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CURRENT STATUS OF CHEMICAL AND BIOLOGICAL WEAPONS' DEVELOPMENT, TRENDS, POSSIBILITIES AND PROSPECTS

Abstract

The threats posed by chemical and biological weapons can be considered as significant even in these days. Due to the fact that infectious and toxic warfare agents are relatively simple and cheap to produce they are known as the "poor man's nuclear bomb". They could become dangerous devices with a dreadful effect when they fall into the hands of terrorist groups and aggressive powers. After reviewing the historical development of these weapons the author makes an attempt to assess the further development of chemical and biological weapons and the risks associated with their possible deployment.

A vegyi és biológiai fegyverek által jelentkező veszélyeztetettség napjainkban is jelentősnek mondható. A fertőző ágensek és a mérgező harcanyagok, viszonylag egyszerű és olcsó előállíthatóságuk okán „a szegény ember atombombája"-ként ismertek. Terrorista csoportok, agresszív hatalmak kezében veszélyes és rettenetes hatású eszközök válhatnak belőlük. A cikk szerzője ezen fegyverek történeti fejlődésének áttekintése után kísérletet tesz arra, hogy a vegyi és biológiai fegyverek jövőbeni továbbfejlődését és esetleges alkalmazásuk kockázatát felbecsülje.

Keywords: *biological weapon, chemical warfare agent, development, threat ~ biológiai fegyver, mérgező harcanyag, fejlesztés, fenyegetés*

INTRODUCTION

Today people can continuously obtain information from the media about the hazards of toxic warfare agents, biological weapons, pathogenic micro-organisms and the toxins produced by them. Because of the low costs and the ease of production, the practically openly available know-how and the uncontrolled outflow of poorly paid or unemployed Russian experts, chemical and biological weapons, addressed as the "poor man's nuclear bomb" are spread all over the world and could have fallen or can fall into the hands of countries, fanatic religious sects and political groups that may deploy these weapons to achieve their goals.

During the Gulf War – and to a lesser extent during the Kosovo conflict – the leaders of the United States and the NATO countries seriously considered the possibility that commanders of the enemy would use weapons of mass destruction without considering or disregarding consequences (counterstrike) during military operations. Strikes executed with chemical weapons and toxic warfare agents seemed to be the most likely possibility but considerable emphasis was placed on the protection of the allied troops against biological weapons particularly after the Iraqi arsenal of mass destruction weapons had been assessed.

Although biological weapons have never been officially put into action in battles, certain countries made a lot of efforts during the Cold War to develop, produce and put in service their own infectious viral and bacteriological weapons. Pathogens of diseases already representing huge danger have been genetically modified, using the most advanced knowledge available in order to create even more effective warfare agents.

To prevent the spread of biological weapons the great powers prepared and signed the Biological Weapons Convention in 1972 which prohibited the development, production and stockpiling of pathogens and toxins of bacteriological origin and their use as weapons of mass destruction. Twenty years later a similar prohibitive convention concerning chemical weapons was signed in Paris.

By the 1980s utilizing the chaos resulting from the end of the Cold War and the crisis and disintegration of the Soviet Union numerous countries could get access to the knowledge and professionals needed to produce chemical and biological warfare agents. However, the Conventions could not prevent the worldwide propagation of chemical and biological weapons.

The leaders of Asian, African and Arab world countries based on dictatorial principles look at chemical and biological weapons as a tool to counterbalance the influence of the United States and the NATO but – for the time being – they did not deploy them in war operations because they fear counterstrike.

The situation is much worse in case of the terrorist actions of fanatic religious sects and political groups.

