more heat, but sometimes even extreme cold (due to increased strength and frequency of meteorological extremities). It also can be a significant risk and can cause large number of casualties. The endangered population is the homeless and the poor, whose number was significantly increased in Europe last years due to the economic crisis.

Heavy precipitation has been linked to a number of outbreaks of water-borne diseases, due to mobilizing of pathogens or extensive water contamination from overflowing sewage pipes. Reductions in summer water flows may increase the potential for bacterial and chemical contamination. Higher water temperatures may also result in increased occurrence of harmful algal blooms. Increased fecal bacteria contamination is also likely to affect drinking water intakes and areas of water used for recreation. Furthermore the scarcity of suitable water for routine hygiene practices of high significance for health such as proper hand washing might contribute to more infectious diseases outbreaks.

There are a number of other health issues emerging from climate change in Europe, where quantification and valuation have not been explored sufficiently on a Europe-wide basis. Whilst air pollution levels have fallen dramatically in recent decades in Europe, the health risks of air pollution are still significant, primarily from particulate matter and ozone. However, future policy on air quality and on climate (mitigation) is very likely to determine any future increase in respiratory diseases and mortality. The most significant effects of climate change are likely to be in relation to ozone – which is a major pollutant in many parts of Europe.

There is also the potential for an increase in the seasonality and duration of allergic disorders (‘hay fever’, asthma), with implications for direct costs in terms of care and medicines, as well as lost working hours.

Finally, there may be other indirect health effects due to climate change acting on other health determinants, such as on indoor and outdoor air quality, the level of air pollution and the nature, severity and timing of air allergens, such as pollen or mould. Populations at potential risk include children and the elderly. However, people already suffering from chronic respiratory conditions such as asthma, serious allergies or chronic obstructive pulmonary disease will be particularly at risk.

CHALLENGES OF CLIMATE CHANGE TO MILITARY

Climate change effects will strike at the heart of political, economic, and military institutions by imposing heavy human, economic, and environmental costs on all societies, especially fragile ones already in crisis for those and other reasons. Considering the military force the climate change affects the everyday activity and increases the fields of operation.

In everyday activities, there are emerging needs:

- towards more economical operation (fuel, electric power, etc.),
- to decrease emissions,
- to modify physical and psychological training of soldiers,
- to modify technological demands from military equipment,
- to reinvestigate of all military installations.

There is a common need to broaden the activities:

- towards disaster management,
- taking part in more frequent conflict management.

Based upon the above mentioned, the main task for military concerning climate change is:

To be „more economical" by:

- decreasing energy consumption,
- increasing energy efficiency,
- increasing the use of renewable energy sources,
- securing the attainability of energy resources and
- decreasing environmental consequences.

The impacts of climate change appear simultaneously in the human, installation, equipment, training, tactics and strategic levels. Temperature and humidity affect how well we perform many tasks. Temperature extremities reduce the effectiveness of troops. Work on human factors will be important in understanding how changing weather patterns will affect troops and their clothing requirements, for example. Key issues include:

- The geographical distribution of transmissible diseases changes the medical countermeasures and treatment policies required for operations.
- Changing activity of pests and disease vectors affect the viability of operations.
- Idiosyncratic physiological responses to extremes of temperature make it important to identify susceptible individuals, especially prior to rapid-response operations.
- Training must be developed to prepare troops for greater environmental extremes.
- Climate factors could affect how people react to exposure to chemical or biological weapons.

The defense community contributes to climate change through energy use. Its estates, and other activities, will have to find more efficient ways of using energy. Challenges for estates:

- Decreased durability and performance of materials will affect maintenance and facilities management.
- Rising sea levels and possible storm surges will affect ports and coastal training areas
- Hotter weather may mean temperature controlled transportation and storage for complex munitions.
- Clothing and equipment must change for operations in changed weather patterns.
- Runways that become unstable as tarmac softens and buildings that cannot withstand the pressures of high winds will require revised specifications.
- Sensor systems now used to monitor the humidity and temperature of equipment and supplies may not be adequate.
- Higher temperatures reduce air density and limit aircraft operations. The power generated by engines and the lift generated by wings and rotors falls as the temperature rises.
- Ocean temperatures, and murkier waters, could influence operating regimes for submarines.

A helicopter's carrying capacity falls steadily the higher it flies but also with higher ambient temperatures. If climate change leads to more days with higher temperatures, that will have a direct impact on operations, and possibly on the number of helicopters needed to supply troops**.**

Defense depends on effective logistics and the ability to move people, equipment and supplies. The frequency of operations may increase, both as a result of severe weather events requiring humanitarian support, for example, and due to possible climate induced conflicts. Climate change will influence what needs to be moved around and the equipment needed to move it. To pick just one obvious example, troops operating in hot climates need more water.

