THE UNIVERSITY OF CALGARY

# CROSSING THE RUBICON:

# THE UTILITY OF CHEMICAL WEAPONS

BY

BEDIAKO BUAHENE

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE

DEGREE OF MASTER OF ARTS

DEPARTMENT OF POLITICAL SCIENCE

CALGARY, ALBERTA

June, 1988

ISBN 0-315-46560-3

# THE UNIVERSITY OF CALGARY

# FACULTY OF GRADUATE STUDIES

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a thesis entitled, "Crossing the Rubicon: The Utility of Chemical Weapons," submitted by Bediako Buahene in partial fulfillment of the requirements for the degree of Master of Arts.

Supervisor, Dr. C.A. Cannizzo
Department of Political Science

Dr. W.H. Critchley
Department of Political Science

Dr. C.I. Archer
Department of History

Date June 10, 1988

# Abstract

In April 1915, during the Battle of Ypres a poisonous chlorine cloud drifted over Allied lines causing thousands of casualties. With the introduction of chemical weapons to the battlefield, a Pandora's box of lethal gases was opened which has yet to be closed. Chemical attacks became the norm throughout the First World War, so much so, that by war's end, Germany's munitions arsenal contained up to fifty percent chemical shells, with Allied stocks not far behind. In 1925, all major powers (except the U.S.) signed the Geneva Protocol prohibiting first-use of lethal chemicals, though not their stockpiling or development. By the end of the Second World War, all major participants had acquired large stockpiles of even more deadly chemicals than those used during the First World War. This time, however, deterrence and lack of military utility prevented their employment. Nevertheless, the major powers were not prevented from continuing research, from developing more elaborate chemicals, and from introducing complex scenarios into their respective military doctrines. Given that chemical warfare remains a distinct possibility, the theoretical framework of deterrence provides the necessary organizing and structuring concepts such as retaliation, protection, detection, finite deterrence, and defence. It is from this perspective that the following paper involves an examination of chemical warfare as it relates to deterrence—both historically and in the NATO–WTO confrontation today. The historical section allows for the investigation of how past experiences have meshed with theory. The NATO/WTO section will look at various scenarios proposed in the literature, and how those scenarios relate to the current NATO posture and the historical realities of deterrence.

# Acknowledgements

Without doubt, this thesis could not have been written without the assistance of many friends and colleagues. Above all, Dr. C.A. Cannizzo must be absolved of all guilt as she corrected my drafts with uncanny precision and care. Her depleted stocks of red and black felt pens attest to her concern. Therefore, I extend my sincere gratitude to her for having slaved through my thesis and provided me with guidance and assistance beyond the requirements of her supervisory duties.

My 'personal librarian' Mr. T. Kuny deserves my warmest thanks as he led me up research avenues hitherto unknown to me and continually suggested new materials and sources. At times more dedicated to my work than I, his probing questions allowed me to focus many thoughts. I feel compelled to apologize to my office mates, especially Sammy, for having to suffer through the endless discussions I initiated on my topic and to Steve Haigh, a theorist, for proofreading a thesis he knew nothing about and may not have wanted to.

Finally, my thanks also to the inter–library loan staff for going out of their way to locate my numerous and obscure requests. In the same vein, Nancy Mancell and Debbie Teale deserve credit for their incredible patience and help in formatting this thesis.

# Contents

# List of Tables

# Introduction

> ...overtaking his cohorts at the river Rubicon, which was the boundary of his province, he paused for a while, and realising what a step he was taking, he turned to those about him and said: "Even yet we may draw back; but once cross yon little bridge, and the whole issue is with the sword. As he stood in doubt, this sign was given him.... Then Caesar cried: "Take we the course which the signs of the gods and the false dealing of our foes point out. *Iacta alea est* [The die is cast]," said he.[1]

Standing on the river bank, Julius Caesar pondered his destiny. To cross the Rubicon meant facing uncertain and potentially disastrous consequences—yet at the same time, success could reap untold spoils. To remain, on the other hand, would ensure his survival and that of his men. By crossing the river, Caesar embarked upon a course that had only two outcomes—victory or defeat. Once decided, Caesar knew he could not turn back; he must follow through with all his might, or accept certain death. His bold decision was a gamble and yet archetypal in the annals of military history. Nearly 2000 years later the German General Staff was in the process of formulating a decision that would, like Caesar's, irrevocably alter the existing situation. The gamble was great but the prize even greater.

At 1700 hours on 22 April 1915, three red rockets screamed into the evening sky. For the Allies it announced the beginning of another artillery barrage, for the Germans an experiment that could lead to the victory they desperately needed. Both were wrong. Instead, April 1915 ushered in the use of weapons hitherto deemed savage and against all laws of humanity—chemical agents.[2] No other

[1]Suetonius, book I, *The Deified Julius*, with an English Translation by J.C. Rolfe (London: William Heinemann Ltd, 1913), p. 45.

[2]The generally accepted definition of a chemical agent is: "a solid, liquid, or gas which through its chemical or incendiary properties produces lethal or damaging effects on man, animals, plants

conventional weapon has aroused such moral indignation, political discussion, and doctrinal confusion, yet been so hard to turn back from.

The great chemical cauldron of W.W. I had barely cooled when public outrage and political expediency dictated that chemical weapons (CWs) were grossly inhumane and should be banned, since they detracted from the art of warfare and reduced the soldier to a victim without immediate recourse to action. Some within the military establishment vigorously defended the new weapon, while others argued that it had displayed little that was of military value. This juxtaposition—namely lack of military utility but continued support, versus apparent international political desire to remove chemicals from the battlefield—is at the centre of this thesis. Consequently, one of the basic aims of this study is to develop an understanding of some of the inherent difficulties in deploying and using chemical weapons.

Central to this research is the question of the efficacy of CWs, and the basis upon which deterrence for CWs functions. This kind of analysis provides an alternative to the preponderant academic one, the latter tending to focus on arms control and disarmament as the method by which to analyze the lack of an international agreement. This thesis concludes that the absence of doctrine, and the perceived usefulness of CWs for defence and deterrence are among the reasons that CWs still infest national arsenals to this day. In other words, avoiding the

---

or material, or produces a screening or signalling smoke." Trevor Dupuy, Curt Johnson, Grace P. Hayes, eds., *Dictionary of Military Terms* (New York: The H.W. Wilson Company, 1986), p. 47. Chemical warfare is defined as: "Employment of chemical products to produce death or casualties in man, to create a military advantage, or to defend." U.S. Department of the Army, *Dictionary of United States Army Terms*, April 1965 A.R. 320–325, pp. 84–85, as quoted in Frederic Brown, *Chemical Warfare: A Study in Restraints* (Princeton: Princeton University Press, 1969), p. xviii, fn. 1.

issue of arms control and of disarmament allows a different interpretation from the standard one, and so suggests different reasons for the continued existence of CWs. Ironically, since their inception, the military has unsuccessfully attempted a catharsis, as traditionalists consider CWs as having gone beyond the acceptable level of battlefield brutality. "These feelings lead some to the position that nuclear weapons are preferable and should be used to counter the chemical threat, even at the expense of what would have to be far more catastrophic consequences."[3] This nuclear versus chemical weapons' controversy is significant and plays a key role in the discussion of current thinking and will be elaborated upon in Chapter 3. Emphasis in this thesis is placed on an in-depth analysis of the historical record to extract the necessary information for a precise understanding of deterrent policy devoid of dogmatic rhetoric.

The study of deterrence and the aftermath of its failure, as it relates to CWs, will clarify why CWs were employed in the past, but also will allow for predictions about the future course of chemicals in war. The significance of deterrence, and on occasion its impotency, should not be underestimated as it will underscore the fact that chemical warfare has often been initiated in desperation, or as a result of an asymmetrical conflict, yet is seldom used in situations of possible escalation and adequate defences.

The notion of deterrence features prominently in chemical warfare literature, but few, if any, truly define the term with respect to CWs. A full discussion of deterrence is impossible since the literature is voluminous and often outside the

[3]Hugh Stringer, *Deterring Chemical Warfare: U.S. Policy Options For The 1990's* (Washington, D.C.: Institute For Foreign Policy Analysis Inc., April 1986), p. v.

scope of this paper.[4] Fundamentally, however, deterrence is understood to be a relationship in which "...one party tries to influence the behaviour of another in desired directions."[5] It basically enables one party—through the threat of sanctions or deprivations—to prevent another party from taking a course of action that the deterrer deems undesirable. Similarly, Morgan in his classic analysis of deterrence succinctly argued that deterrence is:

> ...a relationship between two sets of rational decision makers in which one group conveys a threat to retaliate and thereby imposes costs so severe that [for] the other group the benefits to be gained by attacking [are] insufficient to make it worthwhile.[6]

In another landmark study, Schelling pointed out that deterrence involves "...the exploitation of potential force. It is concerned with persuading a potential enemy that he should in his own interest avoid certain courses of activity."[7] In other words, deterrence is a bargaining process. Though rather simple, these definitions highlight various characteristics inherent in deterrence theory.

The main tenet of deterrence is similar to that of a business precept. In other words, the cost of aggression will be weighed against the possible benefits that might accrue from such an action. If an actor fails to respond to the deterrent, or threat, few options remain other than to pre-empt before the fact or retaliate afterwards. In theory at least, retaliation, in whatever form necessary, must clearly be at the level of unacceptable cost to the aggressor, while at the same time, it

[4] For a concise yet insightful survey discussion of general deterrence literature, see John Raser, "Theories of Deterrence," *Peace Research Reviews* (Volume 3, number 1 February, 1969), pp. 1–52.

[5] John Baylis, Ken Booth, John Barnett, and Phil Williams, *Contemporary Strategy* (New York: Holmes & Meier Publishers, Inc., 1984), p. 69.

[6] Patrick M. Morgan, *Deterrence: A Conceptual Analysis* (Beverly Hills, CA: Sage Publications, Inc., 1977), p. 58.

[7] Thomas Schelling, *The Strategy of Conflict* (Cambridge, MA: Harvard University Press, 1960), p. 9.

must not severely impinge upon the actor whose deterrent failed. If the latter condition does not hold, the deterrer becomes self–deterred, or simply stated, the deterrent works to restrain aggression by the deterrer as well as the deteree. This is the structure of Mutual Assured Destruction (MAD). Deterrence at this level is based on the idea that the actors understand that unacceptable damage will result on both sides if any aggressive action is taken. The paradoxical nature of a deterrent relationship is self–evident as "...each side hopes to gain security, not by being able to protect itself, but by threatening to inflict unacceptable damage on the other."[8] As MAD is fallaciously equated with all forms of deterrence, a number of suspect joints exist in the conceptual scaffold of current deterrence thinking which prevents chemical deterrence from gaining a sound footing. It is rather an onerous supposition to equate and evaluate CW deterrence with deterrence literature espoused since 1945. Superficially, both deterrence regimes may appear similar, yet the logic and concepts of CW deterrence are decidedly different. Since the introduction of nuclear weapons into national arsenals, deterrence has come to be understood in terms of arming with nuclear weapons in order to avoid war. Accordingly, military establishments exist not to fight but to deter a war.[9] The cornerstone of such logic is the perceived capability to inflict massive and unacceptable damage upon one's enemy and, more importantly, the perceived readiness actually to do so. This premise works well at the nuclear level because nuclear weapons are unlike any other weapon system. Yet, as Green has indicated, nuclear deterrence theory rests on the fundamental assumption that it is always

[8]Robert Jervis, "Deterrence Theory Revisited", *World Politics* (Volume 31, issue 2, January 1979), p. 292.

[9]Bernard Brodie, *The Absolute Weapon* (New York: Harcourt Brace, 1945), p. 79.

possible to maintain "... a delicate psychic balance in which such a immense threat is seen as essentially peace-preserving—sometimes even in times of actual warfare. Whether this balance can be maintained will depend on the answers to many questions...."[10] Consequently, chemical deterrence cannot have a 'sound footing' when nuclear deterrence, itself, is based on such a fragile structure.

The same jargon used to discuss nuclear deterrence is incorporated into chemical deterrence as if CWs could be likewise abstracted from the arsenals of nations. Unlike nuclear weapons though, CWs can work at a number of levels and in different modes. Therefore, chemical deterrence must theoretically function at a warfighting level. Moreover, considerable mental exertion would be needed to imagine solely CWs being used in a conflict. As a result of unpredictable effects and the historical development of doctrine, CWs are relatively integrated into the planning of battles as one of the many weapons to be used. But the ambiguity of chemical weapons' effectiveness has, in part, contributed to the military's posture of continually considering their possible use, while failing to undertake the necessary steps to integrate them into the force structure. In other words, the utility of CWs has not been proven to the satisfaction of the military, but the possibility exists that CWs may still evolve into a practical weapon.

Chemical deterrence also has been used as the rationale for the retention of a sizable and thereby credible stockpile for use in retaliation-in-kind. Unfortunately, the historical record, though often interpreted as such, does not fully support the view that the use of gas at the tactical level will deter further use; nor will the possession of CWs, prior to hostilities, necessarily prevent the enemy from initiating

[10]Philip Green, *Deadly Logic* (Columbus: Ohio State University Press, 1966), p. 201.

chemical warfare.[11]

Both nuclear and chemical weapons are considered weapons of mass destruction, yet CWs do not pose the same threat as nuclear weapons do to nation–state survival and security.[12] Further, while strategic bombing of cities with CWs, in the World War II sense of crushing morale and weakening the economic infrastructure is a real possibility, the likely magnitude of destruction is simply not equivalent to that which nuclear weapons can accomplish because a stupendous and unrealistic expenditure of resources would be required. Quester suggests that the fear of a strategic attack neutralizing a nation, prevalent during the 1920s, is analogous to the current situation.

> For while weaponry changes rapidly, human brainpower changes little, if at all; if people four decades ago believed that they possessed today's weapon systems, then we may have a natural "simulator exercise" in many ways superior to any we could attempt to erect artificially.[13]

Since Hiroshima then, the strategic threat posed by CWs is not of the magnitude as that of nuclear weapons. As this paper will demonstrate, however, notions of the threat of escalation are important ingredients to chemical deterrence.

At this point the question of the significance of CWs for the field of political science should be addressed. Politicians are very hesitant to discuss CWs publicly,

---

[11]Vachon provides an insightful and more extensive discussion of this view and the dangers of using nuclear deterrent thought. Capt. Gordon K. Vachon, *Chemical Weapons: Certain Seldom-Heard Views* (Ottawa: Department of National Defence, Operational Research And Analysis Establishment, June 1981), pp. 4–7.

[12]In 1947, the United Nations defined weapons of mass destruction to "...include at least some types of chemical weapons whose elimination from national armaments thereby became, in the words of General Assembly resolution 41(1), an 'urgent objective' of the United Nations,..." J.P. Robinson, "Chemical arms control and the assimilation fo chemical weapons," *International Journal* (Volume 36, number 3, Summer 1981), p. 515.

[13]George H. Quester, *Deterrence before Hiroshima* (New York: John Wiley & Sons, Inc., 1966), p. 172.

which is underpinned by a blatant public disgust towards an acceptance of lethal agents. Past research has often been coloured by emotional outbursts condemning gas warfare, while others took the extreme position of considering CWs as a typical German weapon. "From the standpoint of using CWs, CWs are a typical German weapon as they reflect the techno–scientific gifts of the German people."[14]

The moral outrage present in the literature on chemical warfare is often a reflection of a dominant professional cleavage, with one side expressing the view of politicians and academics concerned with arms control and disarmament and the other side comprised of military professionals and experts primarily engaged in strategic and tactical considerations. Within the latter group, other themes have emerged which have contributed to the overall doctrinal confusion associated with chemical warfare. Between the end of the First and Second World Wars, a severe rift existed among those military thinkers who saw CWs as a new and wondrous way of achieving victory, and those who sided with the first group demanding arms control. From 1945 onward, military opinions have largely consolidated to form the view that CWs are here to stay and that therefore, both offensive and defensive preparations are necessary over and above the reliance upon international convention and ongoing arms control negotiations. Nothwithstanding military revisionism, the political end has changed little and there is continued optimism that the world can rid itself of this unwanted calamity. Post–1945 scientific academic literature, of which the publications from the Stockholm Peace Research Institute

[14]Author's translation. *"Die chemische Waffe ist auch vom Standpunkt ihrer Anwendung die typisch deutsche Waffe, da sie der besonderen naturwissenschaftlich-technischen Begabung der Deutschen entspricht."* This statement was made by a member of the German National Office for Economic Reconstruction (*Reichsstelle für Wirtschaftsaufbau*) in 1938. Hans Günter Brauch, *Der chemische Alptraum* (*Bonn: Verlag J.H.W. Dietz Nachf. GmbH, 1982*), p. 76.

(SIPRI) are in the forefront, has treated CWs in a more clinical fashion, suggesting that killing by gas is just another weapon system on the battlefield. The findings herein suggest a reconciliation of these major divergent areas following somewhat in the SIPRI tradition. Consequently, a more wholistic view on the issue of CWs will be presented by drawing upon all the major themes, by analyzing history within a politico–military framework, and by teasing out the major consensus found within the literature.

