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# Draft

Ten Years Chemical Weapon Convention, 1987-2012
Does it make a difference?

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## Introduction

The tenth birthday of the entry into force of the Chemical Weapon Convention is covered by a 25-year period. There is a good reason for choosing this period. In 1987 the former Soviet Union for the first time in history displayed its Chemical Weapon Arsenal, clearly demonstrating its intention to get rid of this class of weapons. In addition the working text of the CWC was near completion. Everybody involved new what was at stake. Finally the year 2012 is the date at which, according to the original text of the CWC all Chemical Weapons, production facilities etc in the "possessor States" must have been destroyed.
In the very beginning of the 25-year period there were two opposing blocs, the old NATO and the former Warsaw pact. Both blocs strongly felt that the other was threatening with, amongst others, Chemical Weapons.
The question is posed: Has anything changed, Does it make a difference? Many feel that there is still a serious threat of Chemical Warfare, for instance from non-Member States. Many fear the use of Toxic Chemical Compounds by terrorist. It is often pointed out that a significant part of the former SU stock, now controlled by Russia, will still be around in 2012. In addition it has to be awaited whether the complete stock in other possessor States will have been destroyed by 2012. Actually the question is do we believe that the CWC and OPCW have made a contribution to a safer world, was it worth the investment? This paper tries to answer that question from a technical viewpoint in relation to Chemical Defence.

## Quantifying the Hazards of Chemical Weapons.

If a small quantity of CW would be nearly as hazardous as a large quantity destruction of 90 or 99 % of the present stock would mean little in the threat or hazard reduction. In order to evaluate if the CWC makes a difference it is of value to quantify the hazards of Chemical Weapons.
After World War I a discussion took place regarding the effectiveness of some weapon systems and whether or not the weapons were humane. For Chemical Weapons this resulted in a fierce debate of those in favour of the use, stating that they were more humane than high explosives,

and those against emphasising the cruel nature of the weapons. Those against partly won the debate, which resulted in the non-first use declaration of the Geneva protocol in 1925.
The arguments used by those in favour of CW were based on WW I statistics, correct but manipulated to a certain extent.
During WW I 150.000 tons of CW were produced. 125.000 tons were actually used and resulted in 1.25 million casualties. So 100 kg of CW was required to produce 1 casualty. The argument than continues by indicating that 250 kg of high explosive ammunition was required to make one casualty. The conclusion was evident CW is more effective. However the statistics on CW use did not account for the containers, gas bottles or shells and bombs that had to be used to make the CW attack possible. If that correction is made it is likely that CW was per unit weight about equally effective as high explosives.
In the debate some refinements in the statistics were used. So the high explosive used 250 kg of metal + explosive to make one casualty with 1 in 3 dead. Asphyxiating gasses required 100 kg to make one casualty with 1 in 10 dead. Besides the correction for the weight of the containers and the explosives required to throw the CW at the enemy, another important correction has to be made. The small amount of Mustard used in WW I (8000 tons) produced 1/3 of the casualties. Increasing the required amount of asphyxiating gases by another 50 %.
For Mustard agent the statistics get really complicated. Germany produced 10.000 tons from which 8.000 were used. The allies produced 2000 tons or so against the end of the war and very little was used. The casualty statistics show that about 400.000 were due to Mustard gas. Straightforward 20 kg of H would make one casualty. There are however two major correction factors. The first one is that in1917 and 1918 the ammunition used by Germany became of a poor quality, 50 % of the ammunition did not explode on impact, leaving until today an enormous problem in South West Belgium and Northern France. But more importantly a large fraction of H was not used in the anti-personnel mode but in the terrain denial mode, as a chemical minefield. The allies quickly learned never to occupy a once contaminated terrain. With these correction factors the estimate amount of H to produce one casualty was between 3 and 10 kg. The number of death was 1 in 50 to 100. (Similar numbers came to light in the use against Iranian troops). The lower death toll of CW agents was used as an argument to show that CW was more humane than high explosive warfare.
The son of Frits Haber in his analysis of CW pointed out that there was a large variation in the effectiveness of individual CW attacks. Some were very effective whilst others hardly showed any effect. The statistics discussed above have to be seen as grand total averages, large variations might occur. Later computer modelling of CW attacks showed that for not protected personnel in a defensive scenario the number of effective dosages to produce a casualty was in the order of 1 to 10 million. Or another rule of thumb was the use of 1 billion effective dosages against a military target, which would produce 30 % casualties, sufficient to neutralise the target. For the nerve agents this would correspond to about 1 kg to produce one casualty or 1 ton of agent to attack a military target of a limited size (infantry).
The message from WW I is: relative small amounts of CW can be effective in producing casualties amongst unprotected personnel
The second important lesson from WW I was that once the troops had a rudimentary form of protection the amount required to make them a casualty increased. Actually it increased proportionally with the protection factor. In 1916 all British troops were equipped with masks in some form and the Wehrmacht did no longer attack them seriously with CW, until 1917 when the first H attacks were aimed at the troops with respiratory protection. The results were devastating in three weeks the British faced more CW casualties than in the whole year 1916.