Although terrorists performed their actions a lot more frequently in the 1960s and 70s the number of terrorist actions became much smaller by the turn of the millennium while their impact exceeded the activities of previous decades by several orders of magnitude. The 20th March 1995 can be considered as a milestone in the international history of terrorism when the result of the development of chemical and biological weapons resulted in the sarin attack by the Aum Shinrikyo Japanese sect in the Tokyo subway causing 12 dead victims and 5500 injured persons. Due to the nature of terrorism, the disintegration of the bipolar world and the political vacuum that occurred in the place of the Soviet Union significant changes took place from the 1980s. After the disintegration of the former great power crime and corruption gained ground at government level in the successor states. This enables the governments of radical countries and terrorist groups with a lot of money to get hold of the Soviet made weapons of mass destruction and the experts that had developed and produced them. [1]

Till now the wartime deployment of mass destruction weapons was prevented by the fear of military response (see: Gulf War) but for numerous countries (e.g. Iran, North Korea etc.)

chemical and biological weapons are military or incidentally terrorist tools for deterrence. Consequently government backed terrorist groups may easily get access to warfare agents. From the aspect of a terrorist attack the so-called super toxins produced by living creatures could represent even higher hazard than pathogenic micro-organisms.

While smuggling and discharging, respectively, of traditional biological warfare agents, bacteria, rickettsiae and viruses into the air is difficult, moreover the effect cannot be assessed accurately in advance – it may happen that due to unfavorable circumstances no infection takes place or an epidemic of global magnitude develops, just to mention the two most extreme options – discharging any of the super toxins into the potable water system of a city would cause a vast number of deaths and enormous panic among the civilian population.

For several years there are alarming signs that terrorist acts can be expected in the coming decades using weapons of mass destruction – chemical or biological warfare agents – against targets in the U.S.A. and Western Europe, respectively. The number of terrorist acts decreased in the past two decades but the severity and the number of deaths increased. Terrorist actions implemented using anthrax in the territory of the United States fit into the prediction.

Political acts arising from the opposition of the two world orders have been replaced by attempts and attacks of religious sects, third world Anti-Western groups, and – as a new phenomenon – dissatisfied militant organizations.

The most known events are the sarin attack on the Tokyo subway (religious sect), the explosion in Oklahoma City (internal terrorism), exploding two U.S. Embassies in Africa (government backed terrorism), and 09/11 (2001) and subsequent terrorist acts in the U.S. (worldwide terrorism).

Due to the changes of international politics in the end of the 1980s and 90s the threats posed by biological weapons did not decrease by the beginning of the new millennium but its aspect changed. While previously biological warfare agents and related means of delivery were developed in the spirit of preparing for armed conflicts and biological weapons had been concentrated in the hands of a small group (Soviet Union), respectively, in our days smaller countries and terrorist groups can also get hold of these weapons by using the knowledge of former Soviet experts. In fact biological weapons do not only affect the country where they are deployed but by the propagation of contagious diseases they may have an impact on the whole world; we could say that they are double-edged swords that could easily have an impact back to the party applying them.

The danger chemical and biological weapons pose on Hungary is small. In case of a military conflict North African or possibly certain Arab countries could strike a blow which would have noticeable primary and secondary effects on Hungary but the probability of that is insignificant.

Chemical and bioterrorism could be a bigger problem which would put Hungary in the field of sight of certain fanatic religious and political groups because of our NATO and EU membership. [2]

Considering the preparedness the conditions of protection and prevention against chemical and especially biological weapons is quite deficient therefore the major task for the future is to establish these conditions.

HISTORICAL REVIEW OF THE DEPLOYMENT OF CHEMICAL AND BIOLOGICAL WEAPONS

The history of chemical and biological armaments can be discussed in three phases:

- early history, from the very beginning till the beginning of the 20th century,
- modern history, from 1918 till the end of the 1990s
- history of these days, from the beginning of the 90s till today.