Biological warfare will not be touched upon for reasons of brevity. "Biological agents include those that depend for their effects on multiplication within the target organism, and are intended for use in war to cause disease or death in man, animal or plants."[15] Their existence does not detract from the overall coherence of this paper because biological weapons (BWs) have historically played only an extremely limited role. This is because of the difficulty of controlling the spread of organisms, and the fact that the incubation time for viruses is simply too long for them to be of any immediate use on the battlefield. We shall not, however, discount the current view which holds that BWs retain strategic possibilities because of their ability to decimate the opponents' population without the physical devastation of a nuclear blast. Indeed, the introduction of BWs into a war may be synonymous with an escalation to the nuclear level, which in theory at least, is not necessarily the case with the use of chemicals. Assuming the offending nation can be identified,

[15]United Nations, World Health Organization, *Health Aspects of Chemical and Biological Weapons* (Report of a WHO Group of Consultants, 1970), p. 12. "This definition therefore excludes toxins elaborated by some microbes...when they are preformed outside the target organism. In some discussions of chemical and biological weapons, such toxins are classified as biological agents because the technology of their production resembles that of biological agents rather than that of chemical agents." *Ibid.*, fn. 2.

a nuclear response to a biological attack is not totally implausible since the massive devastation of human and animal life would be a serious impediment to a nation's survival.

Finally, the 1975 Biological Weapons Convention banning research, development, production and stockpiling of BWs should, technically, make any discussion on this topic a moot one. Giving credence to *Realpolitik*, biological warfare cannot totally be discounted. However the dynamics of BW, as explained above, are likely to be different from CWs and therefore, need not be discussed in this thesis. Since toxins fall between a chemical and biological weapon, it was deemed best to present at least a cursory overview of their alleged use.

The structure of the thesis will follow the traditional format associated with an analysis of chemical warfare, opening with a historical discussion. Hence, Chapter One will recount the trials and tribulations of the attempts to introduce chemicals as an alternative weapon on the European battlefield. This chapter will focus specifically on the years between 1915 and 1945, as these were the formative years of chemical development and strategic chemical warfare thinking. Rather than reviewing every battle in which gas was used during the First World War, only those with a significant chemical component will be addressed. The Inter–War years saw the international arena attempting to reach a comprehensive and all encompassing arms control agreement while the military vacillated. Gas warfare was not part of the Second World War even though a number of "accidents" occurred.[16] Thus the W.W. II discussion focuses primarily on what each nation had available and

[16]Julian Perry Robinson, *Problem of Chemical and Biological Warfare: A study of the historical, technical, military, legal and political aspects of CBW, and possible disarmament measures. Volume 1: The Rise of CB Weapons* (Stockholm: Almqvist and Wiksell, 1971), pp. 153–158.

why CWs were never employed. This, incidentally, is an important issue since it has resulted in the germination of a false sense of security in society, based on the belief that since CWs were not used in the Second World War, there will be no interest in employing them in the future. This attitude fails to take into account the fact that World War Two may be a historical quirk, wherein CWs were discounted as a practical weapon due to the fluidity of battle. In fact, the offensive and defensive technological improvements that have been made over the last decades have increased the incentives to use CWs.

Chapter Two details the development of CWs from the mid–fifties onwards. Unlike Chapter One, it will not be solely a historical review. Instead, the emphasis will lie in the recognition of the continued popularity and spread of CWs with an analysis of the best documented occurrences. The concept of deterrence will be a major theme as nations must make the decision between a credible offensive and defensive capability when confronted with a chemically armed opponent. The policy implemented depends entirely on a nation's threat perception, political will and, to some degree, its historical record.

Chapter Three initially involves a survey of the chemical warfare policies of both the U.S. and the Soviet Union, followed by an analysis of NATO's posture. Deterrence will be explored further, using earlier chapters as the founding framework. This chapter addresses the question of what U.S./NATO policy is, and whether this is a realistic policy in light of both Soviet capabilities, and of past lessons regarding deterrence and actual use. Unfortunately outside the realm of arms control and disarmament, first–hand policy information was not obtainable from the Canadian Government, though the Canadian Research Defence Establishment at

Suffield was willing to assist on technical matters.

To allow for a more readable paper, the following terms are interchangeable, except when explicitly noted otherwise: gas warfare, chemical warfare, poison gas, noxious fumes, and toxic agents. All terms specifically refer to chemical substances used on the battlefield to kill men. This approach will prevent the inevitable overconcentration on the technical aspects of CWs that often accompanies such an analysis.[17] A more technical discussion on various agents and the protective equipment available has been inserted into an appendix.

[17]This definition is also intended to exclude chemicals now employed in warfare such as high explosives, smoke, and incendiary substances that exert their primary effects through physical force, fire, air-deprivation or reduce visibility. World Health Organization, *op. cit.*, p. 12, fn. 3.

# Chapter 1

# The Opening Move

## 1.1 HISTORY OF CHEMICAL WARFARE 1915–1945

For all practical purposes 22 April 1915 was the first gas attack in modern warfare, yet by this time the idea of warring with toxic agents was already a century old.[1] In 1812, a British naval officer by the name of Thomas Cochrane proposed to use sulfur dioxide to force Napoleon out of Toulon, Flushing, and other ports. His idea was not adopted but Cochrane persisted with the notion of using gas throughout his career.[2] During the siege of Sebastopol in 1855, Cochrane (by now Admiral Lord Dundonald) endorsed a plan calling for the use of sulfur fumes against the Russian defenders. The British government deemed the plan feasible but did not allow for its execution.[3] During the American Civil War, the U.S. War Department received a suggestion for manufacturing gas–releasing artillery shells. However, actual gas use did not occur until the Boar War when British artillery fired picric acid.[4] Partially due to increasing world–wide interest in chemicals, the Hague conventions of 1899, and their revisions of 1907, declared that: "the Contracting Powers agree to abstain from the use of projectiles the sole object of

[1] Wydham D. Miles, "The Idea of Chemical Warfare in Modern Times." *Journal of the History of Ideas* (Volume 31, April–June 1970), p. 297. His article presents a concise discussion of some of the thinkers behind chemical warfare.

[2] *Ibid.*, p. 298.

[3] Colonel Alden H. Waitt, *Gas Warfare: The Chemical Weapon, Its Use, And Protection Against It* (New York: Duell, Sloan and Pearce, 1942), p. 8.

[4] Thomas Meeker, *Chemical/Biological Warfare.* Center for the Study of Armament and Disarmament. (Los Angeles: California State University, December 1972), p. ii.

which is the diffusion of asphyxiating or deleterious gases."[5] No major European power felt bound by either Convention and research continued, though in a more secretive manner.[6] Moreover, the U.S. refused to sign the 1907 Treaty citing that it would interfere with the "inventive genius of its citizens in providing weapons of war...[furthermore] it was illogical and not demonstrably humane to be tender about asphyxiating men with gas."[7]

### 1.1.1 World War One

Although many nations considered using chemicals from the outset of World War I, Imperial Germany has the dubious distinction of first employing lethal agents in battle. When German scientist Fritz Haber suggested to the *Oberste Heeres-Leitung* (OHL–German supreme command) that they deploy lethal gas clouds in an effort to end the stalemate on the Western Front, a Pandora's box of chemical weapons was opened. The moment the first yellow–green cloud gently drifted over the Allied line, the Kaiser's Army set the stage for a *higher form of killing* and one they were wholly unprepared for, but the die was cast.

In 1914, all participants had various kinds of chemical munitions at hand, consisting primarily of harrassing agents filled into bullets and artillery shells. These

[5]Quoted in Major Charles E. Heller, *Chemical Warfare in World War I: The American Experience, 1917-1918.* (Leavenworth Papers No. 10, September 1984), p. 3.

[6]Both conventions were designed to govern the relations between belligerents such as their method of warfare and use of weapons. Thus article 23 specifically forbade the use of poison or poisoned weapons, the treacherous killing of individuals, the killing or wounding of an enemy who had surrendered or who had no longer any means of defence, and the use of arms or materials calculated to cause unnecessary suffering. Frank Barnaby, Organes Baroyan, et. al., *The Supreme Folly: chemical and biological weapons*, edited proceedings from an international conference on chemical and biological warfare (London: 21 to 23 November 1969), p. 7.

[7]C.E. Heller, "The perils of unpreparedness: the American Expeditionary Forces and Chemical Warfare." *Military Review* (Volume 65, no. 1, January 1985), p. 14.

were used sparingly and only achieved very marginal successes. For example, on 27 October 1914 Germans shelled a French position at Neuve-Chapelle with 3000 105mm "Ni-Schrapnell" shells. The shelling had no effect and only after the war did the French find out that they were attacked by chemicals. On the Eastern Front, 18,000 shells filled with T-Stoff were fired at Russian positions. They succeeded in disrupting counter battery fire but the results were still disappointing.[8]

By the end of August 1914, the great German advance came to a grinding halt and the resulting stalemate forced all sides to scramble to find a wonder weapon which could break the deadlock and end a war that was only supposed to last until Christmas. The Allies had two options, one being sea-borne landings behind the German front, the other being headlong frontal assaults supported by massive artillery. Since Britain commanded the seas, Germany only had one option—the land—available to them and chose to supplement it with chemical warfare.

Even though Imperial Germany introduced lethal chemicals onto the battlefield, the idea did not germinate from a coherent long–term policy. General Falkenhayen called a conference bringing together science, industry, and the military in an effort to solve the stalemate problem. This "Think Tank," of which Fritz Haber was a member, produced numerous proposals centering around toxic agents which, when implemented, either failed to produce the expected results or proved totally ineffective. Compounding the military fiasco, Germany suffered from a shortage of artillery shells, propellants, and explosives, a malaise that affected all participants. Consequently, Haber suggested the next best thing, namely to release toxic gas from

[8]Austin Bay, "Chemical Warfare Perspectives and Potentials." *Strategy and Tactics* (July/August 1980), p. 24.

cylinders rather than shells. Though not fully convinced, by the end of December 1914 the General Staff gave the green light and operational plans were drawn up for the first lethal gas attack in modern warfare.[9] The decision was not without its critics but the desire to break the deadlock—which for the Germans was far more disastrous than for the Allies—overrode ethical and legal considerations. The next decision to be made was where the first attack should be staged. Falkenhayen surveyed his army commanders for a volunteer and found that all refused except one. Duke Albrecht of Württemberg commanded the Fourth Army facing Ypres and agreed to use gas in an attack.[10] Unfortunately for the Germans, Ypres was one of the worst places for this experiment because, among other things, the prevailing westerlies favoured the Allies.[11] Nevertheless, the attack began on 22 April 1915 at 1800 hours whereupon 6000 cylinders released 135 tonnes of chlorine gas. The last gas attack of this campaign occurred on 24 May at 0245 hours.[12]

The first gas attack was an overwhelming tactical success, a success, however, that the German Army was unable to exploit. The gas caught a French Territorial and an Algerian unit completely by surprise and a rout almost ensued.[13]

---

[9]L. F. Haber., *The Poisonous Cloud: Chemical Warfare in the First World War* (Oxford: Oxford University Press, 1986), pp. 27–28.

[10]Crown Prince Rupprect of Bavaria, commander of the Sixth Army south of Ypres and General Karl von Einem, commander of the Third Army in the Champagne region, were among those commanders who were strongly against using gas in the attack initially scheduled for 14 April 1915. Brauch, *op. cit.*, p. 66.

[11]By choosing Ypres, Falkenhayn picked a place where the weather conditions were least predictable. Had the Germans studied meterology records from captured French and Belgian ports, they would have known this. After the attack, the allies discovered that the wind only blew 32 percent of the time from the German quarter, while it blew 44 percent of the time to their advantage. 24 percent of the time it benefited neither side. Haber, *op. cit.*, p. 29.

[12]The chlorine, from all 6000 cylinders, was released on a 7 km long front within ten minutes. Haber, *op. cit.*, p. 35. Throughout the paper the metric tonne (2204 lbs equals 1 tonne) will be used as this was the most common measurement in sources. Whenever found, imperial tons were converted to metric tonnes to allow for consistency throughout.

[13]Both the French and British High Command were aware that there was 'something in the wind'.

> In an attempt to escape the effects, some men tried to bury their mouths and nostrils in the earth; others panicked and ran. But any exertion or effort to outdistance the cloud only resulted in deeper breaths and more acute poisoning. As the tide of gas washed over the struggling men their faces turned blue from the strain of trying to breathe; some coughed so violently they ruptured their lungs.[14]

Seeing these effects of the gas, German soldiers were drained of any zeal they might have had in pursuing the routed enemy, especially since they possessed only the crudest form of respirator.[15] Thus the German advance halted after only 2.5 miles, even though there was practically no resistance. Ypres was just four miles away. Unfortunately, since the Germans did not believe that the experiment would work so well, they had failed to prepare adequately for the possibility that it could actually succeed. Falkenhayen had refused to request extra ammunition and there were no reserves available.

---

General Ferry, commander of the French forces opposite those German lines with the gas, received a report that asphyxiating gas was to be used soon. Ferry suggested to his Corps Commander and to the liaison officer to Joffre's HQ that the German trenches be shelled. His idea was dismissed and in the aftermath of the debacle, he was transferred for being right. The German, August Jaeger, who provided the information, received ten years penal servitude in 1930 for having contributed to the loss of the war after his name was revealed in Ferry's memoirs. Captain B. H Liddell Hart, *The Real War: 1914-1918* (London: Faber & Faber Limited, 1930), p. 194; Robert Harris and Jeremy Paxman, *A Higher Form Of Killing* (London: Chatto and Windus Ltd., 1982), p. 4. According to Major General Foulkes, Director of Gas Services, there were no less then thirteen separate indications which should have prompted the British to prepare for such a contingency. One such indicator was the capture of a cylinder already in position in the German front line. Maj. Gen. C.H. Foulkes, *Gas! The Story of the Special Brigade* (London: Blackwood, 1936), pp. 41-42, as quoted in Squadron Leader A.F. Graveley, "The Voices of Experience: Learning for the future from the chemical war of 1915-1918." *Army Quarterly and Defence Journal* (Volume 110, no. 4, 1980), p. 434, n. 8.

[14]Harris and Paxman, *op. cit.*, p. 2.

[15]Liddell Hart, *op. cit.*, p. 196. Bay estimated that the Allies suffered roughly 15,000 casualties of which 5000 were fatal. Bay, *op. cit.*, p. 25. SIPRI, in a 1975 study, estimated 7000 casualties with 3000 dead. These figures seem rather high but are widely accepted. Trumpener quotes German reports as having found 200 seriously incapacitated French soldiers who were taken to German hospitals. A less drastic casualty to kill ratio can be found in a French casualty report by the medical inspector Sieur, dated 25 April 1915, which referred to 625 gassed soldiers as of the previous day, of whom three died. Ulrich Trumpener, "The Road to Ypres: The Beginnings of Gas Warfare in World War I." *Journal of Modern History* (Volume 47, Sept. 1975) p. 460, f. 1.

> In Flanders the Germans thus offered a hostage to fortune. Disclosing their new weapon prematurely and for a paltry prize, they gave their opponents the advantage in retaliation until sufficient gas shells were produced to replace gas cylinders.[16]

Indeed two days later, in the second gas attack, both Canadian and British troops stood their ground and repelled the German advance even though they possessed, if any, very primitive respirators. This stance, though noble was also foolhardy as their gallant efforts contributed little to the improvement of the Allied situation in the Ypres battles.

In a sense the whole affair was a comic tragedy laden with the irony that "the Germans demonstrated an astonishing lack of thoroughness in initiating the use of gas."[17] As an experiment it was a complete success; as a final battle it was an abject failure. After the first attack a German eyewitness prophetically stated: "I am not pleased with the idea of poisoning men. Of course, the entire world will rage about it first and then imitate us."[18] The OHL immediately recognized the tactical opportunities as well as the limitations of chemical attacks, but had now opened the door to Allied retaliation. Naturally, Imperial Germany vehemently denied having either committed an act of atrocity or even of having broken Article 23 of the Hague Convention of 1899, which bound signatories "to abstain from the use of projectiles the sole object of which is the diffusion of asphyxiating or deleterious gases."[19] The OHL argued that by disseminating gas through cylinders rather than projectiles, they were not in violation of the Hague Convention.

---

[16] *Ibid.*, p. 195.
[17] Brown, *op. cit.*, p. 4.
[18] Richard D. McCarthy, *The Ultimate Folly* (New York: Alfred A. Knopf, 1969), p. 5.
[19] Brown, *op. cit.*, p. 7.

As it turned out, the Allies were caught by surprise so that German soldiers could have exploited the situation and broken the stalemate, but *fortuna* was on the side of the former.[20] Since the Allies saw themselves the victims of a hideous sort of warfare, there was no difficulty in justifying their retaliation, because the impression was given, through the means of propaganda, that "...the Germans had now thrown every consideration of humanity into the winds."[21]

Germany, in the technical race to deliver gas more effectively, soon fell far behind, as it had falsely assumed that Britain could not produce a chemical warfare industry quickly enough.[22] The German assessment was understandable considering the total lack of a chemical infrastructure. But the British response was swift with crude defensive equipment available within days. The British undertook a herculean effort which resulted in the first Allied gas attack in September 1915, during the Battle of Loos.[23]

This first Allied gas attack caught the Germans off guard and initially dealt them a loss of three miles of territory. Hence, in Germany, gas warfare was downplayed by not "...revealing the enormity of their casualties due to allied gas operations. Gas casualties were listed only as wounded or killed with no mention of the cause."[24] Like the OHL, the British eventually came to similar conclusions regarding the disutility of chemical warfare but, by that time, whatever constraints

[20]Brauch, *op. cit.*, p. 6.

[21]John J. Pershing, *My Experiences In The World War*, volume I (New York: Frederich A. Stokes Company, 1931), p. 165.

[22]James L. McWilliams and James R. Steel, *Gas! The Battle for Ypres, 1915* (St. Catharines: Vanwell Publishing Limited, 1985), p. 221.

[23]The French followed in Febuary 1916 and the Russians in October of the same year. Brauch, *op. cit.*, p. 68.

[24]McWilliams and Steel, *op. cit.*, p. 221.

existed on the conduct of chemical warfare had fallen aside and, therefore, the escalation towards more toxic gases and better delivery methods were natural progressions.

