

Biological and Chemical Warfare

Extracts from a Staff Paper by Major G.C. Odendaal*

INTRODUCTION

1. Chemical and biological warfare is very old indeed, at least 2000 years old. The arsenal consists of poison tipped arrows and darts, as well as toxins found in certain wood fibres that were used to incapacitate fish in streams. Armies laying siege to cities would catapult corpses and entrails over the walls to induce a plague and defecate into wells and water supplies. The Romans tilted salt into the soils of Carthage to prevent Carthage from ever becoming a threat to them in the future – either militarily or economically.

2. Since World War II, bacteriological and chemical weapons have become an increasing possibility. But because there is no clear evidence that these agents have ever been used as modern military weapons, discussions of their characteristics and potential threat have to draw heavily upon experimental field and laboratory data, and on studies of naturally occurring outbreaks of epidemics of infectious disease, rather than on direct battlefield experience. The potential importance of biological agents in warfare can be sensed when one remembers that infectious disease even as recently as World War II caused numerous casualties.

3. The greater threat posed by chemical weapons today derives from the discovery and manufacture of new, more toxic compounds. On the other hand, bacteriological agents already exist in nature and can be selected for use in warfare.

4. It would appear that chemical and biological agents have been used on a wide scale today as weapons of war, especially against the inhabitants of Afghanistan. These weapons are mainly being used by the Soviets and it can therefore be concluded that the use of chemical and biological weapons in Southern Africa cannot be ruled out.

AIM

5. The aim of this staff paper is to discuss the effects of chemical and biological warfare and the possibility of such warfare in the foreseeable future.

SCOPE

6. In order to reach the aim as set out above, the following aspects of the topic will be discussed:

- (a) History of chemical and biological warfare.
- (b) Modern day use of chemical and biological agents in war.
- (c) Chemical and biological agents and their effects.
- (d) Protection against biological and chemical warfare.

DISCUSSION

History of chemical and biological warfare

7. *Chemical Warfare*

- (a) The application of chemical warfare really commenced before the advent of recorded history, by the use of fire and smoke to overcome an opponent. At the siege of Plataea in 429 B.C. burning pitch and sulphur was used while the so-called "Greek fire" was a mixture of highly combustible substances ignited by water.
- (b) The adoption of chemicals as weapons during the Great War (1914–1918) was logical in that the principal combatants were firmly entrenched in a stalemate situation, making any advance without terrific losses virtually impossible.
- (c) The introduction of gas as an effective weapon in warfare dates from April 22, 1915, when the German forces launched a large scale attack with cylinders of chlorine against the allied position in the Ypres Salient where the British and French lines joined. The Germans waited for the wind to blow in the right direction before opening the valves of the containers. The target was the Allied troops who had just moved into position and were enjoying the fresh breeze, when greenish-yellow clouds enveloped them. Five thousand were killed immediately, while another 15 000 casualties fell about in contortions of pain, horror

and panic, each man affected drawing in his own lung exudate! The gas penetrated a distance of 5 km to the rear.

- (d) May, 1915, the Germans again released gas in three attacks, this time on the Russian front, taking the Russians completely by surprise. About 25 000 Russians were killed or wounded with repeat panic conditions.
- (e) By September 1915 ICI in England was manufacturing gas, but could not equal the output of the German chemical manufacturing potential. The British were able to release gas from about 5 500 cylinders at Loos in Belgium. The Germans were unprepared, all facilities were swamped and the soldiers panicked. The results of the attack was a wasteland of death, with also 2 000 British soldiers gassed by accident.
- (f) In December 1915, the German Gas Corps moved into positions at Ypres and released the newly perfected gas Phosgene against British troops, again producing panic conditions with symptoms coming on much later than experienced with use of chlorine. In June 1916 the British retaliated with 1 5000 tons of Phosgene at the battle of the Somme, obtaining a rearward penetration of 12 miles on a 17 mile front. Gas filled projectiles were now used with the newly made "Livens projector" and "Stokes mortar" making delivery into enemy lines surer and more accurate.
- (g) In July 1917, the projectiles on exploding exuded a heavy greasy liquid smelling like "Garlic" or "Mustard" hence referred to as "Mustard Gas". Mustard Gas caused intolerable pain in the eyes, followed by vomiting and with foot-long brown blisters penetrating the skin and the flesh.
- (h) In 1925 the French and Spanish armies were reputed to have used poison gas on the Moroccan rebels.
- (i) In the same year the Geneva Protocol against Chemical and Biological Warfare was signed by 38 nations, but not ratified.
- (j) In 1935–1936 Italy used 700 tons of poison gas against Abyssinian tribesmen during the colonising war. First aerial bombs were used then sprays, resulting in appalling suffering by the defenceless natives; gas residues remained active for long periods on foliage and water surfaces sprayed.
- (k) In the same period a momentous and far reaching discovery was made by a German chemist, while researching insecticides.