It also will be a great challenge for defense logistics, that changing weather patterns will affect the movement and storage of drugs, food and other supplies.

CLIMATE CHANGE AND CBRN DEFENCE

The climate change has an impact on the CBRN defense a little bit more significantly than other services in the military force. Natural disasters due to "*domino effect*"[2] probably will increase the number of CBRN defense operations. The climate change touches the people, the installations and the technical equipment.

CBRN defense is based on three general principles that specifically address the hazards created by CBRN incidents:

- *contamination avoidance* of CBRN hazards;
- *protection* of individuals, units, and equipment from unavoidable CBRN hazards; and
- *decontamination* in order to restore operational capability.

Application of these principles helps to minimize vulnerabilities, protects friendly forces, and maintains the forces' operational tempo in order to achieve operation or campaign objectives.

Individual protection

The standard Mission-Oriented Protective Postures (MOPP) levels consist of different combination of protective mask, hood, protective cloth, gloves, overboots. This system imposes both physiological and psychological stresses upon the wearer and interacts to degrade individual and unit performance in normal circumstances.

Body temperature must be maintained within narrow limits for optimum physical and mental performance. The body produces more heat during work than during rest. Normally, the body cools itself by evaporation of sweat and radiation of heat at the skin's surface. MOPP gear restricts these heat loss mechanisms because of its high insulation and low permeability to water vapor. In addition, physical work tasks require more effort when soldiers wear protective clothing because of added weight and restricted movement. This results in more body heat to be dissipated than normal and body temperature tends to rise quickly. The amount of heat acclimatization depends upon the amount of physical activity, the level of hydration, the clothing worn, the load carried, the state of heat acclimatization, physical fitness, and fatigue, as well as terrain and climatic conditions. The temperature rise will increase the heat stress, which more significant in case of decon operations, where soldiers wear heavy protective clothes.

The heat is a determining challenge in military operation as the following example shows [6]:

A Memorandum for Commanders issued by Lt. Gen. James B. Peake, commander of the U.S. Army Medical Command on June 2002, provides some background. The memo stated in part:

"Heat injury remains a significant health problem for our Army. From 1992-2001, 1,433 soldiers were admitted to the hospital for treatment of heat injury. From 1997-2001, 5,822 soldiers were treated in clinics for heat injuries."

The memorandum cites three variables that interact to cause heat injuries: climate, intensity of activity and individual risk factors, especially level of fitness.

A serious challenge associated with body armor, apart from its excessive weight, is the heat caused by lack of effective perspiration, eliminating the body's natural ability to dissipate and dispose of metabolic heat. Increasing heat stress exhausts the human body within a short

[2] domino effect – Occurrence of a serious disaster can start a series of other catasthrophes e.g. at Fukushima an earthquake caused a tsunami and finally a nuclear disaster.

time, even under normal conditions, let alone the extreme heat encountered in the Middle East and Central Asia.

Enabling troops to endure these conditions, cooling vests are worn under the body armor or assault vests, preventing 'heat overload' on extended missions. Unlike 'air conditioners' that cool an entire space, these personal cooling systems sustain a microclimate just around the human body. Microclimate can be sustained by circulating dry, fresh air, liquid, ice or wax to draw and absorb heat from fighter pilot suites.

This can also be a solution concerning CBRN IPE[3], but there are very limited versions of CBRN clothes include some kind of cooling nowadays. Large scale research and development is necessary, not mentioning the production and the costs of procurement for the military.

Collective Protection

Collective protection provides positive pressure NBC protection to a variety of vans and shelters. Collective protection equipment includes NBC filter system, cooling and alarm systems and protective entrances. The cooling system is a basic unit of the equipment due to global warming.

Cooling reduces heat stress in soldiers operating in extremely hot and/or humid conditions. MOPP gear significantly increases the potential for heat stress, making cooling systems desirable. The two basic types are crew compartment and individual. Crew compartment cooling provides air conditioning to the compartment. Individual cooling is more effective when used while MOPP gear is worn. The choice of cooling system depends on the vehicle type and primary mission. The next generation of combat vehicles will provide individual and compartment cooling systems.

In cold weather operations, decon and some aspects of detection must be accomplished in heated shelters. One of the most challenging problems is preventing contamination from entering warm areas. For example, frozen agents on clothing are hard to detect because low temperatures slow the effects of the agents. For collective protection, chemical hazards become a true challenge in the cold. Successful cold weather operations are dependent upon heated shelters. Without these, combat effectiveness is decreased. Most collective protection systems have proven to be reliable and durable in the cold. Fluctuations in pressure may occur when the system is exposed to high winds. In cold environments, indirect vapor absorption presents the greatest problem in entry and exit. For this reason it is important to have detection capability in the shelter itself, which is currently prescribed in normal entry/exit procedures. If agent is detected, soldiers in the shelter will immediately mask. The soldiers inside the shelter will be monitored to identify who has brought the contamination in. Once identification has been made, the soldier exits and the shelter is then immediately purged. If follow-on detection proves negative, soldiers may resume entry/exit procedures.