With Allied retaliation, gas warfare began in earnest and came to be focused both on improved protective equipment and on more toxic chemicals. Scientists feverishly worked to increase the toxicity of chemical compounds while attempting to diminish the dependence of agents on meteorological and environmental variables. Germany took the lead in the chemical sector by introducing phosgene in December 1915, which not only penetrated existing gas masks but was also far more toxic. The natural response by the Allies was an improved gas mask, whereupon the Germans rebutted by adding vomiting gases such as diphenyl chlorarsime to the phosgene. The idea was that, should they inhale even minute amounts, troops would be forced to take off their masks, the obvious consequence.[25]

During the night of 12 July 1917, the zenith of chemical warfare was reached when the German army began shelling Ypres with mustard gas, an agent unlike anything used before. Not only was it colourless and essentially odourless (though at times it exhibited a slight garlic or mustard smell) it could persist for days or even weeks on the battlefield. This gas attacked the sensitive parts of the skin and could even penetrate clothing. As a result, British casualties reached unprecedented levels with 70 percent of all gas casualties being attributed to mustard gas between July 1917 and November 1918.[26] In the final German spring offensive of 21 March 1918, a spectrum of agents was employed during which mustard gas was used

[25]Robin Clarke, *We All Fall Down: The Prospect of Biological and Chemical Warfare* (London: Allen Lane, The Penguin Press, 1968), p. 29.

[26]Edward M. Spiers, *Chemical Warfare* (Urbana: University of Illinois Press, 1986), p. 25.

to protect German flanks as in the case of Flesquieres Salient, which "...should have told the British commanders that the Germans had no intention of making an infantry attack directly on the Salient."[27] The Allies had been beaten in the chemical field and could not counter with mustard gas for nearly a year.[28]

In the technical arena, however, the Allies and especially the British succeeded in surpassing German technology by being able to deliver agents faster and in greater concentrations, and by being able to protect their troops more effectively. By the end of 1916 artillery became the main method for gas attacks. The progression from gas clouds to gas shells was a natural evolution in chemical warfare because improved anti-chemical training had dealt successfully with the wind-dependent gas clouds. As a consequence cylinder attacks subsided—a pleasant respite for the front line troops, who had to live in the ever present danger of cylinder leakages "...which often gave warning of an impending attack by sending hundreds of rats fleeing across No Man's Land."[29]

The debut of the famed British Livens Projector came during the battle of Arros, 9 April 1917. German troops were overwhelmed by the unprecedented concentration of gas and reeled back, but, as had so often happened, the battle ended

[27]Martin Middlebrook, *The Kaiser's Battle* (London: Allen Lane, The Penguin Press, 1978), p. 154. Spiers also pointed out that persistency was its only real tactical utility by rendering vast areas impassable, such as the defensive German actions in the Bourlon Woods in November 1917 or Armentieres in April 1918. During the opening ten days of the spring offensive bombing, roughly one million gas shells were expended. Spiers, *op. cit.*, p. 25. Unlike the first gas attack, the German army was prepared in the 1918 offensive. During a fifteen hour bombardment of Armentieres, 20,000 gas shells were fired. "...liquid mustard ran like rainwater in the gutters of the streets." Harris and Paxman, *op. cit.*, pp. 26–31.

[28]The French responded first in June 1918 followed by the British three months later. Spiers, *op. cit.*, pp. 25–26.

[29]Harris and Paxman, *op. cit.*, p. 24.

in stalemate.[30] The swiftness with which an area could be saturated, coupled with the projector's lack of accuracy enhanced its value because it caused considerable nervous apprehension amongst German troops, thereby contributing to morale breakdown. The Germans were slow to counter the Livens Projector, but later in the war introduced a more sophisticated version of the British model. By no means the only improvement in offensive technology, the Livens Projector was among the more noteworthy devices used. As with defensive equipment, each new improvement in offensive hardware was soon copied by the enemy.

Ironically, while Germany fell further and further behind in the technical aspects of chemical delivery, it remained in the forefront of doctrine and chemistry. Nevertheless, it took two full years after Ypres to develop a surprise gas attack doctrine that was functional. In essence, industry and technology provided the military with a weapon it did not know how to employ and, as a result, doctrines only emerged through battlefield experimentation. Generally, the objective of gas was to inflict casualties upon the enemy through surprise and to erode combat effectiveness by forcing opposing troops to wear cumbersome protective equipment. Long bombardments were designed to undermine discipline. Only towards the end of the war did doctrine become sophisticated enough to employ gas, especially mustard gas, for target–specific operations and combined gas/high explosive shell fire. In their last offensive, the OHL exploited this combination with devastating effect by using high explosives for the rolling barrage and mustard gas far in advance of the forward moving troops so as not to hinder their progress.[31]

[30]Haber, *op. cit.*, p. 186.
[31]Bay, *op. cit.*, p. 26.

A number of paradoxes were inherent in the introduction of CWs. The OHL desired a "wonder weapon," but when one presented itself, the military hesitated to employ it on a massive scale. Partly because of Prussian arrogance, a full study of the possible consequences resulting from initiating a chemical war was not undertaken, resulting in the commission of two severe blunders by the OHL.[32] The first of these was the failure to note properly the winds; the second was the assumption that the British chemical industry could not produce effective chemicals. But Britain managed not only to build an efficient chemical industry, it also vastly surpassed the Germans, staging 768 gas operations. Though German statistics do not indicate how many gas attacks in total Germany launched, the number was, at best, only a fraction of those of the Allies, based on projections of known ratios. For example, Germany only launched twenty-four cloud gas attacks, while being the recipient of roughly twenty French, several Russian, and 150 British cloud attacks.[33]

A second paradox lay in the absurdity of continued chemical escalation; except for very few occasions, chemical attacks rarely achieved the projected results.[34] In addition to improved defensive technology, there ensued tighter anti-gas disci-

[32]The term "Prussian arrogance" may be a little strong, however, it aptly describes similar perceptions at the time. "Never since the dawn of time had there been such a perversion of knowledge to criminal purposes; never had science contributed such a deadly toll to the fanatic and criminal intentions of a war-crazed class." Francis A. March, introduction by General Peyton C. March, *History of the World War: An Authentic Narrative of the World's Greatest War* (New York: Leslie-Judge Company, 1918), p. 212.

[33]McWilliams and Steel, *op. cit.*, pp. 220-221. They base their information on data gathered by Major-General C.H. Foulkes in *Gas Brigade*. Hanslian states that Germany launched fifty cloud gas attacks throughout the war. The discrepency could be as a result of Foulkes only counting Western Front attacks. Rudolf Hanslian, *Der Chemische Krieg, Erster Band: Militärischer Teil* (Berlin: Verlag von E.S. Mittler und Sohn, 1937), p. 35.

[34]The German gas attack at Bolimov (Eastern Front) on 2 May 1915 during which 6000 Russian died proved to be one of those rare successes. Bay, *op. cit.*, p. 26.

pline, better intelligence, and improved forewarning. The German gas attack in the Wieltje sector, Flanders, on 19 December 1915, clearly demonstrated that a prepared enemy was a match for gas. Even though 35,000 British troops were exposed to a phosgene/chlorine gas cloud, the German advance was stopped cold with only 120 British gas fatalities.[35]

A third paradox arose from the use of mustard gas. As with the earlier gases, mustard gas contributed very little to any significant victory and the statistics do not support the view that the success of the German 1918 spring offensive was due to the incredibly high ratio of gas to high explosive shells. The desire to find not only the perfect combination between mustard gas and high explosives but also to perfect its offensive capability blinded all sides to the true value of the gas. The persistency of the toxic fumes increased the need for an even greater logistical decontamination system and better protective equipment, yet neither forced a rout nor significantly slowed down counterbattery fire. Mustard gas, hailed as the weapon that could break the stalemate, merely added another and often unwelcome level of complexity to the battle. The cult of the gas offensive had been finally broken. Only during the German retreat of 1918 did the OHL recognize its value as a defensive weapon. By drenching the areas through which they retreated with gas, the Germans forced the Allies to slow down their pursuit, which in turn allowed for an organized German retreat.

The three year chemical arms race was the result of the belligerents attempting to improve their respective CW arsenals and tactics in the misguided belief that this weapon would provide the much desired breakthrough. Not surprisingly, by

[35] *Ibid.*, p. 25.

1918 chemical munitions accounted for roughly fifty percent of German and twenty–to–thirty percent of Allied shells[36], with the military demanding a higher ratio for the projected 1919 war year.[37]

The increased use of CWs achieved neither strategic victory nor brought about a comprehensive doctrine that would justify their proper use. In the end, copious amounts of firepower and men brought the results general staffs had expected chemical agents could have achieved.

### 1.1.2 The Aftermath

After the guns fell silent in November 1918, and the soldiers returned to their barracks, the debate of whether gas was a failure ensued. Even to this day, statistics remain inconclusive since records were rarely kept on all aspects of chemical warfare.

> The statistical approach leads to a dead end. One answer to the question 'Was Gas a Failure?' is that, expressed numerically, the advantages and disadvantages of chemical warfare cannot be summed and compared, so that this line of enquiry leads to the conclusion that the case for and against gas is 'not proven'. That, however, still leaves open other approaches. Three are particularly relevant and in examining them we will come closer to the explanation for why gas was a failure in 1915–1918. The first is the belief that the military lacked commitment to this mode of warfare and pursued it haphazardly. The second is that the organization of gas warfare—research, development, manufacture, and application—was amateurish throughout the war. And third that defence against gas was on the whole sufficient to contain the threat posed by this new weapon.[38]

[36]Harris and Paxman, *op. cit.*, p. 31

[37]In 1915, roughly 48 percent of all German CW were delivered by artillery shells. By 1918 this proportion increased to 98 percent. Overall, artillery accounted for 87 percent of all CW agents delivered, with the British at 64 percent being the lowest. Robinson, SIPRI volume 1, *op. cit.*, p. 36.

[38]Haber, *op. cit.*, p. 262.

All four of these methodologies are discussed below beginning with the traditional numerical approach.

### Comparative Casualty Figures

Throughout the war the dictum of employing more, if less could not perform the task, also held true for CWs which accounted, in part, for the continued escalation and the omnipresent haze on the battlefield. By the end of the war the human gas toll was estimated at 1.3 million casualties of which 91,000 died.[39]

Table 1.1: World War I Gas Casualties Estimates

| Sources | Total Casualties | Killed | Comments |
|---|---|---|---|
| Prentiss | 1.3 million | 91,000 | Most cited source |
| Clarke/US. H. of Rep. | 1.3 million | 91,000 | Source unknown |
| Haber | 531,000 | 17,900 | Western Front only |
| Enc. Britannica | 800,000 | NA | All fronts |

The exact figures are still conjecture because Germany, in an attempt to downplay its losses due to gas, either never recorded gas victims separately or destroyed most of the records and during the final months of the war, which accounts for a high proportion of the casualties, kept no records at all. Russia's records are also wholly incomplete. [40] According to Haber, it is basically impossible to tell with any accuracy the exact figure because the belligerents not only kept poor records but also inflated or deflated the numbers according to their needs. He views Prentiss'

[39]Robinson, SIPRI volume 1, *op. cit.*, pp. 128–129. SIPRI obtained the figure from the seminal study by Augustin Mitchell Prentiss, *Chemicals in war, a treatise on chemical warfare* (New York: McGraw–Hill Book Company, Inc., 1937).

[40]Clarke, We All Fall..., *op. cit.*, p. 31, Clark's source is the Committee on Science and Astronautics for the U.S. House of Representatives (1959). It is not clear as to where the Committee obtained their statistics. Harris and Paxman, *op. cit.*, p. 32, use the SIPRI, volume 1, as their source.

statistics as overstated for these reasons. Prentiss, therefore, made an educated guess, especially considering the fact that three–fifths of his total is accounted for by Russian dead, which equates to 56,000 soldiers. In Haber's own analysis of the available data, the gas casualty figure was roughly 531,000, of which 17,700 died. But these figures only apply to the Western Front since Eastern Front data is so inadequate.[41] Brauch quotes, among those already mentioned, the Encyclopaedia Britannica, which indicates that CWs caused 800,000 casualties, the lowest figure available.[42] Whichever total is used, gas casualties were only an insignificant fraction of the overall casualties.

Another statistical index is gas produced and used. By war's end, the belligerents had produced 136,200 tonnes of toxic agents, of which roughly 113,000 tonnes were actually used.[43] Germany alone used 51,840 tonnes of toxic gases.[44] Once again the figures are not particularly accurate but it is known with certainty that gas warfare constituted a relatively small portion of the behemoth weapons industry. Further, no accurate data is available on the exact financial costs to each belligerent; although for Germany at least, it was comparatively small due to its extensive chemical industry prior to 1914. It is difficult to assess exactly how much of a burden gas warfare was on the treasury, but Haber attempts to do this by showing the manpower and economic costs invested by the government into chemical production versus 'normal' ordnance.[45] Perhaps the best way of putting

[41] L.F. Haber, *op. cit.*, pp. 243–258.

[42] Brauch, *op. cit.*, p. 71.

[43] *Ibid.*

[44] In an earlier chapter, Prentiss pointed out that over 3000 chemical compounds were selected for testing of which thirty were deemed suitable for the field. Only a dozen were actually used of which roughly half proved successful. Prentiss, *op. cit.*, p. 656.

[45] Haber, *op. cit.*, pp. 259–261.

chemical warfare into perspective is to consider that gas shells accounted for only four percent of all shells produced in Britain.[46] In Germany, it peaked in 1918 at 28 percent, a total unsurpassed by any other belligerent. All the percentiles roughly equate to 38.6 million gas shells for the U.K., Germany, and France.[47] Harris and Paxman, on the other hand, indicate that 66 million gas shells were produced.[48] This discrepancy can in part be accounted for by the fact that Haber's statistic only refers to three of the belligerents. Prentiss indicates that 10 million mustard gas shells were produced, 9 million of which were used.[49]

The accelerated growth of chemical warfare and its related infrastructure did not, however, readily correspond to an increased number of casualties or fatalities. Once again statistics are neither readily available nor accurate enough to prove or disprove that a correlation exists. Nevertheless, when one considers the fact that roughly ten million men died in battle and when one takes into account the highest estimate of 91,000 men poisoned to death, the overall impact of gas warfare was miniscule.[50] In terms of chemical warfare, World War I was a huge laboratory in which each side attempted to develop even more deadly agents. Throughout the war, twelve tear gases, fifteen choking agents, three blood poisons, four blister agents, and four vomiting gases were actually employed.[51]

## Organizing Defences

[46]Britain's total rose to 8.4 percent by 1918, a percentage higher than in France. *Ibid.*, p. 260.
[47]*Ibid.*, p. 261.
[48]Harris and Paxman, *op. cit.*, p. 24.
[49]Prentiss, *op. cit.*, p. 662.
[50]Pitt gave a total death toll at 9,998,771 plus 6,295,512 sufficiently wounded for their subsequent lives to be marred by physical suffering. Barrie Pitt, *1918: The Last Act* (London: Cassell and Company Ltd., 1962), p. 277. It is not clear as to how he arrived at such an accurate total.
[51]Robin Clarke, *op. cit.*, p. 39.

From the very beginning, science and technology led the way while tactics struggled to conform with the properties of the various agents introduced. Since the first gas attack resulted in conflicting opinions as to its success or failure, it was only natural for the military to turn to scientists to solve a dilemma they had created in the first place.

Except for the Germans, the combatants were faced with the problem of working at the frontiers of applied science. Companies such as *Bayer*, *BASF*, and *Farbwerke Hoechst* were in the forefront of chemical technology even before the war.[52]

> The manufacture of poisonous gases, as distinct from other aspects of chemical warfare, was not particularly labour–intensive. But skilled manpower in general for the chemical industry became increasingly scarce as the war progressed and with the exception of Germany and the U.S. the management was poor.[53]

Unlike the offence, the defence posed less of an administrative problem because it was relatively straightforward with regards to what needed to be done. Civilian industries were easily adaptable since many of these were already in existence with expertise readily available. This explains the incredible speed by which Britain was able to provide at least primitive defences within days after the first chemical attack. The ease of manufacture is illustrated by the fact that British industry was able to produce and distribute 38 million civilian gas masks within a year.[54]

## Lack of Military Commitment

[52]It is interesting to note that among the initial scientific crew recruited for gas warfare were the future nobel laureates James Franck (later he worked on the A–bomb), Gustav Hertz, Otto Hahn (also a member of the future A–bomb team), and Fritz Haber. Trumpener, *op. cit.*, p. 471.

[53]Haber, *op. cit.*, p. 170.

[54]Though a post–war figure, it exemplifies that ease of production. The gas mask began production in 1937 by the time of the Munich crisis, 38 million had been distributed. L.F. Haber, *Gas Warfare 1915–1945: The Legend and the Facts* (The Stevenson Lecture, University of London: Bedford College 25 November 1975, xerox, n.d.), p. 14.

Interestingly enough, during the war itself the humanity argument was irrelevant and instead, the question of honour within the profession had to be confronted as toxic agents accelerated the erosion of the mystique of warfare. In the past, among the hallmarks of the military profession was the belief that "...war would be limited in its efforts to combatants only, and that the most honorable and heroic way to defeat the enemy was in hand-to-hand combat."[55] Not surprisingly, military leaders voiced their disdain for a weapon that, to some degree "...symbolized the encroachment of science and technology into military decision making..."[56] General Peyton March argued that "war is cruel at best, but the use of an instrument of death, which once launched, cannot be controlled, and which may decimate non-combatants—women and children—reduces civilization to savages."[57] The British Commander, Lord French, expressed the "deepest regret and some surprise" that the German Army, which claimed to be "the chief exponent of the chivalry of war should have stooped to employ such devices against brave and gallant foes."[58] The Germans themselves were not immune from a sense of guilt. General von Deimling, Commanding General of a German Corps at Ypres commented: " I must confess that the commission for poisoning the enemy just as one poisons rats struck me as it must any straightforward soldier; it was repulsive to me."[59] That the military was not particularly enticed by this new weapon can

[55]Brown, *op. cit.*, p. 40.