British Western Front in France. Gas mask parade. (D DOC S 841–1523)

These were related to the organo phosphoric group of chemicals, which inhibit cholinesterase in animal muscle. From this work he developed the original "Nerve gas", afterwards coded "Tabum". After this another gas coded "Sarin" was developed by I.G. Farben and subsidiaries. Other chlorine based gases were also synthesised and researched.

- (l) World War II passed by with no report of actual use of poison gas or other toxic chemical substances. However a few "near misses" seemed to have occurred.
- (m) Around 1950 the red revolt in Malaya had the British very worried about the political future of this rich tropical colony. Amongst other military action they took against terrorist was the successful use of 245T (trichlorophenoxyacetic acid) to destroy food crops.
- (n) During the period 1961–1962 the Armed forces of USA mounted "Operation Ranch Hand" using substances closely related to natural plant hormones to strip bare the jungles in Vietnam. The defoliant agents used were code named "Green", "Pink", "Purple", "White", "Blue" and "Orange". Use of the most controversial agent "Orange"

drew condemning criticism. This consisted of two chemicals 245T, a defoliant, and 24-D containing minute quantities of dioxin, the most toxic chemical ever produced by man at the time. Deformities reported in animal foeti, were either not notified or went unheeded. It caused rapid and explosive self destructive plant growth. Weeds grew into giant bushes and trees bowed down with rotting fruit and then died.

8. **Biological Warfare**

- (a) "A plague upon your children". The quotation is biblical. Biological warfare, active or guerilla, accidental or intentional, has been practised since time immemorial.
- (b) One of the first written instances of its use for political ends is described in the Old Testament of the Bible, when God visited the seven plaques upon Egypt to obtain the release of the Israelites from bondage. The poisoning of water in desert warfare is historical, having continued through the time of World War II.
- (c) In the 14th century the Tartars catapulted plague infected human bodies into besieged Crimean towns. The Russians and



British Western Front in France. The York and Lancaster Regiments in the trenches. Examination of small box gas respirators. (D DOC S 841–1575)

Swedes did likewise to each other in their early military campaigns.

- (d) The British were reputed to trade smallpox infected blankets to the non-immune American Indians in the early colonisation of the North American Continent, while whole tribes of Redskin were decimated by contact with a few French Jesuit missionaries in French Canada due to the transmission of unfamiliar diseases.
- (e) In Africa and the Orient large numbers of the indigenous populations were annihilated by diseases such as measles and smallpox introduced during the colonising military excursions into new areas.
- (f) Thus this method of warfare has quite a tradition; not to win wars, but to create fear, abhorrence and panic. The immune or tolerant carriers of familiar disease benefitted from the sudden introduction of such diseases to indigenous peoples.
- (g) In World War I in 1915, the Germans were reputed to have immobilised the advance of the Russian Army by killing off their horse transports with glanders and anthrax. Plague was also supposed to have been used against Russian soldiers.
- (h) More recently before World War II, Russian agents are reported to have been arrested in China by the Japanese during the Chinese War, while in possession of cultures of dysentery, cholera, anthrax. In fact it was claimed that 6000 Japanese soldiers had actually been killed in Shanghai by some of these cultures. The Japanese themselves were reported to be using Chinese, American, British and Australian POW's for experimentation with infectious diseases.
- (i) The ideal of using some biological agent to knock out key areas, such as command posts, airports, food stock-piles, or other strategic places, was still strong enough to outweigh obvious disadvantages of its use. Such disadvantages were shown up in one of the earliest experiments the British carried out on one of the Islands off the Scottish coast, using explosives loaded with anthrax amidst tethered goats. This was so successful that the site is still contaminated today.
- (j) Experiments with biological agents still continued in spite of their draw-backs. One such example was the successful assassination of top Nazi Heydrich in Prague in 1942, with what was afterwards claimed to have been grenade splinters deliberately contaminated with botulinus toxin. Some