The conclusion again is CW works when the protection is circumvented but becomes nearly totally ineffective when there is some form of protection. In terms of WW I statistics if the respiratory protection factor of the troops was 10 the amount of asphyxiating gasses required to make one casualty would be above 1000 kg, disregarding the explosives and containers required to transport the agents.

The short-term goal of the CWC is to reduce the amount of agent present in the world. Every ton of agent can still produce 100 to 1000 casualties amongst military in defensive position. So with a few hundred tons available in rogue States it still would be possible to make around 1 million victims. So if we reduce from 1987 to 2012 to 10.000 tons we still need the full Chemical Defence system. However, the picture becomes very different when protection is involved. When the skin and the respiratory system would continuously be protected by a factor 1000 (present day masks and clothing are aiming at these or higher numbers), the few hundred tons in a rogue state would just be sufficient to attack one target with minimal effect.

## Incomplete destruction by 2012

It is unlikely that the possessor States will have destroyed all the stock; significant quantities might be around. However, more than just the agent is required to start a Chemical War. At the beginning of WW II the US estimated that for the first two month in Chemical War 25.000 tons of mainly Mustard agent was required. This still is true; a large stock is required to start a Chemical War.
If the agent is available the next step is a filling station to fill the shells and the bombs. Then weapon systems must be available to deliver the weapons and trained personnel to carry out the missions. For instance artillery-firing tables are required to calculate ammunition expenditure for various climatic conditions. The military doctrine to use chemical weapons, the trained troops, and the standard operating procedures, the artillery firing tables have all disappeared from the military scene for the last 20 years. But above all the political will; the intentions to carry out a chemical war have been abandoned by the member states.
The conclusion is that even when the destruction is not complete by 2012 the previous 100.000 tons do not form a real hazard. If there is a hazard it comes from the few hundred tons possibly available in rogue States.
The few hundred tons estimate comes from US-open sources published on the Internet. Recently a larger number (3000-5000) was mentioned in a South Korean intelligence estimate. However the record of the intelligence community regarding estimates is not very good. In 1987 the same Internet sources came to estimate quantities in the USSR of 400.000 tons, 10 times the present day value. The last estimate of the Iraqi capability comprising 700 tons appeared to be false, as did the estimate for Libya. For the time being it seems that the term a few hundred tons per rogue State is the best available estimate.