[56]*Ibid.*, p. 42.

[57]Quoted in, General P. March, *The Nation at War* (New York: Doubleday-Doran, 1932), p. 333, as quoted in *Ibid.*, p. 41. General March was Chief of Staff of the U.S. Army and made this remark after visiting a hospital in France.

[58]Quoted in, *The Dispatches of Lord French* (London: Chapman and Hull, 1917), as quoted in *Ibid.*, p. 41.

[59]Quoted in, General von Deimling, *Reminiscences* (Paris: Mantaigne, 1931), in Hanslian, *The German Gas Attack*, p. 9, as quoted in *Ibid.*, p. 41.

easily be seen. It was an unprecedented weapon with no existing body of theory, and experience could only be gained at great cost. So many variables (such as weather conditions and terrain) had to be incorporated into each operation that each battle presented unique and distinct problems, making it difficult to establish all encompassing and comprehensive guidelines. Since battles, in part, are often an attempt to control the chaos better than one's enemy, few commanders were eager to add the complexity of gas to their operational planning, especially since there were absolutely no assurances that the additional effort would result in the kind of success that conventional weapons alone could not achieve. Nevertheless, obedience to the cause overrode such practical and virtuous concerns, and as a substitution for a violated and tarnished code of honour, the military adopted the humanitarian argument.

Gas is humane!

Early writers such as Haldane and Prentiss argued that gas warfare was beneficial because the gains exceeded the losses. Prentiss argued that gas was the greatest casualty producer of all weapons. On average, 192 lbs of gas were needed to create one casualty, while 60 lbs of mustard gas, or 22.5 mustard shells, could produce a casualty. This contrasted with the 500 lbs of HE, or the 5000 rounds (rifle or machine–gun) required to produce a casualty.[60] Over time, however, both authors have been proven wrong. Backed by the scientific cult, they presented statistics which clearly indicated that the mortality rate among gas victims was only about two percent, as opposed to thirty percent for other weapons. In addition, being gassed was allegedly a less painful experience and if one survived, suffered few if

[60]Prentiss, *op. cit*, pp. 661–662.

any chronic after–effects. In a strange twist of logic, the military was attempting to present the illusion of conducting warfare with the possibility of limited death, should gas become the main weapon of war.

Perhaps one of the earliest and strongest defenders of chemical warfare was Haldane; in a monograph *Callinicus*, in which he used statistics as the cornerstone of his main argument, he philosophically suggested that: "if it is right for me to fight my enemy with a sword, it is right for me to fight him with mustard gas: if the one is wrong, so is the other."[61] Those who opposed CWs on the grounds that they degraded the spirit of the fighting man were merely "... Scribes and Pharisees of our time" whose hypocrisy allowed them to condemn chemical warfare whilst condoning the use of high explosives, even though the latter killed one in three as opposed to mustard gas, which only had a one to forty ratio.[62] In terms of mortality rates, Prentiss, in his study of official records, pointed out the relatively low death to casualty rate in comparison to other "more lethal" weapons.

Table 1.2: Effectiveness of Gas

| | % of all Casualties | | Deaths as % of Casualties | |
|---|---|---|---|---|
| Country | Gassed | Non–Gas | Gas | Non–Gas |
| Germany | 96.5 | 3.5 | 4.5 | 36.5 |
| France | 95.5 | 3.5 | 3.5 | 32.0 |
| Britian | 91.9 | 8.1 | 4.3 | 24.0 |
| U.S.A. | 74.2 | 26.8 | 2 | 25.8 |

Germany suffered only 4.5 percent gas deaths of total wounded while 36.5 percent died of wounds from other causes and Britain had a death rate 4.3 percent in comparison to 24 percent of its non–gas casualties. France's gas death toll amongst

[61] Haldane, *op. cit.*, p. 2 and p. 82.
[62] *Ibid.*, p. 33.

casualties was 4.2 percent while 32 percent died of other causes and the U.S suffered only a 2 percent gas death toll while 25.8 percent died from wounds from conventional arms.[63] Advocates of gas warfare presented such statistics as evidence to support their assertion that using gas was humane (since the death/casuality rate was less) and therefore, should be at the apex of all other weapons systems.

Another classic defence expounded was that even though warfare was a negation of humanity, killing by gas was less horrible, in terms of suffering, than injuries resulting from high explosives, bullets, and bayonets.[64] On this basis, Amos Fries, Commander of the American Expeditionary Force and supported by the chemical industry, lobbied heavily to retain the Chemical Warfare Service as an independent branch of the armed forces. He also advocated continued research, development and production of agents at the Edgewood Arsenal.[65] And in Germany, Fritz Haber, scientist extraordinare, defended CWs before a parliamentary investigation committee of the *Reichstag* by arguing that gas warfare was merely the renewal of an age-old military technique using modern resources.[66]

Thus during the Inter-War years the military continued to struggle with the concept of gas warfare while science and industry resumed research and development, though on a smaller scale. "Gas warfare was a threat not only to the enemy,

[63]Prentiss, *op. cit.*, pp. 670-671. Heller, in a recent authoritative study, indicated that the U.S. suffered a total of 31.5 percent (70,552 men) gas casualties of which 1.7 percent died (1221 men). Heller, *op. cit.*, Leavenworth Papers, pp. 91-92. Haldane argued that only one in four British soldiers died and only one in two hundred became permanently unfit as a result of mustard gas attacks. Haldane, *op. cit.*, pp. 26-27.

[64]Waitt, *op. cit.*, p. 6.

[65]Brauch, *op. cit.*, p. 75.

[66] "*...die Erneuerung einer uralten militärischen Technik mit modernen Hilfsmitteln.*" Haber made this statement in 1923 as part of a speech entitled *Zur Geschichte des Gaskrieges. Ibid.*, p. 73.

but to all men: it was a weapon of the scientist and technician."[67]

### 1.1.3 Inter–War Politics

Overall, the political establishment only exacerbated the dilemma for it had tacitly accepted gas as a method of war. But this was to change as the political battle raged parallel to that of the military. The public, stirred–up by propaganda, was hostile towards any formalization of gas warfare and politicans heeded these wishes. Various international agreements, such as the Washington Conference of 1922, in which signatories pledged not to use gas against one another, were drawn up.[68] However, the real impetus to ban CWs came from numerous traditional–career military professionals and politicians, rather than from public hysteria. President Wilson and General Pershing were among those lobbying for a ban. The pro–chemical weapons' attitude resided primarily with those in the military who directly were involved in gas warfare. They countered the banning craze which emerged after the war with the previously mentioned humanity argument to further their bid for the retention of the institution.

The harshness of the Treaty of Versailles of 1919 may have sown the seeds for the next world war. Specifically, in terms of gases, the Treaty especially forbade Germany from producing any toxic chemicals, while at the same time implicitly sanctioning Allied efforts. Article 171 of the Treaty stated:

> The use of asphyxiating, poisonous or other gases and all analogous

[67]Meeker, *op. cit.*, p. iii.

[68]Since the Allies initially had nothing with which to counter German gas attacks, they used propaganda so successfully against the "inhuman gas–using Hun" that it was continued even after they, themselves, were using gas very extensively and effectively. J.H. Rothschild, "Propaganda and Toxic War." *Ordnance* (Volume 50, 1966) p. 617. In a sense, propaganda was too successful as public hostility remained fervent long after the war.

> liquids, materials or devices being prohibited, their manufacture, and importation are strictly forbidded in Germany. The same applies to materials specially intended for the manufacture, storage and use of the said products or devices.[69]

In effect, Article 171 suffocated any future German revival of its chemical warfare capabilities, while Article 172 of the same document enabled the scientifically inferior Allied industry to partake in the spoils of victory.

> ...The German government will disclose to the governments of the Principal Allied and Associated Powers the nature and method of manufacture of all explosives, toxic substances or other like chemical preparations used by them in the war or prepared by them for the purpose of being so used.[70]

Given the size and sophistication of the German chemical infrastructure relative to that of the Allies at the outset of W.W. II, one can unhesitantly assume that neither the German government nor industry were in any rush to fulfill the obligations of Article 172.

During the latter part of the Inter–War years the juxtaposition between popular literature exaggerating the horrors of chemical warfare, governments equivocating and industry downplaying the issue continued to exist. As far as the public was concerned, the Geneva Protocol effectively banned the chemical scourge from the battlefield. Under the auspicious title of "Protocol Prohibiting the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare," Geneva 17 June 1925, the Protocol gave the impression of acceding to public will.[71] The inherent weakness of the document, however, was that it did not

[69]Clive Parry, LL.D., *The Consolidated Treaty Series*, volume 225 (1919), (New York: Oceana Publications, Inc., 1981), p. 268.

[70]*Ibid.*

[71]J.B. Neilands, Gordon H. Orians, E.W. Pfeiffer, Alje Vennema, and Arthur H. Westing, *Harvest*

prohibit research, development, production, and storage of gases, nor was there any method for verifying compliance; most of the signatories exploited this to the fullest.[72] In essence, it was not a limitation or disarmament treaty but merely an acceptance of no first–use. Though impossible to prove conclusively, there seems to be a correlation between Article 172 of the Treaty and the lack of any limitations or even prohibition of research by industry. In other words, industry may have lobbied against any encroachment upon their business interests, thereby perpetuating the existence of CWs. Neither public disdain nor military hesitancy prevented the continuing maintenance of chemical warfare branches in the armed forces; rather it was the depression that caused the slashing of all military budgets, especially those of the vulnerable chemical warfare departments.

The U.S. Chemical Warfare Service, for example, suffered from both funding and political pressures. As previously mentioned, Amos Fries successfully extracted his service from the tentacles of a pacifist Congress, but the manufacture of all toxic agents was discontinued at the Edgewood Arsenal. "The only toxics in existence in the U.S. Army from 1922 to 1937 were some leftovers from World War I that were held in storage in the lone Chemical Warfare Service storage depot at Edgewood...."[73] Similar fates befell the British and French chemical warfare sections. Not wanting to be left vulnerable, each country retained a minimum stock of chemicals in addition to constantly improving and increasing defensive measures. Military leaders, despite the ambiguities and internal divisiveness over use, did not

*of Death: Chemical Warfare in Vietnam and Cambodia*, foreword by Gunnar Myrdal (New York: The Free Press, 1972), p. 209–211.

[72]Germany, of course, was prohibited from stockpiling CWs under the Versailles Treaty.

[73]Leo P. Brophy and George Fisher, *The Chemical Warfare Service: Organizing For War* (Washington: Office of the Chief of Military History United States Army, 1959), pp. 31–32.

doubt that chemicals would be an integral part of the next war. The Protocol did little to dispel such anxieties.

Since science and technology created the chemical apocalypse in the first place, these institutions were the natural choice to solve the problem of effectively using CWs. The dynamics of chemical weapons' technology allowed for constant improvements and even prior to the end of the war, gas-laden aircraft were thought to hold the answer to the stalemate. This theory was never tried yet the idea remained, so much so, that many military theorists thought the greatest utility of chemicals to lie in gas bombing cities, thus reviving the offensive mystique. Some theorized that drenching a city or cities with gas would shorten a war or allow for a decisive victory, as a nation could not adequately protect all cities or its helpless population and consequently would have to sue for peace. In his classic treatise *Command Of The Air* (1921), Douhet saw the aircraft as the optimal vehicle for carrying out gas attacks. Gas could contaminate whole sections of a city, thereby crippling its ability to function. He argued that gas, in conjunction with explosives and incendiaries, could paralyze a nation because air power could attack the critical centres necessary to sustain the war effort. Simply stated, gas bombs would terrorize a population and increase the difficulty of returning a city to normalcy.[74] This view was far from unanimous as some military analysts and specialists involved in gas warfare considered gassing a city, by spraying or dropping poison bombs, as impossible because of the incredible difficulty of producing enough of a

[74]Giulio Douhet, *The Command of the Air* (New York: Arno Press Inc., 1972), p. 182–186. Military analyst W. Ley argued that Douhet's theory failed to consider air currents and anti-aircraft activity. Willy Ley, *Bombs and Bombing* (New York: Modern Age Books, Inc., 1941), pp. 71–82.

concentration for the gas to be effective. Haber, suffering from remorse, perhaps, undertook a crusade to ban gas. Speaking before a committee on Disarmament and Gas Warfare held at the *Reichstag*, he stated that gas war could now be brought to the hinterland and render government impossible as even the slightest smell of gas would evaporate courage. He went on further to argue that, especially for Germany, it would be better to have a prohibition on gas warfare because Germany was now lagging behind in research and development. "...[gas] had drawn upon itself so much hatred and brought about so much competition that [Germany] had no desire to repeat the experiences."[75]

Since passive defence of the civilian population was impossible, deterrence was the only protection. The Soviet Union, France, and Britain, among others, reserved the right to retaliate if attacked with gas.[76] The U.S. Senate failed to ratify the Protocol; consequently the U.S. Joint Army and Navy Board stated U.S. policy to be such that, "...the U.S. will make all the necessary preparations for the use of chemical warfare from the outbreak of war. The use of chemical warfare, including the use of toxic agents, from inception of hostilities, is authorized."[77] Though ominous in tone, in reality, the U.S. was unprepared when the war actually broke out. "Continued neutrality provided a useful interval to address the problems of unpreparedness."[78] Only after the fall of France were production facilities expanded

[75]Fritz Haber, "Gas in Warfare: A German Expert's Views," *The Times of London* (3 July 1926), p. 3.

[76]The reservation stipulated specifically that the Protocol ceases "...to be binding in regard to any enemy States whose armed forces or allies do not observe provisions," and also ceases "...to be binding as regards use of chemical agents with respect to any enemy State whose armed forces or allies do not observe provisions." Neilands, et. al., *op. cit.*, p. 211.

[77]Ltr Jt Plng Com to JB, 17 Oct 34, sub: Use of Cml Agents. JB 325, Ser 542, as quoted in Brophy and Fisher, *op. cit.*, p. 21.

[78]John Ellis van Courtland Moon, "Chemical Weapons and Deterrence: The World War II

and the role of the Chemical Warfare Service strengthened.

Germany secretly began building–up its chemical warfare capability as early as 1923, in violation of the Versailles Treaty.[79] Even prior to the war German scientists, unbeknownst to the rest of the world, made a quantum leap forward with the discovery of nerve agents.

Hitler's ascension to power accelerated the systematization of cooperation between the military and chemical industry. Increased cooperation had already started in 1928 but it was not until the giant *I.G. Farben* cartel agreed in 1933 to re–start its toxic agent production that the precarious position of CWs within the military was strengthened. On 23 December 1936, in an *I.G. Farben* laboratory, the chemist Dr. Gerhard Schrader, while working on an experiment to find a more toxic insecticide, stumbled across a hitherto unknown, yet highly toxic gas. The practicality of this odourless, colourless, and persistent gas was immediately recognized and was duly offered to the military. Named Tabun, it was accepted as a potentially useful toxic weapon and orders were issued to begin production. One year later, while further analyzing Tabun, Schrader discovered an even more toxic gas and named it Sarin, alleged to be thirty times more toxic than phosgene.[80] In 1944, Nobel laureate Richard Kuhn, while investigating the pharmacological attributes of Tabun, discovered the most toxic of all previous nerve gases—Soman.[81]

Experience." *International Security* (Volume 8, Number 4, Spring 1984), p. 9.

[79]Groehler gives an interesting synopsis of the continued technological improvements right up until 1945. Olaf Groehler, "*Vorbereitungen für die chemische Kriegführung durch die deutsche Armee zwischen erstem und zweitem Weltkrieg.*" *Revue Internationale d'Histoire Militaire* (Volume 43, 1979), p. 176. Brauch discusses the industrial pressures behind the re–introduction of CWs in the early 1920s. Brauch, *op. cit.*, pp. 78–82.

[80]Robin Clarke, *The Silent Weapons* (New York: David McKay Co., 1968), p. 32.

[81]Tabun and Sarin were given the code names Trilon 83 and Trilon 46 respectively. Brauch, *op. cit.*, pp. 82–84. Production of Tabun began in April 1942 at Dyherfurth near Breslau; by the end

Nerve gas toxicity of the first two was several times that of mustard gas and was capable of inflicting damage both through contact with the skin and by inhalation.

German science had come a long way from the seemingly primitive gases used in 1915. Considering that Germany had such advanced chemical technology and the means to employ them, the question instantly arises as to why they were never used during World War Two. Why deterrence worked is still a debated issue, yet a number of common themes are evident. Unlike World War I, the Second World War began with all belligerents deterring each other from chemical use because their military inventories contained at least rudimentary means by which to wage a gas war. What little doctrine was available tended to be antiquated, offensive and strategic in nature, all parties seemingly having forgotten the promising defensive applications. The only truly recognizable doctrine in existence amongst all belligerents was the emphasis on mass air assaults on cities using gas, the chemical version of mutual assured destruction.

### 1.1.4 World War Two

Accompanying the German entourage invading Poland were chemical troops whose main task was to provide smoke and other non-lethal chemical assistance to the advancing Wehrmacht. They were prepared, however, to use toxic agents if necessary. The German high command had not planned for the use of CWs on the grounds that "...gas would slow the tempo of operations and interfere with offensive concentrations."[82] Notwithstanding military hesitancy, in a rare display

of the war, 12,000 tons were stockpiled. A production plant for Sarin was also readied which had the capability of 7200 tons per year. Clarke, The Silent Weapons, *op. cit.*, p. 34.