time after 1943, the USA was accused of dropping millions of Colorado Beetles on German potato fields and again on rice fields of Japan in an attempt to starve the civilian population.

- (k) The history of research, trial and use of germ warfare continues to the present day. North Korea claimed dirty tricks were used by the USA during the Korean war in 1952, when American POW's confessed to dropping germ bombs including infected fountain pens. This was supposedly confirmed by an international Commission of Enquiry. Reports of research are only available from the USA. A Soviet officer has revealed the existence of a special 7th Directorate of Chemical Bacterial Warfare and recently the Russians were reputed to be considering the possible use of the more rare and newly identified virus fevers such as lassa fever, ebola fever, and green monkey fever (Marsburg) etc.

MODERN DAY USE OF CHEMICAL AND BIOLOGICAL AGENTS IN WAR

9. It would appear that chemical weapons have been tested on a massive scale against the inhabitants of Afghanistan. It would also appear that chemical weapons have been used against insurgents in Kampuchea and Laos. Agents used here, are three types, viz incapacitant/riot control agents, a nerve agent, and an agent which causes extensive haemorrhaging.

10. After 1977 it was possible to formulate strategy and tactics for the use of new chemicals specially belonging to the trichothecene group of compounds. After this date, Soviet jet aircraft (as well as the slower Antonov-12) were used against the Hmong tribesman. After 1979, numerous reports of chemical attacks against Kyhmer Rouge guerillas in Kampuchea started to emerge.

11. While trichothecenes have been used in chemical attacks, there is some doubt about the ability of these agents to produce death in 10 to 15 minutes from rapid and massive bleeding. There is close correlation between the symptoms observed in people suffering from trichothecene poisoning and those suffered by victims of many chemical attacks. However, this correlation is still not close enough to explain reports such as the following;

“Two L-19 airplanes made an attack on Pha Na Khun, a Laotian village of some 250 people on September 28, 1978. The first sprayed yellow and green powder that was not wet like rain, but fell to the ground. The second plane followed a few minutes later and fired a rocket that exploded about 20 metres overhead releasing a red smoke. Approximately 230 people were killed immediately and only 19 or 20 survived. All the animals died. The yellow and green powders made everyone feel dizzy, their movements became confused, their vision grew blurred and it was difficult to move. People fell to the ground with vomiting and diarrhoea. When the red smoke came down, people vomited blood and had massive nose bleeds.”

The phrase “yellow rain” now entered the military vocabulary.

12. Analysts were puzzled by the high amount of pollen found in some samples, however, this has led to the conclusion that many of the samples analysed were, in fact, bee excrement. This theory has been rejected by Dr Chester Mirocha. The bee pollen theory does not explain how T-2 toxin has been detected in numerous blood samples taken from troops close to where chemical attacks have been reported. It is quite possible that pollen has had T-2 toxin impregnated into it. The pollen, containing T-2 toxin, could then be used in the same way as poisonous gas.

13. Several weapons in the soviet arsenal can readily be adapted to deliver chemical munitions, ie the BM-21 rocket launcher, and the HIND-A assault helicopter. It is also possible that the role of the MI-24 assault helicopter and the BA 21 rocket launcher is being changed in operations where support is being given to infantry.