Biological warfare agents were first used by the ancient Romans when they poisoned the water of hostile settlements with dead animals. In the Middle Ages the Tatar army delivered human cadavers and animal carcasses that had died of bubonic plague by catapults into the city of Kaffa. After the epidemic it was easy for them to occupy the city and – according to some historians – this set off the big plague epidemic that swept through medieval Europe several times killing 25 million. In the 18th century, during the British-French war in North America British soldiers distributed blankets infected with smallpox among Native Americans. The epidemic that broke out decimated Native Americans who were unprotected from smallpox. An example of the early appearance of chemical weapons is Greek fire used in ancient times that had a secret composition. Other examples include inflammatory weapons deployed mainly in sieges and sea battles.

World War I was the first big war where the deployment of weapons of mass destruction en masse, specifically chemical weapons, became one of the tools to successfully fight the war. In France (first application in Ypern, 1915) the troops facing each other used so-called "poison gases" (chlorine, phosgene, sulphur mustard, irritating warfare substances) both for assisting attacks and for defensive warfare. The result was several tens of thousands of deaths and wounded soldiers. [3]

On 17 June 1925 the countries signing the Genève Protocol declared – in the hope of a more humanitarian war – that they would not deploy chemical weapons against each other's troops in future conflicts. This already included (taking into account the technical level of the era) the prohibition of applying and developing, respectively, toxins of biological origin as well as contagious diseases under wartime circumstances.

The modern era of biological armaments can be counted from 1918 when the Japanese army set up its special unit No. 731 for biological warfare. Several experiments were carried out on Chinese inhabitants in the war for possessing China-Manchuria between 1931 and 1942.

The British and the Americans were afraid that the Japanese and German armies will have an advantage that cannot be caught up with in the area of chemical and biological armaments so they started their own programs but as an effect of the accidents occurring during the experiments the development of biological weapons discontinued before the end of World War II. In the field of chemical weapons they sought the development of vesicant substances already applied in World War I (sulphur mustard, nitrogen mustard, Lewisite) although the Germans already invented tabun and sarin in 1938-39 thus the main focus was moved to the research, development and manufacturing of neurotoxins.

There was no precedent for chemical and biological weapons being deployed en masse during World War II and the emphasis was put on the development of nuclear weapons and having concluded the project successfully the U.S. deployed both of his nuclear bombs in Hiroshima and Nagasaki.

During the cold war biological weapons began unexpected development and although the U.S. and the NATO countries terminated their own development projects during the World War there were more and more signs that the Soviet Union carries out secret experiments for that purpose. In the 60s and 70s the great powers regularly "tested" their latest military developments thus it is widely known that for instance the U.S. deployed big volumes of various chemical warfare agents in the Vietnam war (new types of substances appeared here that had

an effect on the environment and not on human beings, such as herbicides to eradicate dense vegetation).

In order to prevent the worldwide propagation of biological weapons and their possible wartime application the Biological Weapons Convention was created on 10 April, 1972 (complete name: Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction).

Since the end of World War II the so far homogeneous antifascist coalition split into two and almost 4 decades of cold war began. The U.S. and her allies, later on NATO countries, did not continue their biological weapon projects started earlier while the socialist block consisting of the Soviet Union and the countries of Eastern Europe, later on the countries of the Warsaw Pact, did continue their projects. The efforts of the Soviet Union were quite soon crowned with success as a full range of first generation biological warfare agents and delivery methods were worked out and deployed.

The development of second and third generation biological weapons started in the 70s. Their charge consisted of the genetically modified pathogens of contagious diseases most dangerous ever, which were even more devastating. Light was thrown on the research work – continued to be carried out secretly despite the Biological Weapons Convention prepared in 1972 and ratified by the Soviet Union in 1975 – through and accident that happened in the "Biopreparat" institute in Sverdlovsk in 1979 when anthrax set free from the factory and caused the death of several people. The leaders of the Soviet Union denied the incident and indicated natural infection as the cause of the deaths. [4]

The present day history of chemical and biological armaments began in the early 90s. After the disintegration of the Soviet Union and the changing of the old world order more and more information have come to light on secret bioweapon research supported by the leaders of the Soviet Union. In the last decade of the millennium the successor states of the former Soviet Union declared their intention to finish their previously started development and manufacturing projects and destroy the biological warfare agents accumulated as well as their means of delivery. Numerous specialists participating in the biological weapon program have lost their jobs which led to a new "brain drain". Certain countries working under the principle of dictatorship and extremist groups having ample funds, respectively, could and can easily obtain the knowledge that had accumulated during several decades of research in the area of the former great power.