[82]Groehler, *"Die Entwicklung..."*, *op. cit.*, pp. 723–726.

of insight into W.W. I gas successes, contingency plans to saturate the Western Front were prepared. It was thought that their implementation would slow down any French attempt to relieve the pressure on the Polish Army.[83] The passive French reaction to the invasion, however, and the quick destruction of the Polish Army made this unnecessary. The decision not to use gas was based on exercises in which the results showed that chemicals impaired the rapid deployment of one's own forces as well as causing extra burdens upon support units. Unlike chemicals in the First World War, if toxic agents were to be used they would be included in the entire operational framework of the campaign and be escalatory in nature, rather than remain on a tactical level.

In 1939, technical proficiency and CW stockpiles were insufficient to initiate an assault with a massive use of CWs which, according to doctrine, were necessary to achieve a breakthrough. Instead, the German General Staff, decided to gamble that motorization and speed, not chemicals, would be the determining factor of the breakout mystery. Gas warfare and Blitzkrieg strategy were incompatible doctrines and consequently, September 1939 began with a chemical–free artillery barrage. This would remain the norm throughout the war. 'Accidents' and allegations of use did occur but never incited a retaliatory response, in part, because retaliation meant immediate escalation. Tensions were high on all sides during the first weeks and the German charge that Poles had used mustard land mines on the outskirts of Jaslo received immediate attention, especially from Britain since it was accused of having supplied the mines. The British War Office vehemently

[83]Groehler uses only primary documents located both in East and West Germany. *Militärarchiv Freiburg, W 61.20./76*, as quoted in Groehler "*Vorbereitungen...*", *op. cit.*, p. 177.

denied the accusation and countered with the charge that the German statement was a ploy designed to justify the introduction of gas warfare, as in World War I.[84]

In May 1942, Tass reported that Germans were using gas against people sheltering in underground tunnels.[85] Another incident is said to have occurred during the Allied operations at Anzio in early 1943. A stray German artillery shell hit an ammunition dump containing chemical shells. The resultant toxic cloud drifted towards German lines, whereupon the Allied commander warned the German commander, indicating that it was unintentional.[86]

During the initial years, Blitzkrieg tactics pre–empted the use by Germany of chemicals, whereas the Allies were constrained by a lack of adequate resources, misperceptions of German capabilities, and international law. As the tide turned against Germany, anxiety about German intentions permeated the Allied Supreme Command and intelligence services. General Bradley thought that Hitler "... might risk gas in a gamble for survival" as the use of persistent gas could "... have forced a decision in one of history's climatic battles."[87] Some, mainly in the intelligence community, believed that Hitler "... may order the use of chemical warfare as a last desperate resort and without regard to military or humanitarian considerations."[88]

The Allies, especially Britain and the U.S., agreed to retaliate by targeting German cities rather than opting for tactical ones. This decision was made clear to

[84] "Nazi Poison Gas, Warning by the Office of War," *Times of London* (21 October 1939), p. 3.

[85] This story was only given a small paragraph in an overall discussion of the Eastern Campaign. "Blow for Blow in Russia," *Times of London* (11 May 1942), p. 4.

[86] S. Rose, ed., *CBW: Chemical and Biological Warfare* (London, 1968), as quoted in SIPRI, volume 1, p. 155.

[87] Bradley was remarking upon the danger of gas during the Normandy invasion of June 1944. Omar N. Bradley, *A Soldier's Story* (New York: Henry Holt and Company, 1951), p. 279.

[88] JIC Memorandum for Information nr. 139: Use of Chemical Warfare by the Germans, 23 Feburary 1945, CS 441.5 (8–27–42) Section 5, as quoted in Courtland Moon, *op. cit.*, p. 11.

Hitler for deterrence purposes and also to appease Stalin, who feared that Germany was planning massive gas attacks. Already in 1942 Churchill had stated that any gas attack on Russia would be treated as an attack on Britain and that the British Air Force "...will immediately use against suitable objectives in Germany the large stocks of gas bombs held in England."[89] Roosevelt's public warning of the terrible consequences that would befall the Axis armies if they were to use gas came in 1943.[90] The Roosevelt–Churchill declarations, though functioning as a deterrent, were limited in scope. The policy of escalatory retaliation "...was integral to coalition warfare providing a protective umbrella to cover vulnerable allies," but the declarations committed each nation to retaliate only under certain circumstances.[91] The Allies themselves were restrained from initiating gas warfare because of the vulnerability of the British Commonwealth and the Indian sub–continent, even while America remained safe.[92] For example, in November 1943, after heavy casualties in the Pacific, U.S. General Porter urged that, "the initiation in gas warfare is of the greatest importance. We have an overwhelming advantage in the use of gas. Properly used, gas could shorten the war in the Pacific and prevent loss of many American lives." His recommendation was rejected on the basis of America's allies' vulnerability.[93] Thus, Allied policy was somewhat contradictory as the needs of the individual members of the Allied coalition collided with the

[89]Winston S. Churchill, *The Hinge of Fate* (Boston: Houghton Mifflin Company, 1950), p. 330.

[90]Cornwell B. Rogers, ed., "American War Documents," *Current History* (Volume 4, August 1943), p. 405.

[91]Courtland Moon, *op. cit.*, p. 14.

[92]CCS 106/13. Allied Chemical Warfare Program 2 April 1944 CCS 441.4 (8–27–42) Section 3 as quoted in *Ibid.*, p. 15.

[93]Memorandum, Major General William N. Porter to Lieutenant General Joseph McNarey, 17 December 1943, OPD 385, TS, as in quoted *Ibid.*, p. 17.

changing pressures of a global conflict.

The Allies hoped to deter the Germans by announcing at the beginning of the war that they would adhere to the Geneva Protocol.[94] Moral and ethical justification to retaliate would once again be on the side of the Allies. In reality, both defensive and offensive stocks were highly inadequate and the American Chemical Warfare Service lacked the capability to deliver strategic attacks.[95] In theory at least, in the event of a gas attack the immediate response would be bomber raids "...flying 150 percent of their normal number of missions during the first fifteen days...[In] this initial effort,...gas bomb loads would consist of 75 percent gas munitions and 25 percent high explosives...."[96] In retaliation against V1 and V2 raids, Churchill suggested drenching German Ruhr cities in such a way that most of the population would require medical attention, but his advisors rejected the idea on the grounds that it could lead to the initiation of gas warfare in less prepared theatres.[97] The supply situation had improved somewhat in 1943/44, yet gas munitions were still insufficient for offensive operations.

To judge whether Allied statements actually deterred Hitler from ordering the use of CWs is difficult. The waning of German air superiority over the Reich contributed to the self-imposed moratorium on any chemical attack. As the military situation became more precarious, the idea to use gas became strongest among

---

[94]Anglo-French Declaration on the Conduct of Warfare (2 September 1939), as quoted in J.R.M. Butler, *History of the Second World War: United Kingdom Military Series. Grand Strategy*, volume II (London: Her Majesty's Stationery Office, 1957), p. 568.

[95]Brophy and Fisher, *op. cit.*, p. 268.

[96]Once the situation returned to normalcy, bomb load would consist of 50 percent gas bombs, a figure reduced to 25 percent by late 1944. *Ibid.*, p. 82.

[97]He grudgingly yielded stating: "Clearly I cannot make head against the parsons and the warriors at the same time." Winston S. Churchill to General Ismay, 29 July 1944, Premier 3/89; Winston S. Churchill to the COS, 6 July 1944 Premier 3/89, as quoted in Courtland Moon, *op. cit.*, p. 18.

Hitler's political cadre: Bormann, Göbbels, and Robert Ley (head of the Labour Front), who adamantly urged Speer: "You know we have this new poison gas.—I've heard about it. The Fuehrer must do it. He must use it. Now he has to do it! When else! This is the last moment."[98] Hitler, himself, toyed with the idea of using gas against Russia because he assumed that it would be in the best interest of the West for the Germans to halt the Soviet onslaught.[99] He, therefore, ordered continued full production at the three major nerve gas plants.[100] The military especially, felt that Germany would get the worst of it in light of significant Allied air superiority. As the war came closer to Berlin, the military pointed out that the German population was crowded into a narrow area and would take the brunt of casualties. Moreover, the war was being fought on German soil and therefore, they would be gassing their own population and German capability did not include the ability to attack the U.S. or the wide spaces of Russia.[101]

Throughout the war German intelligence overestimated Allied chemical warfare capabilities, thus presenting pessimistic reports to the leadership. The lack

[98]Albert Speer, *Inside The Third Reich*, translated from German by Richard and Clara Winston, introduction by Eugene Davidson (New York: The MacMillan Company, 1970), p. 413.

[99]Hitler brought the issue of gas up at a situation conference in Autumn of 1944. When nobody agreed with his speculation, he did not return to the matter again. *Ibid.* p. 414.

[100]On his own accord, Speer attempted to slow down gas production by diverting primary supplies under the guise that they were needed in the production of anti-aircraft munitions. *Der Prozess gegen die Hauptkriegsverbrecher vor dem Internationalen Militärgerichtshof. Nürnberg 14 November 1945-10 Oktober 1946, volume 41 (Nürnberg: Obersten Kontrollrats für Deutschland, 1949)*, p. 461. He undertook this action because he did not want any international crimes committed "...which could be held against the German people after they lost the war. That was the decided issue." *Trial of the Major War Criminals before the International Military Tribunal, Nuremberg 14 November 1945-October 1946*, volume 16 (Nuremberg: Allied Control Authority for Germany, 1948), p. 528. Though a little self-serving, his views and actions were corroborated by other defendants at the Nuremberg Trials such as Kehrl, Milch, and Seyss-Inquart.

[101]Office of the United States Chief of Counsel for Prosecution of Axis Criminality, *Nazi conspiracy and aggression, (Supplement A)* (Washington D.C.: U.S. Government Printing Office, 1947), pp. 900-901.

of any scientific materials on nerve gases was enough to convince German authorities that the gases had been discovered, their importance recognized, and details immediately classified by the Allies.[102] Nothing was further from the truth. Paradoxically, each side's lack of detailed intelligence information contributed not only to deterrence but also to an arms race. As each belligerent believed itself to be behind, defensive and offensive production expanded rapidly with the Allies eventually outstripping German production, even though they lagged far behind in 1939. Britain had only 405 tonnes of gas to repel any German gas attack during 1940, but by war's end she had accumulated 35,000 tonnes.[103] America's fledgling Chemical Warfare Service blossomed to gigantic proportions, ending the war with a total of thirteen new chemical warfare plants which had produced 135,000 tons of toxic agents.[104] Germany, on the other hand, began actively increasing its chemical warfare capability in the mid–thirties and yet the chemical industry was unable to exploit its full potential as it had to compete for scarce resources with the more conventional military industries. Entering the war with roughly 10,000 tonnes, the most of any belligerent, Germany lost its lead and by 1945 had only 69,000 tonnes in stock.[105]

[102]Clarke, We All Fall Down..., *op. cit.*, p. 35.

[103]Brauch, *op. cit.*, p. 93. The 405 tonne figure is from Harris and Paxman, *op. cit.*, p. 111.

[104]This is an impressive achievement considering that the dilapidated Edgewood Arsenal was the only one the U.S. had in 1940. *Ibid.*, pp. 116–118. According to SIPRI, volume 1, p. 304, the U.S. produced 131,400 tonnes.

[105]Groehler uses the figure of 69,000 tonnes of which 12,815 tonnes were nerve gases. Tabun comprised 8770 tonnes of the total, as quoted in Brauch, *op. cit.*, p. 93.

## Non–use in World War Two

Deterrence succeeded in functioning during the Second World War for numerous reasons. All parties agreed to adhere to the Geneva Protocol, yet feverishly prepared for the eventuality of having to use gas, a contradiction still in existence today. The legal prohibition and political adherence to the decrees increased the constraints since the:

> ...use of such weapons would not only have flouted international law and much popular feeling, but would also have indicated in the clearest terms to the world in general, and the enemy in particular, that the user intended to pursue his war aims with extreme measures. The fact that he would therefore have had to anticipate an extreme response from his enemy would have further constrained the decision to initiate [chemical warfare].[106]

While the Protocol was superficially important, the real reasons deterrence worked in W.W. II were of a more practical nature. Operationally, gas posed a number of limitations which often hindered its use. Increased logistical difficulties and added complexities to the battle made commanders leery of advocating CWs. Since most gases dispersed relatively quickly, except for mustard gas, it would be a futile exercise to bombard large areas. For the Germans, early victories and Blitzkrieg tactics made the use of CWs impractical and, according to doctrine, unnecessary since CWs were allegedly designed to overcome stalemates. None of the military leaders were eager to use gas in retaliation for that meant that it would be directed against the most vulnerable targets at hand—cities, rather than frontline troops. Insecurities regarding each other's chemical weapons' capability prevailed and the

[106] Julian Perry Robinson, and Boserup, Anders. *The Problem of Chemical and Biological Warfare: A study of the historical, technical, military, legal and political aspects of CBW, and possible disarmament measures. Volume 5: The Prevention of CBW* (Stockholm: Almqvist & Wiksell, 1975), p. 26.

ongoing debate over effectiveness prevented any unanimous guarantees of swift results.

In 1945, thirty years after the introduction of CWs, the belligerents were prepared as never before for a gas war. Nevertheless, the images of World War I haunted both the military and the public at large. This wonder weapon, which was supposed to get the troops out of the trenches and secure victories in fact accomplished neither. From the very beginning, the military felt uncomfortable with a weapon that violated the code of chivalry. CWs demanded a reaction to every new action taken, causing escalation beyond the control of the military, forcing the latter to be held at the mercy of science and industry and, to some degree, the vacillations of politicans.

Deterrence failed in the First World War for the simple reason that the threat was insufficient to prevent a nation from using CWs. During a global war, in particular, restraints on illegal behaviour become increasingly difficult and, in fact, in such circumstances there are few reasons for a nation to invoke self–restraint. In World War Two all belligerents were theoretically and publicly willing to fight a retaliatory and escalatory chemical war even to the point of strategic city bombing. In reality, however, the need to satisfy the doctrinal demand for a swift victory overrode the advocates of chemical warfare. The human element can neither be discounted nor underestimated, since the introduction of CWs would have required a defenceless victim and an immune attacker, neither of which were present. From the moment defensive measures were available to blunt tactical use, escalation to the point of strategic reprisals was likely to be the consequence of such use. In essence, a system of deterrence based on denial of military objectives and strategic

punishment was effectively in operation. The absence of either of these factors would logically imply the non–operation of deterrence and thus, it is the sporadic usage in non–European theatres that now must be addressed.

# Chapter 2

# The Flanks

## 2.1 CHEMICAL WAR ON THE PERIPHERY

The history of CWs demonstrates the precarious position they have had in the international arena. World War Two ended, not in the prophesied chemical holocaust, but rather in another scientific experiment which this time achieved what the scientists predicted—final victory. CWs, once analogous to the biblical incarnation of the Apocalypse of the Four Horsemen, now were surpassed by the potential of a radioactive wasteland. The victors argued that chemical deterrence, as prescribed by the Protocol, stood firm even during the chaos and turmoil of a war preventing the use of CWs even at a time when the Axis powers were in their death throes. However, such thinking was confined to the major and European powers.

This chapter will involve an examination of the concept of deterrence as it has applied to chemical warfare and use since the First World War. Outside of Europe caveats do exist, however, and should be mentioned here. Not every use or even alleged use of CWs will be introduced, as reliable information from many of these events is sketchy at best. Thus, the reason for including a brief discussion of the Italian use in Ethiopia, the Japanese use in Manchuria, Southeast Asia, Soviet involvement in Afghanistan, and the current Iraq/Iran war is based primarily on the availability of documented information from disinterested parties. Essentially a discussion of those instances will enable the recognition that, if chemical deterrence

is to apply to today's world, further refinement of the concept and operation of deterrence is necessary.

### 2.1.1 The Abyssinian Campaign

On 20 October 1935, Mussolini's legions marched into Abyssinia with their minds set on conquest, and with the knowledge that poison gas could be used.[1] For the military it meant that approval to use CWs had tacitly been given at the highest level even though Italy had signed the Protocol on 3 April 1928.[2] The need to use CWs arose relatively early in the campaign. Mussolini was in dire need of military victories since he realized that: "Italians greeted the commencement of war with surprisingly little enthusiasm and his claim that it was a war of defence against a barbaric aggressor lacked credibility."[3] Mussolini knew that such a large force in the field during the rainy season would be financially, politically, and, to some degree, militarily dangerous.

On 12 November 1935 he therefore sacked the current commander De Bono in favour of the more aggressive Badoglio, who was given instructions to press forward with whatever means necessary including not only gas, but also flamethrowers and the bombing of villages.[4] These instructions were the result of frustration on Mussolini's part, because much to his embarrassment, Ethiopian troops fought with greater skill and tenacity than had been expected.[5] Hence, pressured by time and

[1]Denis Mack Smith, *Mussolini's Roman Empire* (London: Penguin LTD, 1970), p. 60, as quoted in Spiers, *op. cit.*, p. 90.

[2]Ethiopia signed on 18 September 1935. Neither country held reservations to the Protocol.

[3]Smith, *Mussolini, op. cit.*, p. 197.

[4]Alberto Sbacchi, "Legacy of Bitterness: poison gas and atrocities in the Italo–Ethiopian war 1935–1936," *Genève–Afrique.* (Volume 13, 1974), pp. 36–39. In fact, Mussolini even inquired whether Badoglio wished to use bacteriological warfare. *Ibid.*, p 42.