## The consequences of a few hundred tons

In order to neutralise the few hundred tons outside the control of the OPCW, Chemical Defence is mandatory. Without this Defensive posture the effects of the agent might be devastating.
The available amount of agent in a conflict will be reduced by pre-emptive strikes. In addition superior air power will not allow a full attack to develop. The total amount of agent in a conflict

will have been reduced by a least a factor hundred if not thousand in comparison with 25 years ago. This means that a chemical attack will become a rare incident and has very little consequences provided the troops are protected. The paradox is that if the troops are lacking Chemical Defence, the consequences of a CW attack might be very serious. Chemical Defence is usually seen in several steps:
The first question is what are the agents of interest and how much of this agent will the soldier encounters in the battlefield. Combined with this is the effective dosage of an agent or better how much protection is required in order to prevent casualties when attacked. Actually this is the ratio between the challenge dosage and the just no-effect dosage.
The next steps are the technical Chemical Defence steps:
Detection / Physical Protection / Medical Countermeasures / Decontamination / Training
With a fair Chemical Defence system, comprising mainly of detection, protection and training the effects of the few hundred tons will be largely neutralized, in any case to the degree that they are military non-significant.
The present day detectors are capable of detecting most classical agents of interest, the scheduled compounds. Problem areas sometimes mentioned are Toxic Industrial Chemicals (TICS) and non-scheduled highly toxic compounds ( Novichoks?) or synthesised toxins. Regarding detection TICS are not a real problem because one can smell their presence.
Non-scheduled nerve agents will still act as cholinesterase enzyme inhibitors and enzymatic detectors will work. Methods are under development to rapidly detect pathogenic aerosols and toxin aerosols.
Two parameters, one for efficiency and one for capacity can characterize the physical protection provided to the troops. The total amount of agent, concentrations and dosages in a future individual attack are lower than in the previous century. The potential opponents will not have the capability to carry out major attacks. The casualty acceptance is also reduced. As a consequence the efficiency, defined as the ratio in challenge dosage and permissible exposure dosage stays the same.
The required capacity is reduced a great deal. For one multiple attacks on the same unit are no longer of interest. Secondly the “fight dirty” concept has been abandoned and troops will withdraw to a contamination free area, shortly after contamination. The required protection times and thus the capacity can therefore be reduced. Consequently the number of spare canisters can be reduced from 3 to 1.2 per man. Similarly the number of protective suits gloves and boots can be reduced from 2-3 to 1.2 per man. Decontamination of suits for Chemical Agents becomes superfluous.
TICS are not a real problem with regards skin effects. They might form a problem for the respiratory protection. However large storage sites of TICS in the area of operation are known. One should prevent any operations in the vicinity of those sites. The present day canisters can cope with small amounts of TICS, so the concentrations encountered at some distance of a storage site. Special canisters are required if one wants to operate close to the storage sites.
In view of the fact that Chemical Warfare will be reduced to rare incidents, with very limited number of casualties it is not realistic to pay much attention to Medical Countermeasures. In addition large sums have been spent for 90 years in finding a therapy for instance for Mustard gas poisoning without success and breakthroughs are not expected in the near future. The extensive research towards therapy and prophylaxis for CW agents can better be spent in the area of Biological and Toxin weapons
Decontamination regarding CW agents will seldom, if at all, be used in future conflicts. Nuclear and Biological decontamination might be of interest but just water will do the trick.

Chemically contaminated equipment will be abandoned and clean up might become of interest after ending the conflict. No military wants to move equipment around that has been contaminated because the guarantee of absolute toxic free cannot be given.
In view of the changed conditions it is mandatory to set up new doctrines regarding Chemical Defence and new forms of training. Without training the Chemical Defence system will not work adequately and the few hundred tons might become very hazardous again.

## Conclusion

Technically the main success of the CWC is the significant reduction of the amount of CW agents intended for use in conflicts. Chemical Warfare will be restricted to rare incidents this has consequences for the defensive posture of the forces. There will be less interest in the area of Medical Countermeasures and Decontamination. Detection will still be of much interest but in the area of physical protection there could be far less emphasis on the capacity of the protection. This will reduce the investments for canisters and for protective clothing. This will reduce the physiological burden of he mask and clothing. Physical protection, Decontamination and Medical Countermeasures are the main areas where a return on investment in the CWC can be found. Training of the adjusted Chemical Defence posture is essential.
The Chemical Weapon Convention and Chemical Defence work together towards the same goal, making Chemical Warfare an issue of the past.