OPPORTUNITIES OF DEVELOPING CHEMICAL AND BIOLOGICAL WEAPONS TILL TODAY

Iraq is a good example of the opportunities to propagate the weapons of mass destruction in our modern era. A country with a duly aggressive leadership and disposing of appropriate natural, financial and information technology resources can easily find the way to develop its arsenal of chemical and biological weapons, and – as we can see in the particular example – may reach mass production and application through 15-20 years of secret development work.

During the Gulf War the U.S. and the allied powers paid considerable attention to locate Iraq's arsenal of weapons of mass destruction. One of the plain goals of the war was to prevent that a great power is established in the Arabian Peninsula equipped with new weapons of mass destruction, specifically with an almost complete arsenal of biological weapons.

Iraq's program of weapons of mass destruction

Iraq started the development of its chemical weapons potential practically in the early seventies. Within its armed forces Iraq has set up professional chemical troops, started the training of NBC officers and NCOs, and part of the civilian professionals were sent to study at renowned

European universities particularly bearing in mind the research engineers of the future. Starting in 1971 the laboratory size experimental synthesis of certain toxic warfare agents (CS, sulphur mustard, tabun) began utilizing data openly accessible in the technical literature.

From 1981 preparations to manufacture simple toxic warfare agents at semi-industrial and industrial scale started. Diverse methods of producing sulphur mustard were tested and the efficiency of production as well as the problems caused by by-products and the opportunities of purification were analyzed. In the following year experiments began to prepare the industrial manufacturing of other toxic warfare agents, such as BZ (1982-86) belonging to the psychotoxic substances, the lachrymatory chloropicrin (1987), chloroacetophenone (1987) and CS (1984). From the mid-eighties research of the ways of industrial synthesis of neurotoxins started. The plans were always executed according to the following model:

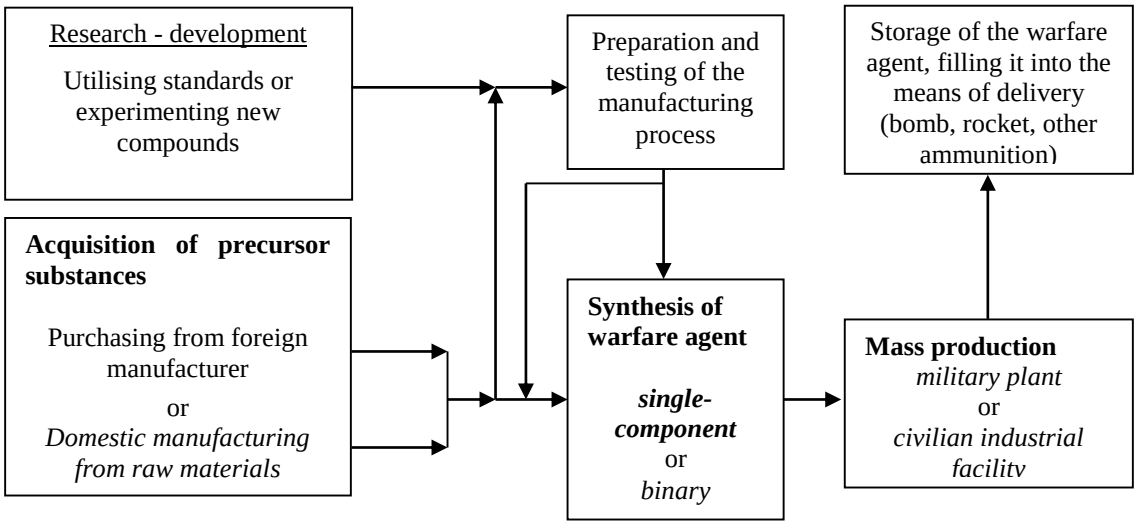

Figure 1: The development process of chemical weapons (made by the author)