[5]In the early 1930s, experts "...assumed that Ethiopia could be beaten without much difficulty

an irate leader, the Italian military opted to use gas beginning on 22 December 1935 to protect flanks of advancing columns and to disrupt Ethiopian communication centers. Both tactics were reminiscent of German gas use of W.W. I.[6] Gas bombs and spray tanks were used effectively in area gassing of the mountainous regions, thereby avoiding the costly necessity of picketing the heights. By spraying the retreating Ethiopians, confusion reigned causing, at times, a rout.[7]

Initially artillery rounds filled with mustard gas were used; however, their effect was limited to the immediate area of impact and easily circumnavigated by Ethiopian troops. Artillery only provided a radius of 10–20 meters of intense ground contamination with very little aerosol released. Troops soon learned to avoid such areas. Spraying, however, contaminated both ground and equipment and with no protective equipment was devastating.[8] As a result, the spray tank was adopted and used by aircraft in ground support roles.

The Italians realized the tremendous efficacy of CWs not only for tactical operations but also for terrorizing and demoralizing the enemy through the gassing of small towns and villages. Sbacchi determined that according to Italian government documents, roughly 4600 gas bombs were sent to Ethiopia, of which 2582 were used between 1935–36.[9]

---

provided a large enough army could be put into the field." G. Bianchi, *Rivelazioni sul conflitto italo-etiopico* (Milan, 1967) as cited in Denis Mack Smith, *Mussolini* (London: Weidenfeld and Nicolson, 1981), p. 174.

[6]SIPRI, volume 1, *op. cit.*, p. 146.

[7]Spiers, *op. cit.*, p. 91.

[8]SIPRI, volume 1, *op. cit*, p. 141.

[9]He determined that figure through deduction as only partial records exist. Records indicate that 4600 gas bombs were sent and by September 1936, 2018 bombs were in stock. Additionally between September 1936 i.e. after the fall of Addis Ababa, and July 1939, 524 more gas bombs were used against Patriot–rebels. Sbacchi, *op. cit.*, p. 34.

Mussolini gambled that the League would be ineffective in preventing Italy's African adventure and by keeping the use of gas as secret as possible, he was able to limit potential international political damage. Fortunately for Mussolini, Hitler marched into the Rhineland (7 March 1936), thereby shifting the concerns of the League to this new crisis and relegating gas allegations to the status of a side issue. Italy's flagrant violation of a Protocol they had pledged adherence to, along with the League's inability to impose strong sanctions, clearly indicated that nothing could be done to secure compliance with the terms of the Convention.[10]

Thus Mussolini had both military and political incentives to use gas, for he was fully aware of both the lack of any defensive posture by the Ethiopian military and of the League's inability to effectively halt his conquest. Speed was of the essence and poison gas enabled this necessity to be fulfilled. Deterrence did not fail because it never existed in the first place. The reason to deploy CWs:

> ...reflected both the inability of the Abyssinians to protect themselves and the absence of any credible deterrent. The Italians were neither threatened with serious retaliation by the Abyssinians nor with intervention by other powers.[11]

According to Soviet sources, out of roughly 50,000 casualties 15,000 were caused by CWs. Italians used 630 tonnes of agents of which 60 percent were vesicants and 40 percent asphyxiants.[12] There is no question that Italy would have succeeded in

[10]The British were perhaps the most adamant in pursuing the allegations, yet refused to commit themselves to any action against Italy without support from other countries, which was not forthcoming. The U.K. Chemical Defence Research Department confirmed the use of mustard gas but Cabinet refused to reveal this fact for fear of having to admit that nothing could be done under the Convention. CAB 27(36), 6 April 1936, PRO, CAB 23/83 and CAB 30(36), 22 April 1936, PRO, CAB 23/84, as quoted in Spiers, *op. cit.*, p. 96.

[11]*Ibid.*, p. 95.

[12]A.A. Stepanov and J.N. Popov, "*Khimicheskoye oruzhiye i osnovy protivokhimicheskoy zashchity*," Moscow 1962, (Translated: Chemical Weapons and principles of anti-chemical defense JPRS

overpowering Haile Selassie's army without CWs; however, their use allowed for a speedy conclusion to the campaign at a lower man and materiel cost to Italy. "In this way the war was probably shortened, but its outcome was not seriously affected."[13]

### 2.1.2 China

The second major incident involving CWs prior to W.W. II occurred in the Far East. Unlike their Western brethren, the Japanese General Staff had no foreboding personal memories of gas warfare, nor had "...any wartime precedents been set to direct institutional or doctrinal preparations for a future conflict."[14] Hence, toxic agents accompanied the Japanese invading force into China in October 1937. China became a laboratory for the testing of both agents and doctrine. Having withdrawn from the League, and never having signed the Protocol, the Japanese were under no legal restraint and employed a kaleidoscope of harassing and lethal agents. According to U.S. intelligence reports, between 18 July 1937 and 8 May 1945, the Japanese used: CN, DA, DC, phosgene, disphosgene, chloropicrin, hydrogen cyanide, mustard gas, and lewisite. Their method of delivery included artillery shell, toxic candles, and aircraft bombs.[15] Unlike Central Europe and Britain, Japan was not very vulnerable to surprise strategic attacks and so continued its

15107), as quoted in SIPRI, volume 1, *op. cit.*, p. 143. "...vesicants, or blister agents, are general tissue irritants with an additional system action. Contact with skin tissues provokes blistering in the affected region after some delay. Contact with eyes causes more rapid injury and leads to inflamation and possible temporary loss of sight." WHO, *op. cit.*, 32.

[13] *Ibid.*, p. 146.

[14] Brown, *op. cit.*, p. 246.

[15] U.S. War Department, Military Intelligence Division, "Enemy tactics—chemical warfare." Washington, September 1944, (Special series no. 24.) (PB 19533) and Office of the Chief Chemical Officer, GHQ, AFPAC. General organization. (Intelligence report on Japanese chemcial warfare, vol. 1) Tokyo, May 1946 (PB 47225), as quoted in SIPRI, volume 1, *op. cit.*, p. 147.

chemical warfare efforts unmolested. While the U.K. and U.S. could have potentially posed a strategic threat, it would have had to come through the medium of sea power, a power limited by treaties and retaliatory capabilities.[16] China's military weakness and the Soviet Union's pre–occupation with Europe gave Japan relatively free reign in the Far East.

Initially, the Japanese employed irritants for no other purpose than to harass the enemy; since the Chinese lacked protection, the successes outweighed the occasional failures. As lethal chemicals became available, those too were used in small scale field trials.[17] Recently, a Japanese researcher compiled a 70–page documentary report showing that Japan used poison gas against the Chinese at least 56 times between 1938 and 1942.[18] As with the Italians in Ethiopia, the Japanese recognized the efficacy of CWs against an unprotected enemy. Even though harrassing agents were not intended to produce fatalities, the psychological impact upon those gassed was frequently paralyzing. "Often the enemy [Chinese] took to their heels at the mere sight of smoke before we launched upon any actual offensive action."[19] Yet, as in all previous wars, gas was never the decisive factor and the Japanese army never intended to use it as such. It provided them with an advantage which the Chinese could only offset by either defensive equipment or a retaliatory capability. For the Japanese, gas simply facilitated the speedy conclusion of offensive battles and aided in defensive actions. Even if the highly suspect Chinese figure of 26,602

[16]Brown, *op. cit.*, p. 246.

[17]Captured Japanese personnel and documents attempted to argue that only irritant agents were used throughout the war. Evidence is inconclusive, but suggests that Japan used lethal gases on a limited scale. Spiers, *op. cit.*, pp. 98–101.

[18]Associated Press. "Japan used gas." *Calgary Herald.* (15 June 1984), p. A12.

[19]BIOS/JAP/PR/1338, pp. 90–91, as quoted in Spiers, *op. cit.*, p. 101.

gas wounded plus 1948 dead were to be taken seriously, the overall impact of gas throughout the war was still miniscule. Official Chinese statistics indicate that 1,087,000 men were wounded and 362,000 dead by February of 1940.[20] The introduction of CWs was a logical technological progression for an army constantly advancing in sophistication. Since the Japanese General Staff was neither burdened by legal constraints nor suffered from a pathological fear of a gas war inferno, no disincentives arose for Japan against the use of CWs, especially in an experimental mode.

An interesting addendum to Japanese chemical warfare policy is the fact that until 1944, Japan remained evasive towards any declaratory policy. But early in 1944, Japan communicated that "...during the present conflict [Japan will not] make use of it [gas] in the future on the supposition that troops of the United Nations also abstain from using it."[21] Without question, the reason for such a timely statement lay in the fear of gas attacks upon conquered and Japanese territory. Such anxiety was not without foundation given the atrocities committed by the infamous Unit 731, which conducted extensive chemical and biological experiments on Chinese and Allied prisoners of war. Fortunately for the Japanese, the activities

[20]The gas statistic is from *Japan's Use of Gas*, PRO, WO 208/3044, as quoted in Spiers, *op. cit.*, p. 99. The overall statistics for Chinese casualties were quoted by Snow, who quoted from Chinese Military HQ documents issued in February 1940. An incongruity exists, however, because in the same month, the military released the figure of 675,000 wounded in 1939 alone. Snow estimates that the Chinese military suffered roughly 2,160,000 casualties, while foreign military observer's estimates range from two to four million. If correct, it would mean a 100 percent loss of the original combat force! Edgar Snow, *Scorched Earth*, book one. (London: Victor Gollancz LTD, 1941), p. 173. Singer and Small estimate that between July 1937 and December 1941, the Chinese suffered 750,000 dead. Even using this lowest of objective estimate of total deaths, it constitutes an insignificant proportion. J. David Singer and Melvin Small. *The Wages of War 1816–1965: A Statistical Handbook* (New York: John Wiley & Sons, Inc., 1972), p. 122.

[21]Telegram 1091, American Legation, Bern for Secretary of State, 22 February 1944, no. sub., 740.00116 Pacific War/79, BF, as quoted in Brown, *op. cit.*, p. 249.

of the Unit were not well known, as this may have sparked an escalatory reaction by the Allies.[22] Senior officers, therefore, never thought that the U.S. would initiate a gas attack, since the U.S., by doing nothing, had apparently ignored past chemical warfare allegations and left China to her own devices. In addition, Roosevelt had on numerous occasions categorically denounced gas warfare.

Significantly, both Italian and Japanese usage of CWs were expressions of the desire to reduce the military costs of their respective invasions. Since their opponents possessed only primitive or no defensive equipment, a number of preponderate reasons emerged to take advantage of this asymmetrical situation. The trend of not being constrained if the opponent lacked adequate defences and if a shroud of secrecy could cover chemical weapons' use continued after the Second World War. Consequently, it comes as no surprise that allegations of gas use have emerged from conflicts such as: Indo–China (1947), Algeria (1957), Yemen (late 1970s), Afghanistan (1982), and Iraq/Iran (1984–present).[23] These wars were all between a metropolis and a satellite region (to use terms coined by Gunder Frank). Such wars are unorthodox in nature, with the metropolis allegedly compelled to adopt unconventional warfare methods such as using gas to 'flush out' and destroy the insurgents, often out of military impotence and frustration. Out of all post–1945 incidences, Southeast Asia and Afghanistan will be discussed briefly because they represent disputed allegations and the apparent use of new technology, whereas the Iraq/Iran war will be examined in greater detail because the evidence is irrefutable

[22]The main complex was near Harbin, Manchuria, and 'employed' 3500 soldiers and civilians. It is estimated that at least 3000 Chinese, Russian, Mongols, British, American, and Canadian prisoners died as a result of the experiments.

[23]SIPRI, volume 1, *op. cit.*, pp. 156–212.

and represents the most recent and only example of the use of CWs in fighting between two large conventional forces.

### 2.1.3 Southeast Asia

In the late seventies, reports began to trickle out of Southeast Asia giving evidence of Soviet use of chemical agents against H'Mong tribesmen of Laos, through their Vietnamese and Laotian proxies. One of the first reports came in 1975 from a People's Liberation Army defecting officer, who took part in "extinct destruction operations."[24] These tribesmen claimed that through either aerial spraying or air-burst rockets, their villages were covered in a yellow, white, or sometimes red or green vapour clouds. As more and more reports emanated from Southeast Asia, journalists euphemistically coined these vapour clouds "Yellow Rain."[25] By mid 1981, the U.S. government felt secure enough publicly to accuse the Soviet Union and its allies of engaging in chemical warfare.[26] Consequently, "concrete evidence" was presented to the press and test results from samples gathered in Southeast Asia released to the public. The U.S. based its claim on the fact that tests had shown traces of thrichothecene mycotoxin—a toxin apparently not found naturally—and on eyewitness reports. According to Haig, 4606 people had already died in Laos between 1978 and the winter of 1979–80, and another 276 in

[24] Joseph D. Douglass and Neil C. Livingston, *America the Vulnerable* (Lexington, MA: Lexington Books, Inc., 1987), p. 146.

[25] Spiers, *op. cit.*, p. 104.

[26] The first public government statement came on 13 September 1981, when Secretary of State, Alexander Haig, announced at a Berlin Press Association meeting that,"...the Soviet Union and its Allies have been using lethal chemical weapons in Laos, Kampuchea [Cambodia], and Afghanistan...." Alexander Haig, "A Certain Idea of Man: The Democratic Revolution and its Future," Address before the Berlin Press Association, Berlin, September 13, 1982, Press Release, Department of State, p. 5, as quoted in Elisa D. Harris, "Sverdlosk and Yellow Rain: Two Cases of Soviet Noncompliance," *International Security* (Volume 2, number 4, Spring 1987), p. 58.

Cambodia.[27] Throughout the early 1980s, the U.S. government stood by the allegation but was unable either to present a toxin–contaminated body or to prove conclusively that any deaths ever occurred from mycotoxins. In fact, much has been written about yellow rain but little hard evidence existed to substantiate the American claim. Meanwhile, the Soviets have consistently denied any wrongdoing and have in turn argued that the U.S. was merely attempting to divert attention from their own use of CWs during the Vietnam war and justifying the production of new binary shells.[28]

By the mid to late 80s, it became clear that the American case stood on shaky ground. The "hard evidence" purported to be samples of T–2 toxin were actually only found in ten percent of sixty–odd plant, water, and soil samples. "Curiously, only two laboratories, at the Universities of Minnesota and Rutgers, have detected trichothecene toxins, and that in only six of the environmental samples."[29] Further, fungi collected from Thailand in Febuary 1982 was tested at the University of Saskatchewan and the results indicated that"...an isolate of *Fusarium equiseti* from Southeast Asia produces trichothecenes, albeit at low levels."[30] By the end of 1983, scientists and experts on chemical warfare argued that the occasional occurrence of yellow rain may actually be a natural phenomenon, a fact highly contested by the American government. Bee defecation and moldy food have been

[27]Alexander M. Haig, "Chemical Warfare in Southeast Asia and Afghanistan," Department of State, Special Report No. 98, March 22, 1982, as quoted in Tom Gervasi, *The Myth of Soviet Military Supremacy* (New York: Harper & Row, Publishers, Inc., 1986), p. 237.

[28]Harris, *op. cit.*, p. 68.

[29]Alastair Hay, "Why Verification is necessary," *New Scientist* (22 March 1984), p. 18

[30]Roy Greenhalgh, J. David Miller, Gordon A. Neish, and H. Bruno Schiefer, "Toxigenic Potential of Some *Fusarium* Isolates from Southeast Asia," *Applied and Environmental Microbiology* (August 1985), p. 552.

listed as highly probable causes for contamination. Such an explanation accounts for both the low death rate and common symptoms displayed by victims.[31] In addition, further credibility was given to the natural occurrence hypothesis after mycotoxins were found in the blood of a number of individuals who did not claim to be victims of yellow rain attacks.[32] Finally, the most recent scholarly effort, released in the Fall of 1987, argued not only that the U.S. Administration came to rash and unsubstantiated conclusions, but also determined that mycotoxins do occur naturally.[33]

### 2.1.4 Afghanistan

In August 1980, the State Department published a 124 page report citing a litany of Soviet chemical attacks in Afghanistan. As in S.E. Asia, the allegations were based on interviews with Mujahideen tribespeople, Afghan deserters, journalists, and U.S. physicians.[34] As with the Southeast Asian situation, U.S. evidence was flimsy at best and initially based on American intelligence sources, which stated that, "...the Soviets had used lethal chemical vapors in their campaign to subdue insurgents in Afghanistan."[35] The State Department, however, admitted that it

[31]Hay, *op. cit.*, p. 18.

[32]Harris, *op. cit.*, p. 89. An unnamed scientist who works for the U.S. defence establishment indicated that he was not convinced that, "...mycotoxicologist Chester J. Mirocha, who analyzed the few U.S. toxin–positve samples, was measuring toxin concentrations greater than natural background levels." "Yellow Rain Enigma: Ghent meeting sheds little new light." *Chemical and Engineering News* (28 May 1984), p. 7.

[33]Associated Press, "Soviets Absolved of "Yellow Rain" use", *Calgary Herald* (1 September 1987), p. B5.

[34]Mike Osborne and Judith Perera, "Chemical warfare: the superpowers' deadly game," *Middle East Magazine* (April 1983), p. 23. The State Department "documented" 59 chemical attacks in Afghanistan by the end of 1982. Douglass and Livingston, *op. cit.*, p. 147.

[35]United Press International, "U.S Is Told Soviets Uses Poison Gas on Afghans," *The New York Times* (24 January 1980), p. A7.

was unable to corroborate the allegation, which was based on the defection of an Afghani Army officer, who was not even an eyewitness to the chemical attacks.[36]

The first "concrete evidence" of chemical attacks was announced by Secretary of State Shultz in November 1982. He stated that two contaminated Soviet gas masks were acquired from Afghanistan, which showed the presence of mycotoxins.[37] However, no bodies were ever found and what little "real" evidence was collected was immediately scrutinized by skeptical scientists. As of yet, the verdict, in regard to the true reason as to why mycotoxins seem to occur where the Soviets happen to be active, is still pending. Soviet refusal to be more co-operative has not aided in quelling the fears of an emerging epidemic of toxin warfare in the international community.