Modern military vehicles require the crew to operate complex equipment while under the stress in a closed down vehicle, the temperature of which will be considerably higher than the outside air temperature due to the “wild heat” being generated inside the vehicle by equipment and the engine, as well as the effect of solar radiation. As a result, a closed down vehicle in the sun can be assumed to be uninhabitable even in a European climate, unless an active cooling system is fitted. The requirement for an efficient heating system for vehicles designed for operation in cold climate must also be addressed to prevent the loss of manual dexterity and possible frostbite Total crew space air-conditioning systems, although effective in a well insulated vehicle and with the crew in normal dress, are much less effective when the crew are wearing CBRN suits and are excessively power hungry in vehicles with little

[3] IPE – Individual Protective Equipment

thermal insulation fitted. To meet these conditions a special crew temperature control system has developed (by Airscrew Ltd.) using the principle of spot cooling and heating, by blowing cooled air over the upper body of the crew in a hot environment and warmed air over their hands and toes under cold conditions, enabling the crew to maintain their correct deep body temperature. Such systems require significantly less power than an equivalent total crew space air-conditioning system. These systems are fitted to a wide range of tracked and wheeled vehicles operating in temperatures from –46°C to +55°C.

CBRN reconnaissance

The CBRN (formerly: NBC) Reconnaissance System consists of chemical and biological agent detectors, radiation detectors, warning and sampling equipment. All equipment is planned for a given temperature and humidity region. If the environmental temperature and humidity values are out the equipment working zone the data are given from the equipment are not real, because the sensitivity and response time can change. In the case of stand-off detectors the air pollution (fog, dust) can hinder the measurement because of the backscatter of laser light. [7-9]

The radiological, biological and chemical laboratory components provide operational in-theatre analysis and assessment for chemical, biological, and radiological agents and substances. Laboratory collects and accepts records, adapts and preserves suspicious environmental samples contaminated with CBRN agents and reports the results for next use.

The laboratory must be operational in the ambient temperature range of –30°C up to +50°C, with the relative humidity up to 90 % (at +30°C). The air conditioning unit must be able to ensure the working laboratory temperature being between 18°C and 23°C.

The future reconnaissance system will provide overmatching capability as an integrated CBRN reconnaissance, surveillance, detection, and identification system that can be employed anywhere on the battlefield. This system will increase the combat power of the deployed force and minimize force effectiveness degradation under CBRN conditions. Capabilities include on-the-move standoff chemical vapor detection, chemical and biological integrated detection, on the-move micrometeorology, and common technical architecture. The future CBRN reconnaissance system will be designed for horizontal technology integration, remote sensor ready upgrades and advanced prognostics/diagnostics.

CBRN decontamination

CBRN decontamination (decon) is the process of making any person, object, or area safe by absorbing, destroying, neutralizing, making harmless, or removing chemical, biological and/or radioactive material clinging to or around it. Deliberate decon requires extensive time and logistical support. Temperatures below 0°C limit the effectiveness of decontamination operations. Current decontamination procedures based on chemicals that require water rinses are impossible in freezing weather. Non-water decontamination procedures have not yet been developed.

The main problem of decontamination in hot weather is the lack of water. Although decontamination takes place as far forward as possible, the lack of water may burden the logistic system. Weathering may be a viable option for chemical contamination. Sea water may be used as a substitute for fresh water during normal decontamination operations, but all equipment must eventually be flushed with fresh water to prevent corrosion.

The developments of the new decontamination system programs were initiated to provide the soldier with a vastly improved capability to perform detailed equipment decontamination on the battlefield. It needs a more deployable system and for more efficient use of water, a scarce resource in an arid environment.

CONCLUSIONS

The climate change is a widely accepted global process, which proved by series measured parameters (global average temperature, sea level, precipitation level and distribution, arctic ice, e. t. c.). The climate change also has an impact on the activity of military forces.

Considering military forces the climate change affects the everyday activity and increases the fields of operation. The climate change touches the people, the installations and the technical equipment. The climate change has an impact on the CBRN defense a little bit more significantly than other services in military forces. Due to domino effect of the natural disasters the number of CBRN defense operations probably will increase in the future. The development and use of CBRN technical equipment needs to be investigated from climate change's point of view. Physiological load of soldiers will significantly increase in future CBRN operations due to extreme temperatures. Wide range of research&development is necessary to fit up the soldiers with appropriate equipment, e.g. with more comfortable IPEs, with more durable measurement units concerning operational temperature range and with more effective decon systems. Preplanning of the CBRN training is also important.

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