By the end of the eighties Iraq succeeded to establish a chemical weapon manufacturing capacity that is significant in every respect. To this they succeeded to provide the basic threefold conditions indispensable to start and maintain self-contained production:

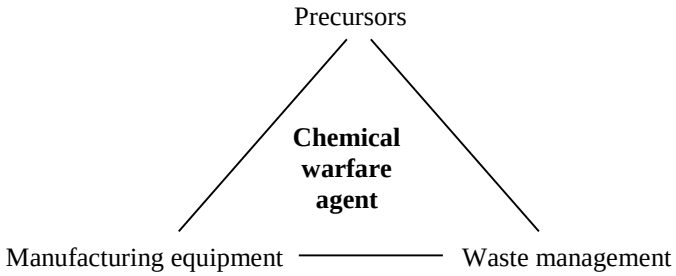

Figure 2: Basic conditions of manufacturing chemical weapons (made by the author)

The research and semi-industrial scale synthesis of toxic warfare agents started with vesicant substances beginning in 1975. For a couple of years the research of the ways of synthesis (primarily of sulphur mustard) and the selection of preparation methods suitable for industrial production were carried out. After that by utilizing the existing capacities of the chemical industry they succeeded to move to semi-industrial and industrial scale mass production. Besides sulphur mustard (bis-chloroethyl-thioether) and nitrogen mustard (trichloro-thriethylamine) they have produced lachrymatory and irritating substances (e.g. 2-Chlorobenzalmalonodinitrile, CS) in the second place.

Relying on initial success a few years later they started the development of neurotoxins also. Because of its simple structure and easy producibility and storing research was started with tabun (N,N-dimethylamide-O-ethyl-cyanophosphate, GA). During the development process specialists relied on their proven systems. However, as they did not find the toxic ability and applicability of tabun satisfactory the research for ways of synthesis was gradually extended to other neurotoxins, such as sarin (0-isopropyl-methyl-fluorophosphonate, GB), cyclosarin (0-cyclohexyl-methyl-fluorophosphonate, GF) and VX (O-ethyl-S-[2-(N,N-diisopropylamino)ethyl]-methyl-thiophosphonate). After they succeeded to work out production methods suitable for industrial use they started the industrial manufacturing of neurotoxins and filling them into weapons from 1985. Mixtures (e.g. GB/GF) have been successfully developed. These could be used to disturb the sensors of the enemy (the most currently distributed military detectors do not detect cyclosarin), and they also produced missiles filled with binary warfare agents.

The magnitude of the program can be characterized by the fact that Iraq admitted to the UN inspectors the production of 3859 tons of toxic warfare agents in the given period. The proportions of that volume were the following:

Table 1: Production quantities of Iraq's chemical weapons program (based on UNSCOM data)

Chemical agent	Quantity/tons
Sulphur mustard, HD	2850
Tabun, GA	210
Sarin, GB	795
VX	4
of which filled into weapon	2870

Naturally, a toxic warfare agent would only become a chemical weapon if it is filled into means of delivery. These can be simple aerial pouring devices, cannon-balls, aerial bombs or even missile warheads. The Iraqis made sure that these are purchased, or developed and manufactured. Based on the data they declared they possessed approximately 350,000 ammunition suitable for delivering toxic warfare agents of which 129,834 pieces were filled with warfare agents and they handed over 227,263 empty pieces for destruction.