### 2.1.5 Iraq–Iran

In the summer of 1980, Iraqi forces crossed the Iranian frontier in the belief that they had chosen an opportune time finally to dispose of their *bête noire*—the Iranians. At the time, no rational reason for failure could be advanced since the military balance had finally tilted in Iraq's favour. The Khomeini Revolution threw the Iranian armed forces into total disarray having to deal with the emergence of a parallel military establishment, the Revolutionary Guard Militia (*Pasdaran*) and suffer through two purges which alone cost the army 10,000 men.[38] The operational

[36]Gwynne Roberts, "Use of Chemical Weapons in Asia," *New Statesman* (4 April 1980), p. 504. In initial attacks, the Soviets allegedly used Soman, while the toxin "scare" began in 1981.

[37]George P. Shultz, "Chemical Warfare in Southeast Asia and Afghanistan: An Update," Department of State, Special Report No. 104, November 1982, p. 3 and p. 4. According to his report, between the summer of 1979 and the summer of 1980, 3000 Afghanis died as a result of CWs. *Ibid.*,p. 8.

[38]Efraim Karsh, "The Iran–Iraq War: A Military Analysis," *Adelphi Papers* (Spring 1987), p. 16.

capabilities of the Iranian military were consequently severely compromised. The airforce, for example, could fly barely half its available aircraft due to the departure of American advisors and the lack of key avionics.[39]

The Iraqi airforce, on the other hand, had modernized its equipment (Soviet planes) and maintained a serviceability of about 80 percent at the start of the war.[40] Hence, Iraq attempted to exploit its apparent technical superiority in order to regain disputed territory. However, Saddam Hussein underestimated Iranian resolve to defend the homeland and overestimated his own country's military prowess. By October of 1980, the war stalemated with both sides resorting to strategic attacks against civilian and economic targets, notably the oil terminals. Iraq gambled and lost. The spring of 1981 saw the Iranians successfully on the offensive, so much so, that by June of 1982 Hussein announced an Iraqi withdrawal from Iranian soil.[41] His limited objective war had floundered and, aware of not being able to sustain a war of attrition, he decided upon the only recourse available to him—to initiate peace talks and secure his own border. Iraq, though technically superior, lacked the ability to sustain continuous casualties.[42]

Iran flatly rejected any peace overtures and on 13 July 1982 launched its own

[39]Interview Data, as cited in *Ibid.*, p. 15.

[40]M. Heller, et al, *The Middle East Military Balance 1983* (Tel Aviv University: The Jaffee Center For Strategic Studies, 1983), p. 312.

[41]Karsh, *op. cit.*, p. 25.

[42]A little over 170,000 Iraqi men come of military age each year versus 500,000 for the Iranians. Roughly two million Iraqi men versus seven million Iranian men are fit for military service. CIA, *World Facts 1985*, pp. 11—117, as quoted in The Royal United Services Institute for Defence Studies, *Defence Yearbook 1987* (London: Brassey's Defence Publishers, 1987), p. 288. The CIA document is critical of the findings. Nevertheless, the huge disparity in manpower is worth mentioning as the *Military Balance* arrives at similar figures with potentially 8.7 million Iranian and 2.93 million Iraqi men between the ages of 18 to 45 available for military service. *Military Balance 1986-1987* (London: International Institute for Strategic Studies, 1987), pp. 96-97.

offensive into Iraq. Though the offensive failed, it represented the first time gas was employed by the defender. Using non–lethal tear gas, the Iraqis were able to frustrate the operations of an entire division, which thought that it was under mustard gas attack.[43] In December 1984, reports and evidence began to emerge that Iraq was using limited amounts of crude mustard gas to repel Iranian human wave attacks.[44] To substantiate allegations of chemical weapons use, Iran dispatched thirty casualties to European hospitals, a move that quickly confirmed the Iranian accusation. Widespread publicity prompted U.N. Secretary–General Javier Perez de Cuellar to send a team of specialists to Iran to investigate the claims of chemical attacks. The group of experts returned from Iran and concluded that mustard gas and Tabun had indeed been used, though the extent of employment was uncertain.[45] Spurred on by further Iranian accusations, the Secretary–General requested that both governments "...furnish him within three days with written declarations reflecting their respective undertakings, as solemn commitments, not to use chemical weapons of any kind for reason."[46] Iran, which in July 1984, had already declared that it would not retaliate in kind, duly complied, while Iraq remained obstinate.[47] As it turns out, Iraq was already in the process of replenishing

[43] "Iraq's Scare Tactic", *Newsweek*, 2 August 1982, p. 11. Iran had signed the Protocol on 4 July 1929 without reservations, while Iraq had signed on 8 September 1931 reserving the right to in–kind retaliation.

[44] "Iraq Reportedly uses mustard gas in war", *Los Angeles Times*, 26 January 1984, p. 8.

[45] Peter Dunn, "The Chemical War: Journey to Iran," *Nuclear Biological Chemical Defense & Technology International* (Volume 1, issue 1, April 1986), p. 29 and 36. Dunn provides a first person account of the investigation.

[46] SIPRI, *World Armament and Disarmament Yearbook: 1985*, (New York: Taylor & Francis, Inc., 1985), p. 183

[47] Initial Iranian adherence to the Protocol was stated in April of 1984 and re–confirmed in July of the same year. Ministry of Foreign Affairs. Deputy Foreign Minister (H. Sheikholslam). Plenary statement at the conference on Disarmament Geneva 26 April 1984. Followed by Ministry of Foreign Affairs. Letter Dated 2 July 1984 addressed to the Secretary–General. U.N. Document S/16664 of

its chemical stocks.[48]

The question as to why Iraq decided to use CWs—even though it surely must have realized the inevitable political repercussions that would follow—still needs to be answered. Unlike Italy or Japan, Iraq is fighting a large scale conventional war, but more importantly, is almost exclusively dependent on foreign armaments. In terms of motivation, a brief parallel can be drawn with Germany's chemical warfare in W.W. I. To some degree, both countries felt compelled to redress a perceived imbalance. The war was not proceeding as well as expected and since regime security was at stake, all means available had to be employed. In their respective wars, both nations could ill afford a war of attrition and thus, Germany attempted to use CWs as a means to victory, while Iraq is determined to stop the Iranian onslaught. In both wars, the nations that faced each other were technically comparable, yet one had a significant advantage in a particular field, chemicals and related arms. Neither Germany nor Iraq had to fear strategic escalation at the time of employment, since the opponents neither had immediate defensive equipment nor a viable chemical industry infrastructure. Though these parallels may simply be a historical quirk, they potentially pose corollary questions. The re-emergence of CWs in a large scale conventional war could possibly announce a new trend, especially in light of the technological advances in chemistry and armaments, along "...with the ease and low cost of their manufacture relative to other weapons of mass destruction."[49]

---

6 July 1984, as cited in *Ibid.*

[48]Associated Press, "U.S. Officials say Iraq stockpiles nerve gas," *Washington Post*, 3 November 1984, p. 20.

[49]W. Andrew Terrill, Jr., "Chemical Weapons in the Gulf War", *Strategic Review* (Spring 1986), p. 52.

Under their mentor, the Soviet Union, Iraq developed at least some of the components for an offensive capability in CWs. By September 1980, Iraq possessed the capacity to protect and decontaminate troops and equipment. Each Iraqi division apparently contains an organic chemical company.[50] Also the Soviets assisted in the development of a chemical warfare doctrine and the purchasing of a wide variety of delivery systems.[51] What Iraq did lack, however, were the industrial facilities to produce significant quantities of the chemical agents domestically. Nevertheless, Iraq has been casting in the world market for improved technology for the production of nerve agents. In an effort to stem Iraq's aquisition of equipment and compounds to produce nerve gas, the U.S. placed an embargo on the sale of such items in March 1984.[52]

Under American tutelage, Iran paid only scant attention to the possibility of chemical warfare. Defensive measures were utterly inadequate and anti-chemical discipline not prevalent. The disparity in capabilities guaranteed an Iraqi advantage as "...the effectiveness of chemical weapons in a combat environment is substantially sensitive to the level of the CW preparedness of the force under attack."[53] Iraq has only employed CWs in defensive and very limited actions, in part because Hussein cannot afford to alienate the U.S., the Arab nations, and Europe. Hussein continues to use CWs because he recognizes that political expediencies in the Gulf War have allowed for the limited use of CWs and will, for a while at least, defer

[50]Jack Anderson, "Iraqis Trained for Chemical Warfare" *Washington Post* (3 November 1980), p. B13.

[51]Terrill, *op. cit.*, p. 52.

[52]Seymour M. Hersh, "U.S. Aides Say Iraqis Made Use of a Nerve Gas", *New York Times* (30 March 1984), p. 1; "Iraq's Nerve Gas Factory", *Newsweek* (24 August 1984), p. 47.

[53]Terrill, *op. cit.*, p. 53.

any formal condemnation and sanctions against Iraq. Credence to the view that the international community tacitly accepts Iraqi use of CWs has been lent by the U.N. Security Council, whose condemnation of chemical warfare in the Gulf failed to mention Iraq in particular.[54]

According to the second U.N. investigatory team sent in February 1986, Iraq has escalated the use of CWs since 1984. The summary statement of the U.N. mission's report stated that:

> After having examined various sites, weapons components, and number casualties in our investigations undertaken in 1984, 1985, 1986 in accordance with the guidelines established by the Secretary–General, together with circumstantial evidence, we unanimously conclude that: (a) on many occasions, Iraqi forces have used chemical weapons against Iranian forces; (b) The agent used has mainly been mustard gas although on some occasions nerve gas was also employed.[55]

Escalation may in part be a result of greater production capacity, in addition to a low cost method of inflicting casuaties. Overall, CWs have only had a negligible impact on the course of the war. The limited usage could be credited to the inherent handicap of all agents, namely the environmental factor. In the wetlands, Iraq did use mustard gas but with very limited success because water and weather robbed the gas of much of its lethality.[56] Though Iraq has increased employment, it has done so only on "...vital segments of the front and only when [Iraq] had no other way to check the Iranian offensives."[57] According to Iranian sources, gas

[54]UN Security Council, "Statement by the President of the Security Council on Experts", report on use of chemical weapons. Press release, SC/91 of 30 March 1984, as quoted in SIPRI, Yearbook 1985 *op. cit*, p. 183.

[55]Peter Dunn, "The Chemical War: Iran Revisited—1986", *Nuclear Biological Defense & Technology International* (Volume 1, issue 3, 1986), p. 39.

[56]Defence Yearbook 1987, *op. cit.*, p. 324.

[57]Karsh, *op. cit.*, p. 56.

casualties have accounted for three to five percent of total casualties.[58]

The future course of CWs in the Iraq/Iran war will be guided by Iraqi beliefs in the efficacy of CWs and by Iran's increased chemical defensive capability. Since Iran will not retaliate in kind, much less escalate, the only other method of deterrence that has worked has been denial through defensive measures. However, historically, either both types of deterrence (denial and strategic escalation) were present or neither was. Thus to bolster deterrence additional incentives might be needed. Such alternatives might include tying negotiations for a peace agreement to non-use, or militarily, by increasing the level of violence against hitherto taboo targets. Strategic escalation may also be an option available to Iran and could be directly tied to every Iraqi gas attack. Within the international sphere, Iran can be expected to make every effort to dispel the pariah state image through a more sophisticated use of public relations techniques. As it stands now, Iran has little recourse under international law as Iraq is using gas within its own borders and against indigenous people; international legal action is not prescribed under the terms of the Protocol for 'domestic' use.

CWs in the Gulf cast ominous implications for future wars in the Third World.

> There are, indeed, foreseeable circumstances under which chemical war may be waged to a much greater extent than it has been in the Gulf War. This would apply to a situation where the nation considering CWs use is not significantly dependent on Western ties, or could exchange those for other sources of supply. It applies to scenarios of compelling military advantage relating to CWs, including pre-emption against an opponent possessing superior conventional armaments.[59]

Considering the number of allegations of gas warfare emanating from Third World

[58]Defense Yearbook 1987, *op. cit.*, p. 305.
[59]Terrill, *op. cit.*, p. 57.

conflicts the patterns of alleged or actual use, and the relative ease of acquisition, fears of CWs proliferation are not groundless.

### 2.1.6 Understanding Chemical Deterrence

The historical battlefield is littered with the remnants of miscarried deterrence and the success or failure of avoiding chemical warfare is no exception.

By 1916 all belligerents possessed CWs, but were not deterred by this fact; rather they encouraged science and industry to produce greater quantities of more lethal chemical agents, as well as better delivery systems. Instead of being deterred after the British retaliation–in–kind at Loos, Germany redoubled its efforts. Before and during the Second World War, all major participants possessed CWs but refrained for various reasons from employing them. From the fact that CWs were not used, one might conclude that "deterrence" worked, but such a view is too facile since it does not account for use in W.W. I. At the close of W.W. I a number of anomalies remained regarding the use of CWs, anomalies which spilled over into the post–war era and frustrated chemical warfare efforts in W.W II. First is the notion that lack of assimilation of CWs into the military establishment is of fundamental importance. This interpretation is an important consideration because it partly dispels the retaliation–in–kind myth that gained momentum after the Second World War.

> In World War II, the lesson was clear; the loci of decision–making with respect to gas warfare lay with the professional military establishments themselves. Military lack of interest kept the issue of initiation from reaching civilian elite groups.[60]

[60]Brown, *op. cit.*, p. 296.

The military was naturally very hesitant to employ a weapon that was contrary to the military ethos and that subsequently proved to be less effective and practical than initially claimed. Additionally, there is little incentive to incorporate a weapon that is constrained from use by international law and by domestic political pressures.

Second, retaliatory capabilities were announced throughout the Second World War, but in reality strong military incentives against doing so presented themselves from the first. The tank and ground–attack aircraft, not CWs, emerged from W.W. I as decisive weapons and consequently had profound effects on doctrine, causing the triad of firepower–mobility–dispersion to be realigned to accommodate these new technologies. Phosgene and mustard gas were far too slow–acting to be of any benefit in mobile warfare, a liability difficult to reconcile with the new doctrine.[61] This recognition could account for the move towards thinking of CWs in strategic terms and their subsequent development as a counter–city rather than tactical weapons. Not surprisingly, the major powers in W.W. II "...tacitly assumed that any use of gas would immediately escalate to the strategic level and therefore, that any initiation should itself be at the strategic level."[62] This was essentially deterrence through escalation not in-kind retaliation.

Third, bureaucratic inertia rather than perceived military usefulness probably had much to do with the fact that CWs remained within national arsenals.

> ...because they were highly specialized, the livelihood, ambitions and career patterns of their occupants inevitably became intertwined to some degree with their special mission. They acquired a self–propagating

[61] Julian Perry Robinson, *Chemical Warfare Arms Control: A framework for considering policy alternatives* (London: Taylor & Francis, 1985), p. 35.
[62] Brown, *op. cit.*, p. 296.

> character. During the post–war contraction of military effort, governments found it easier to run down the institution than to close them out altogether,....[63]

With the general rearmament of military institutions prior to W.W. II, chemical branches, as part of the overall establishment, invariably received the spoils of revitalization. On the other hand, de–mobilization after W.W. II and the ascendancy of nuclear weapons caused the shrinkage of an establishment already in a precarious position because of never having been called into action.

Chemical warfare has undergone what could be termed a "down–hill" utility in Europe after W.W. II and therefore, conflicts in which gas has been employed were primarily against primitive opposition.[64] Such wars have most often been between industrial versus underdeveloped powers, thereby yielding an utterly asymmetrical situation in which CWs were seen as having definite value because the opposition lacked even rudimentary defensive equipment and any means to retaliate. In such instances, CWs can achieve tactical victories. Surprise—an integral component of gas warfare in W.W. I—was not necessary against an undefended opponent and therefore, CWs have had considerable appeal in these situations. The lessons of W.W. I and W.W. II were well learned.

W.W. I taught that the incentives to use CWs were very limited and in subsequent wars, employment was strongly motivated by those military considerations rather than international law. This is not meant to suggest futility of the Protocol. Instead, use has been clandestine and in remote areas, thereby hiding behind a cloak of diplomatic language, while outwardly preserving the spirit of the Protocol.

[63]Robinson, Chemical Warfare Arms Control..., *op. cit.*, pp. 41–42.
[64]*Ibid.*, p. 35.

There is no right or wrong answer to the question of whether CWs are efficacious. CWs have been used mostly in situations in which the advantages far exceeded the possible dangers. In this kind of relationship deterrence never really existed as the target nation had neither political nor military resources to prevent the use of CWs against itself.

# Chapter 3

# The Central Front

## 3.1 THE CURRENT U.S./NATO DEBATE

Any insightful discussion of NATO chemical warfare policy must be prefaced with overview of American policy, as NATO is in possession of neither CWs nor an agreed upon doctrine for employing them if the need arose. Initially, therefore, the focus must be on the evolution of U.S. policy since W.W. II. This chapter will also include a brief review of Soviet posture and policy because current U.S. chemical weapons' modernization is, to some extent, a reactionary reflex to U.S. interpretations of Soviet intent.