14. It is also felt by some that cholera has been introduced into the Southern Continent by the recent terrorist wars in Rhodesia and Mocambique, perhaps deliberately. There are now several endemic cholera areas established in Southern Africa from which it will not be eradicated in the foreseeable future. Two such areas are the Lower Shire Valley and parts of Zululand.

CHEMICAL AND BIOLOGICAL AGENTS AND THEIR EFFECTS

15. *Chemical Agents*

(a) The following are the groups of chemical

agents that have an effect on both man and animal:

- (i) *Nerve Agents*. Nerve agents which are colourless, odourless, tasteless chemicals of the same family as organo-phosphorous insecticides. They constitute the most modern chemicals known; they kill quickly and are more potent than any other chemical agents (except toxins).
- (ii) *Blister Agents*. Blister agents are oily liquids which, in the main, burn and blister the skin within hours after exposure. Mustard gas is a good example. Blister agents caused more casualties than any other chemical agent used in World War I.
- (iii) *Choking Agents*. Choking agents are highly volatile liquids which, when inhaled as gasses, irritate and severely injure the lungs, causing death from choking. They were introduced in World War I and are of much lower potency than the Nerve agent.
- (iv) *Blood Agents*. Blood agents are also intended to enter the body through the respiratory tract. They produce death by interfering with the utilisation of oxygen by the tissues. They, too, are less toxic than Nerve agents.
- (v) *Toxins*. Toxins are biologically produced chemical substances which are very highly toxic and may act by ingestion or inhalation.
- (vi) *Tear and harassing gases*. Tear and harassing gases are sensory irritants which cause a temporary flow of tears, irritation of the skin and respiratory tracts and occasionally nausea and vomiting. They have been widely used as riot control agents, and also in war.
- (vii) *Psycho-Chemicals*. Psycho-chemicals are drug-like chemicals intended to cause temporary mental disturbances.

(b) Agents affecting plants are herbicides, which are agricultural chemicals which poison or dessicate the leaves of plants, causing them to lose their leaves or die.

16. **Biological Agents**. The following are known biological agents:

- (a) **Viruses**. Viruses are the smallest forms of life. Genetic manipulation of the whole virus or chemical manipulation of its nucleic acid, might be used to acquire strains of higher

virulence or greater stability to environmental stresses. The viruses transmitted by arthropods, yellow fever, different kinds of encephalitis, dengue, etc. are all viruses that can be transmitted by aerosols, and the disease by insect vectors: mosquitoes, ticks etc. Infectious hepatitis, influenza and Marburg's virus may be grouped in this category.

- (b) **Rickettsiae.** Rickettsiae intermediate between viruses and bacteria. Like the viruses, they grow only in living tissue. Examples here are:

- (i) Epidemic typhus
- (ii) Rocky Mountain spotted fever
- (iii) Q fever
- (iv) Psittacosis

- (c) **Bacteria and Toxins.** Although many pathogenic (disease producing) bacteria are susceptible to antibiotic drugs, antibiotic-resistant strains occur naturally, and can be selected or obtained through the use of suitable methods of genetic manipulation.

Examples are:

- (i) Plague
- (ii) Bubonic plague
- (iii) Pneumonic plague
- (iv) Yersinia pestis
- (v) Tularemia
- (vi) Brucellosis
- (vii) Anthrax
- (viii) Typhoid fever
- (ix) Melioidosis
- (c) Botulism

- (d) **Fungi.** Fungi also produce a number of diseases in man, but very few species appear to have any potential in bacteriological warfare. An example is Coccidioidomycosis.

Research has shown that vectors for the above mentioned biological agents can be grey rats, rabbits, mosquitoes, rat fleas and flies.

PROTECTION AGAINST CHEMICAL AND BIOLOGICAL WARFARE

17. *How to detect biological or chemical aggression*

There are some signs which might suggest a biological or chemical attack. Certain events are considered suspect:

- (a) Blankets of fog remaining in the wake of an aircraft.

- (b) The parachuting of suspicious looking containers.
- (c) The fragmentation of missiles or bombs into separate containers.
- (d) Trace of a gelatinous mass on shrapnel or on containers.
- (e) The frequent discovery of diseased or dead animals.