Table 2: Ammunition filled with toxic warfare agents in Iraq (UNSCOM data)

Ammunition form	Size/type	Agents filled
Artillery ammunitions	130 mm	HD
	155 mm	HD
Aerial bombs	250 kg	HD, GA, GB, CS, VX
	500 kg	HD, GA, GB, CS, VX
	DB-2	GB
	R-400	binary neurotoxin
Missiles	122 mm	GB
	Al-Hussain	GB, GB/GF , binary neurotoxin

All these data show us that a power (not necessarily a great power or a leading world power) possessing appropriate sets of assets may develop a chemical weapon arsenal of fairly deterrent size by historical standards very quickly. And if the leadership of that country is sufficiently fanatic it would not hesitate to use the tool it owns. From the users' point chemical weapons have a great advantage that their impact can be focused to a relatively small area and short period. As the controversial cases in the period following the Gulf War demonstrate the use of chemical weapons in many cases cannot be unambiguously proven after the event, and in case of local conflicts it often remains a secret forever. For instance the Iraqis declared that out of their chemical ammunition they used 101,080 pieces of different charges during their armed conflicts (Iraq-Iran, Gulf War, Kurdish revolt?) till 1992.

Following up the installation of the Iraqi biological weapon potential is a lot more complicated. In 1995 the Iraqi party still denied to the UNSCOM inspectors that it carried out any experiments with biological weapons. However, on the effect of evidence found by on-the-spot investigations carried out till 1997 they finally "reassessed" what had happened and modified their declaration concerning prohibited activities. According to this the biological weapon program was started in 1974 by the order of the president (Saddam Hussein). The location of the research program was relocated several times and the program continued to be a fiasco for ten years. However, from 1985 the pilot site was moved to Al-Muthanna where the Iraqis switched over to a similar model that was already proven for the development of chemical warfare agents. By the end of 1987 they finally succeeded in producing Clostridium botulinum toxin in a quantity sufficient to carry out experiments with weapons. After that the experiments were extended to include Bacillus anthracis (anthrax) spores, aflatoxin, ricin and Bacillus subtilis.

Based on the data it is obvious that they developed missiles filled with different biological agents, aerial pouring devices that could be mounted on aircraft, aerosol generators and unmanned aircraft as well.

Table 3: Means of delivery of biological warfare agents in Iraq (UNSCOM data)

Ammunition form	Subcategory	Quantity/pieces
Aerial bombs, R-400	filled with botulinum toxin	100
	filled with anthrax spores	50
	filled with aflatoxin	7
	total	**157**
Missiles (modified Al-Hussain)	filled with botulinum toxin	16
	filled with anthrax spores	5
	filled with aflatoxin	4
	total	**25**
Aerial pouring device	**total**	**4 (unfilled)**
Unmanned aircraft (modified MIG-21)	**total**	**1 (unfilled)**

According to the official standpoint these tools have never been deployed. However, if we take a look at the timescale we can see that this program was significantly delayed compared to the chemical weapons program. It is more likely therefore that development was not completed by 1991 thus the readiness was insufficient and the whole project did not reach the minimum deployability level.

POSSIBILITIES OF DEVELOPMENT OF CHEMICAL AND BIOLOGICAL WEAPONS NOWADAYS AND IN THE FUTURE

The first thing we should know about chemical and biological weapons is that they considerably differ from any other weapons. By this I mean the purpose and possibilities of their application and not their structure and composition. Similarly to nuclear weapons they serve deterrence purposes in the first place. However, the difference is obviously significant because they are a lot cheaper when looking at their costs and technical requirements therefore they are available to those who cannot get hold of a nuclear weapon. In addition, it is important that when these weapons are deployed they destroy manpower only. For biological weapons occasionally it can be stated, that they are harmful to certain human communities and leave all other values intact. Furthermore when applied they do not contaminate the given territory for several centuries as nuclear weapons do but only for a very short period (days or weeks). Besides, it is possible that the user had developed antidote or medicine in advance to protect his own people. Finally, the

chemical and biological acts of terrorism that took place until now have shown us that they can be effectively applied in very small areas and quantities (neurotoxin – subway station, anthrax – sent by mail) and at the same time they are difficult to locate and identify.

These features make them unparalleled and suitable to carry out asymmetric warfare. In case of conflicts the contending weaker party, who feels that it has no chances and uses every means, could achieve strategic and tactical results that may have crucial influence on the outcome of the conflict.

How can the technical circumstances of modern times be used for the research and development of chemical and biological warfare agents? Some possibilities are listed below but this is not an exhaustive list.

Computer modeling can primarily be used for the research and development of chemical (and also biological) warfare agents. Software for molecular design is commercially available. These tools make visible the molecular structure of a substance that does not exist yet, predict its stability, basic features and reactions. When these software tools are further developed a computer program can be elaborated that contains theoretical toxicity data and determines other physical and chemical parameters of the new compounds without synthesis. With appropriate background and modifications it can be used for researching biological warfare agents. For instance the entire genetic code of numerous organisms is common knowledge already. Advanced genetic research is carried out to assign fragments of genetic codes to the properties of the entity (gene mapping). If this is done in theory living creatures could be designed using a computer, obviously starting with the simplest forms of life. These are the viruses and then bacteria – regrettably the majority of biological warfare agents consist of them.

Another very efficient method is combinatorial chemistry, the new tool to research and prepare toxic warfare agents. A laboratory is required for this and also the approximate limitation of the chemical compounds to be developed. If in theory we know the key components (which may be 3-4 side chains) of a given compound group (e.g. VX substances) or we are eager to know what combination of them could be particularly toxic than – taking into account several essential elements – we could produce and examine even up to 10 thousand (very closely related) diverse substances in each case. It may happen that out of them only 1-2 compounds are suitable toxic warfare agents.

This is a difficulty that – fortunately – significantly slowed down the appearance of additional highly toxic warfare agents. Modern automatic laboratory devices and combinatorial chemistry considerably changed this situation. With the help of 15-20 different reagents and control substances a computer controlled feeding system can run 10 thousand reactions practically during a night and next morning the researcher would get complete data concerning the few new warfare agents that could be taken into consideration. The effects of pharmaceuticals and the modifications of bacterial and viral strains are studied in an analogue manner.

New warfare agents can naturally be produced in a simpler way also. There are several methods to do that.

1. Compounds with modified side chain A known toxic warfare agent should be taken as starting point and only one component of it should be modified to make the agent better suited to the unique application circumstances (e.g. it should not be a quickly evaporating so-called volatile agent) and that detectors sensitive to ordinary substances do not detect it, respectively.

2. Multi-component (generally binary) chemical weapon. A known toxic warfare agent should be produced with another suitable method in such a way that the synthesis is performed separately down to the two or three principal essential elements only. The components prepared this way are stored separately from each other and they are allowed to mix only directly before or during application. The disadvantage is that the substance will contain more contamination as the reaction is never perfect. The advantage is that warfare agents that cannot be stored in a

conventional way may be produced and used, e.g. because the substance is degradable. Thus the application of the agent can be unexpected under given circumstances.

3. Mask breakers. In essence a mixture should be used. We mix a known toxic warfare agent with a substance that can penetrate the filter layer of conventional gas masks and is able to cause some sort of unpleasant effect (generally not severe in itself, only itching, coughing, weeping etc.) thereby rendering the use of gas mask impossible. Generally the victim tears off the mask thus exposing himself to the effect of the other, more dangerous component. The other alternative is when the mask breaker substance in effect destroys the filter layer of the gas mask thus "making way" for the other component.