18. *Protection against chemical and biological attacks*

- (a) **Chemical attacks.** The best means of protection against a chemical attack is by means of an early warning system based on an automatic alarm that is highly sensitive to chemical vapours from these agents. Alternatively to obtain full protection against these agents the troops in the field must wear protective clothing in addition to a well-fitting respirator. It is also known that the drug atropine, which occurs in belladonna could arrest the muscular failure if given immediately by intramuscular injection. Prophylactic agents, viz Oxine, can confer systematic protection on troops in anticipation of a nerve gas attack.

(b) **Biological attacks**

- (i) *Preventative measures against biological attacks.*

As prevention against biological attacks the following is useful:

- Lead a healthy life.
- Generally increase stamina.
- Maintain a good standard of nutrition and strength.
- Maintain body and clean clothing.
- Keep the body free of vermin.
- Ensure cleanliness in living and working premises.
- Remove refuse regularly.

Prophylactic injections are also valuable as they develop the body's defence against specific diseases.

- (ii) *Action to be taken during a biological attack*

Once a biological attack has started all personnel are to proceed as rapidly as possible to a shelter, cellar or ditch. If no shelter is available the following should be done:

- Button up clothing (put on gloves).
- Lie on ground with the face downwards.

- Place a cloth (wet if possible) in front of face.
- Do not breathe deeply.
- Wrap yourself in a blanket, sack or tarpaulin.
- Hermetically cover wounds.

These measures protect the respiratory tract against the entry of aerosols and prevent large numbers of disease nuclei settling on the skin or entering the body through wounds. The most effective protection is provided by a safety mask and protective clothing.

- (iii) *Action once a biological attack is over.* Once a biological attack is over the body must be cleaned with soap and a brush preferable under a shower or in a bath, and thoroughly rinsed. This mechanical cleaning naturally does not kill the pathogens and the body should therefore be disinfected, if possible. All uncooked food must be inspected. Air-tight containers (and packaging material) will provide sufficient protection. Prolonged cooking of foodstuffs will render them fit for consumption. Water samples must be analysed immediately after a biological attack. Boiling water for fifteen minutes is usually a sound guarantee that the water is fit for drinking. Insect and rodent extermination programmes must be stepped-up in the wake of a biological attack since these animals can constitute a reserve of infection.

19. **Decontamination and disinfection.** The principles of decontamination and disinfection are those of basic hygiene. There are many effective measures:

- (a) **Heat.** Most vegetative bacteria, viruses, parasites and fungi can be killed by boiling for 10 minutes at 100°C.
- (b) **Liquid disinfectants.** Germicides such as many disinfectants are effective: halogenic compounds, hypochlorites, iodized preparations, quaternary ammonium salts.
- (c) **Gaseous disinfectants.** These include ethylene oxide, formaldehyde and betapropiolactone.
- (d) **Disinfection by filtration.** The advantages of filtration processes lie in their ability to sterilise drinking water. Drinking water filters are currently in use in the armed forces.

Decontamination of equipment, buildings, etc., is possible at present and decontamination of clothing can be carried out using conventional methods.

CONCLUSION

20. Recently chemical and biological warfare has become a most distinct feature of military technique. This can be said after it has been established that the Soviet Union used chemical agents in South-East Asia and Afghanistan.

21. Several weapons in the Soviet arsenal can readily be adapted to deliver chemical munitions, ie. the BM-21 rocket launcher, and the Hind-A assault helicopter. It is also possible that the role of the MI-24 assault helicopter and the BM-21 rocket launcher is being changed in operations where support is being given to infantry; a changing of the conventional high explosive warheads used by the above for chemical warheads. Soviet infantry involved in a counter-insurgency campaign could largely be replaced by assault helicopters and rockets launchers delivery chemical and biological weapons.

22. In such a strategy, it would be difficult to predict a chemical attack, because the Hind-A assault helicopter, the MIG-21 fighter and the BM-21 rocket launcher are commonly known as conventional systems.

23. The West in general and even the Republic of South Africa could well take cognisance of this possibility and be prepared.

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