Another option for the development opportunities of toxic warfare agents: so-called super toxic warfare agents that are more toxic by several orders of magnitude than the agents known until now can already be produced. Do they represent real hazard? They do from a certain point of view as we are not prepared to detect them and have not developed antidotes. Nevertheless there is a practical limit and the toxicity of current warfare agents (mainly compounds produced by toxins) already reached that limit – it makes no sense to produce even more toxic substances. Since by taking into account the application methods there are no circumstances where a man can be poisoned by only one molecule.

The problems of developing biological warfare agents are even more complex. The reason for that is that by applying the above mentioned methods an almost endless range of warfare agents can be produced (more and more dangerous bacteria, viruses, etc.). Common sense and rightful fear should preferably limit such kind of developments. It is not a question these days whether we can produce substances that cause incurable diseases as they already exist (ebola, AIDS, etc.). The limit of research is that at least the applier can protect himself from the substances he is experimenting with. And this is not simple at all; just think of the problem of mutation. It can easily be imagined that a biological warfare agent thought to be controlled properly goes through spontaneous mutation (as it is a living substance and propagates) and becomes hazardous and incurable even for those who initiated the attack. It is one of the biggest dangers of such substances that their possession already represents a hazard and responsibilities are associated with it. At the same time these substances fall into the hands of those who don't have the required sense of responsibility at all. Based on this the possible chain of events is absolutely unpredictable and unforeseeable.

However, let's stick to the facts and leave assumptions. A country may seriously threaten its surroundings with its chemical and biological weapons when it possesses the properly structured warfare agents and the necessary means of delivery. The technical parameters of means of delivery substantially influence the rate of hazard potential. Currently there are only a few countries that possess missile technology capable of delivering missiles equipped with warfare agents to any part of the Earth although it is quite likely that this would never happen. Nowadays besides global threat local and regional conflicts represent the biggest problems. There are several countries that possess medium-range missiles (and presumably appropriate warfare agents, too) which are located in chronic crises areas of the Earth.

In the crisis management practices and security policy analyses of the last few years biological weapons are increasingly appearing as assumed risks.

Dictatorial countries holding extreme views in the Middle East and North Africa do their outmost to own such weapons of mass destruction. Iran, Egypt, and previously Syria and Libya received effective help to their related efforts from North Korea (missile systems) and from the well-educated (and poorly paid) scientists of the former Soviet Union who had fled abroad. The majority of these countries have signed the international conventions but have not ratified them. Using the latest achievements of science the scientists attracted to these countries develop agents that have devastating effects and are similar to the arsenal of the great powers.

In spite of international prohibitions they can obtain Chinese and North Korean missile technology and with those they can threaten not only their neighbors but also Europe.

In international politics these countries mainly confront the U.S. and the NATO, respectively. NATO got not just into political but also military conflicts with some of them on several occasions. In the light of these facts Hungary, as an ally, has become a possible target.

Libya and Egypt are those North African countries that can reach the southern NATO member countries and partly Hungary by a medium-range missile attack. Of the Middle Eastern countries Iraq has proved during the Gulf War that it can reach more distant areas with its SCUD missiles.

These missiles may threaten our country, although not directly but indirectly (making an impact in nearby countries and bringing about epidemics).

It is highly probable that attacks are made abruptly, as reprisal or as terrorism. Defence against them can only be effective by applying anti-missile systems installed in due time.

A few words about our direct surroundings. In connection with the NATO operations in our vicinity light was thrown on the chemical weapon program of the Yugoslav government. According to the experts of Jane's Defence Weekly Yugoslavia possessed an inventory of chemical weapons and its scientists worked together with Iraq on the chemical and biological program.

As we are aware that chemical warfare agents were filled into cannon-balls we have to consider the possibility that application with biological warfare agents was also planned. Naturally, the range in the latter case would have been shorter, 5 -12 km only.

It is clear from the above that our country has to face multilayer and diverse chemical and biological threats and must take appropriate preventive measures. These steps should be in harmony with the efforts made by the NATO for that purpose as this is the only way to provide adequate defense for the population of our country.

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