### 3.1.1 American Chemical Warfare Policy

U.S. interest in CWs has oscillated between the Charybdis of institutional and personal attitudes and the Scylla of military trepidation about gas warfare since the inception of the American Gas Service in August 1917.[1] The waxing and waning existence of the Gas Service, later renamed the U.S. Army Chemical Corps is, in part, a direct reflection of the absence of a coherent policy to guide the use of CWs. Late entry into W.W. I and relatively limited exposure to gas warfare did not enhance the reputation of the Gas Service. During W.W. II, Roosevelt made

[1] It was only five months (3 September 1917) after U.S. entry into the War that a formal organizational structure for the Gas Services was agreed upon under General Order 31. Heller, *op. cit.*, pp. 47–48.

it clear that the U.S. would not use chemicals first. Since then, the international community understood this statement to reflect official national policy and tacit confirmation of U.S. adherence at least to the principles of the unratified 1925 Geneva Protocol.[2] In reality, Roosevelt's declaration was neither confirmed nor denied as being official U.S. policy and therefore, until Nixon's moratorium on CWs in 1969, little was known about America's true position.[3]

## Vietnam—The Old Debate

The revelation of U.S. use of chemical agents in Vietnam sparked public outcry and spawned political pressure to formalize a hitherto unstated U.S. chemical warfare policy. The issue, however, was not that simple since, among other things, there existed various interpretations of what actually constituted a chemical weapon. While internal discourse raged, the international community assumed that the U.S. complied with the "no first–use policy." The quarrel surfaced publicly only on a couple of occasions prior to the Nixon Declaration. The 1954 Field Manual 27–10, *Law of Land Warfare*, still cited the conventional view that: "Gas warfare and bacteriological warfare are employed by the United States against enemy personnel only in retaliation for their use by the enemy."[4] In contrast, the 1956 version of the Field Manual emphasized that:

The United States is not a party to any treaty now in force that pro-

[2]The reasons for failing to ratify the Protocol are still conjectural, one being the notion that the Senate rejected any provision that prohibited the use of a weapon not fully developed yet. This position had already been expressed by Captain Mahan, at the Hague 1899 conference, when he argued against attempts to stifle the creative nature of a people. In addition, the absence of provisions to enforce the Protocol constituted the rejection. "Probably however, the isolationist mood of the time did much to contribute to the Senate's action." John W. Fuller, "International Law and B/C Warfare," *Orbis* (Volume 10, number 1, Spring 1966), p. 264.

[3]It should be noted that Roosevelt's speech did not mention bacteriological warfare.

[4]Seymour M. Hersh, *Chemical and Biological Warfare: America's Hidden Arsenal* (New York: The Bobbs–Merrill Company, Inc., 1968), p. 23.

> hibits or restricts the use in warfare of toxic or non–toxic gases, or smoke or incendiary materials or of bacteriological warfare."[5]

In early 1965, Congress discovered that tear gas (CS) had been used by U.S. forces since December of 1964, and had been increasingly employed in ordinary military operations as its value became more apparent to local commanders.[6] In a written response to Congressional inquiries, then Deputy Secretary of Defense, Cyrus Vance, for the President, attempted to clarify the confused military position by stating that:

> While national policy does proscribe the first use of lethal gas by American forces, there is not, and never has been a national policy against the use of riot control agents.[7]

His statement, however, did little to diminish the anxiety that the U.S. government was really uncertain as to what policy to pursue and nowhere was this more evident than in the effort to justify legally first use of some but not other lethal chemicals.

In 1965, presidential approval allowing for the use of tear gas in military operations was formally issued. Concurrent with the authorization, the State Department announced that:

---

[5] John Cookson and Judith Nottingham, *A Survey of Chemical and Biological Warfare* (London: Sheed and Ward Ltd., 1969), p. 145.

[6] Tear gas is usually classified as a harassing gas designed as a sensory irritant which causes "...a temporary flow of tears, irritation of the skin and respiratory tract and occasionally, nausea and vomiting." United Nations, report of the Secretary–General *Chemical and Bacteriological (Biological) Weapons and the effects of their possible use* (New York: United Nations Publications, 1969), p. 13. The employment of harassing agents did not require presidential approval, hence the delayed Congressional reaction. "Commanders are currently authorized to use certain chemical agents such as flame, incendiaries, smoke, riot control agents and defoliants." U.S. Departments of Army, Navy, and Air Force, *Armed forces doctrine for chemical and biological weapons employment and defense*; FM 101–40; NWP 36(C); AFM 355–2; LFM (03) (Washington, D.C.: April 1964), as quoted in Robinson, SIPRI volume 1, *op. cit*, p. 186.

[7] U.S. Congress, Senate, Committee on Labor and Public Welfare, Special Subcommittee on the National Science Foundation, *Chemical and Biological Weapons: Some Possible Approaches for Lessening the Threat and Danger* (Washington, D.C.: U.S. Government Printing Office, May 1969), p. 20.

> We do not expect that gas will be used in ordinary military operations...[but rather]...in situations analogous to riot control, where the Viet Cong, for example, were using civilians as screens for their own operations.[8]

Hence,

> ...CS munitions are used in offensive operations where it is desired to disable enemy troops for a limited period of time. These munitions may be used to "flush out" unmasked enemy troops from concealed or protected positions, to reduce their ability to maneuver or use their weapons, and to facilitate their capture or their neutralization by other weapons.[9]

To fulfill the rather broad mandate given to CS usage, a gamut of weapon systems was developed and made available, ranging from 35 mm cartridges to bulk dispensers.

The second major agent under legal dispute was the use of anti-plant agents. Interestingly enough, by using herbicides and defoliants in Vietnam, the U.S., according to its own definition, was actually engaging in biological warfare. "While certain chemical anti-crop compounds are not truly biological warfare agents, they are so considered as a matter of convenience."[10] In December 1961, President Kennedy authorized operational trials of anti-plant agents against suspected Viet Cong/NVA (North Vietnamese Army Regulars) lines of communication in South Vietnam.[11] Codenamed operation "Ranch Hand", the defoliation exper-

[8]U.S. Congress, House, Committee on Foreign Affairs, Subcommittee on National Security Policy and Scientific Developments, *Chemical-Biological Warfare: U.S. Policies and International Effects*. (Washington D.C.: U.S. Government Printing Office, 1970), p. 4.

[9]U.S. Departments of the Army, Navy, and Air Force, *Employment of chemical and biological agents*; FM 3-10; NWP 36-2; AFM 355-4; FM 11-3 (Washington, D.C.: March 1966), as quoted in *Ibid.*, p. 196.

[10]Department of the Army, *Military Biology and Biological Warfare Agents* (TM 3-216, 1956), p. 24.

[11]SIPRI, volume 1, *op. cit.*, p. 164.

iments were deemed a success and efforts undertaken to expand the areas to be defoliated.[12] The U.S. military downplayed the use of herbicides, arguing that they were merely applying innocuous, commercially available weedkillers, while neglecting to mention that military requirements demanded application rates several times more than is used commercially. In early 1970 the Department of Defense (DoD) stated that around eleven percent of the surface of South Vietnam had been treated with herbicides. This meant that roughly 19,000 $km^2$ out of 172,540 $km^2$ had been sprayed, or 45 kg/ha of agent.[13]

Continued escalation of American use of CS and herbicides in Vietnam incensed the international community. On 16 December 1969, the United Nations General Assembly adopted a resolution affirming the 1925 Protocol and stating further that any chemical agent "...of warfare—chemical substances, whether gaseous, liquid or solid—which might be employed because of their direct toxic effect on man, animals or plant...is not allowed.[14] The resolution passed by eighty votes to three (the U.S., Portugal, and Australia) with thirty–six absentions.[15] Though the vote cannot be viewed as a resounding affirmation of the Protocol's ban of irritant chemicals, it nevertheless conveyed the fact that a substantial proportion of the world community supported the traditional interpretation of the Protocol

[12]The anti–plant agents used were named according to the stripe painted around the 55–gallon shipping containers they came in. Thus, colloquially known agents *Orange*, *Blue*, and *White* were in fact compounds of varying strengths and for different purposes. *Orange*, for example, was a composition between 2,4–D and 2,4,5–T and used as a defoliant. *Ibid.*, p. 174.

[13]Initially the figure of 22,336 $km^2$ was released by the Department of Defense, but reflected "...theoretical estimates based on application rates and the average with of spray–swathes and did not take into account areas that had been sprayed more than once." *Ibid.*, p. 175.

[14]R.R. Baxter and Thomas Buergenthal, *The Control of Chemical and Biological Weapons* (New York: Carnegie Endowment for International Peace, 1971), p. 13.

[15]United Nation, UN Document A/PV.1836, (16 December 1969), p. 16.

as applying to all chemicals.

> The text of the prohibition of chemical warfare in the Geneva Protocol admits of both a broad and a restrictive interpretation of its intended scope. It is clear, however, that by their conduct and declarations in the past four decades the *parties* to the Protocol have demonstrated their understanding that this prohibition bars the use in war of all chemical agents having a direct toxic effect on man...including tear gas and other forms of irritant chemicals.[16]

Feeling continued international presure, the U.S. attempted to defend its position by declaring that after careful textual analysis, the Protocol's provisions did not reveal any intent to prohibit either the use of irritant gases or anti–vegetation agents,[17] especially since the agents under consideration were used domestically in the U.S. and many other countries. This, however, was less than a persuasive argument, because the fact that herbicides and tear gases have accepted usages in peacetime does not automatically make their use in war lawful.[18] The U.S. argued that the Protocol intended to exclude certain chemicals as it was not necessary to make specific reference to each and every agent. In the long–run, the effort was in vain.

In 1969 all production of CWs was stopped after the military had fulfilled its requirements.[19] Furthermore, continued domestic and international pressure persuaded President Nixon to put the ambiguities and uncertainties of U.S. chemical warfare policy to rest by resubmitting the Protocol to the Senate for ratification, thereby affirming the "no first–use" policy for lethal and incapacitating CWs and

[16]Baxter and Buergenthal, *op. cit.*, p. 14.
[17]U.S. Congress, House, Committee on Foreign Affairs, *op. cit.*, p. 6.
[18]Baxter and Buergenthal, *op. cit.*, p. 15.
[19]Walter J. Stoessel, chairman, *Report on the Chemical Warfare Review Commission* (Washington D.C.: Government Printing Office, June 1985), p. 17.

"...unilaterally [renouncing]...any use of biologicial weapons, lethal or non-lethal, even in retaliation."[20] Not since Roosevelt had a President publicly stated national security objectives in relation to CWs. To some degree, the heavy use of agents in Vietnam necessitated the acknowledgment of the lack of a definitive policy regarding the use of various chemicals and also forced a re-evaluation of how closely the U.S. should follow the spirit of the Protocol. Senate ratification of the Protocol in 1975 put at least the legal dilemma to rest.

Simultaneously with the Protocol's ratification, the U.S. also signed the 1972 Convention on Bacteriological (Biological) and Toxin Weapons. In the same year President Ford, sensitive to continued criticism issued an executive order prohibiting the first use of non-lethal chemicals such as harassing agents and herbicides.[21] Thus the mid-seventies represented the formalization of U.S. chemical and biological policy, thereby marking the renewed decline of the Chemical Corps as Congress ceased to provide adequate funds for chemical paraphernalia. Budgetary cuts forced the closure of the Chemical Corps' school at Fort McClellen (Alabama), whose functions were transferred to the U.S. Army Ordnance School, Aberdeen Proving Ground in Maryland. Chemical units were disestablished and their missions were dispersed throughout the Army Training and Doctrine Command.[22]

Chemical warfighting and defensive capabilities continued to erode, so much so, that by 1975, there were less than 2000 chemical officers and specialists in the Army, a fact that seriously brought into question force survivability in a chemical

[20]In 1970, the renunciation was extended to include toxins. U.S. Congress, House, Committee on Foreign Affairs, *op. cit.*, p. 2.

[21]*Ibid.*

[22]Spiers, *op. cit.*, p. 143.

war.[23] This became especially evident after the U.S. Army conducted a review of its chemical warfare readiness in response to the elaborate chemical defensive equipment provided to the Arabs during the 1973 Middle East war.[24] The Air Force had conducted a similar test the year before and the Navy finally followed suit in 1977. All the results showed that serious deficiencies existed and so plans were drawn up to rectify the situation, but very slowly due to considerable political resistance. The Navy seemed the least concerned and did very little to correct the situation.[25] Adding to the fear that U.S. chemical deterrence had fallen below acceptable levels was provided by a gloomy 1977 report, which suggested policy alternatives in light of a perceived massive Soviet build–up and detailed the growing American inability to handle the threat effectively. Compounding the American neurosis about the apparent Soviet growth in CWs was the increasing perception of a Soviet offensive chemical warfighting strategy that was coming to bloom.

> Indicative of the importance attained to CW by the Soviet military is the intense training schedule regularly undergone by combat and support units.... Taken as a whole, the Soviet chemical warfare force posture and structure represents a very serious threat to even a protected adversary. The scope and magnitude of Soviet CW preparations far exceed those which any other nation now considers necessary to support a deterrent posture of retaliation in kind.[26]

In 1984, the Army prepared a report favouring U.S. re–armament as a counter

[23] J.P. Robinson, "Chemical Warfare Capabilities of the Warsaw and North Atlantic Treaty Organizations: an overview from open sources," in *Chemical Weapons: Destruction and Conversion* (London: Taylor & Francis Ltd., 1980), p. 20.

[24] Major C.J. Davidson, "Situation Report on Chemcial Warfare," *Journal of the Royal United Services Institute for Defence Studies* (Volume 125, number 2, 1980), p. 64.

[25] Amoretta M. Hoeber and Joseph D. Douglass, Jr., *"Das Problem Chemische Kriegführung"* Europäische Wehrkunde (Volume 27, number 10, October 1978), p. 492.

[26] William M. Carpenter, et. al., prepared for: Office, Assistant Secretary of Defense, *Evaluation of Chemical Warfare Policy Alternatives—1980–1990* (Alexandria, VA: Defense Technical Information Center, February 1977), p. 4.

to the Soviet Union's formidable chemical warfare capabilities. Further, the Report recounted the incredible disparity between the two nations, concluding that the Soviets enjoyed a superiority in all areas, in the order of: twelve to one in chemical personnel, forty to one in chemical units, twenty–five to one in decontamination units, eleven to one in training facilities, and five to one in production facilities.[27] The DoD perpetuated the belief in an aggressive Soviet chemical warfare policy in a 1985 Defense Intelligence Agency Report, which judged the Soviets to "...demonstrate a formidable capacity to carry out offensive chemical operations. Soviet policy and doctrine promote the need for these types of weapons and their value in warfare."[28] To a certain extent, the official military position was made more credible by military professionals and academics, who argued that the U.S. must take determined and concrete steps to redress such blatant chemical imbalance. According to American military perceptions, the Soviets would use chemicals in a massive first strike to enhance their chance for a breakthrough.

> The Soviets are so immersed in chemical weaponry, tactics, doctrine, equipment and personnel, and so much of their training centers around the use of lethal agents, that it would be odd, from a military standpoint, if they did not employ them.[29]

A civilian professional concurred that: "Soviet Military doctrine envisages the use of chemical weapons and acknowledges their value, particularly when used in mas-

[27]Department of the Army *Chemical Warfare: Deterrence Through Strength* (Washington, D.C.: Government Printing Office, July 1984), pp. 1–5.

[28]Directorate for Scientific and Technical Intelligence of the Defense Intelligence Agency, *Soviet Chemical Warfare Threat* (Washington, D.C.: Defense Intelligence Agency DST–1620F–051–85, 1985), p. 1.

[29]Edward A. Miller and Howard A Cooksey, "Speaking on...Evaluation of Soviets' Overall Threat: Analysis of Potential Factors," *Army and Development: News Magazine* (March–April, 1977), p. 22.

sive quantities and in surprise attacks."[30] Whether or not such perceptions were correct was rarely questioned and instead, the Soviet build–up was seen as innately aggressive in nature. Since the Soviets, themselves, never officially acknowledged the existence of a chemical warfare infrastructure, speculation raged.

### The American Stockpile

The results of the rather circumstantial debate over Soviet intent were translated into action by the U.S. government. Chemical specialists and units were re–established and the Army Chemical School at Fort McClellen re–opened in 1980.[31] Central to the American resurgence in chemical warfighting capabilities was the introduction of a whole array of new binary munitions to replace obsolete systems and the unitary shell, since the original stockpile was considered inadequate to perform the retaliatory task. Even though the stockpile has remained the same since 1969, its true size is still unknown. Estimates range from the 9000 tonnes put forward by the Madison Group, a conservative Think Tank of Congressmen, to 400,000 tonnes from the liberal Center for Defense Information.[32] The latter bases its information on military journals, which point out that the U.S. has 33,300 tonnes (mustard and two nerve gases) filled in weapons and bulk, while the overall figure for nerve gas weapons is roughly 117,000 tonnes. The largest chemical stockpile consists of three million GB and VX nerve gas projectiles for 155 mm and 203 mm artillery.[33] Robinson suggests that the U.S. possesses approximately

[30]Richard C. Wagner and Theodore S. Gold, "Why We Can't avoid developing Chemical Weapons," *Defense* (July 1982), p. 3. At that time, Gold was Deputy Assistant to the Secretary of Defense (Chemical Matters).

[31]Hugh Stringer, *Deterring Chemical Warfare: U.S. Policy Options For The 1990's* (Washington, D.C.: Institute For Foreign Policy Analysis Inc., April 1986), p. 30.

[32]Brauch, *op. cit.*, p. 139.

[33]Center For Defense Information, "Old Fears, New Weapons: Brewing a Chemical Arms Race,"

27,450 tonnes of nerve and mustard gas, of which forty percent is actually filled in munitions.[34]

Other estimates range from 25,200 tonnes to 36,000 tonnes, the former being lower because the author only counted usable agents.[35] Officially the Defense Department states that only twenty–eight percent of the entire stockpile is useful because the remaining seventy–two percent is either stored in bulk, with no immediate means to fill it into munitions, or the ammunition is obsolete with no means of delivery.[36] The Commission report once again disagrees with current official findings, arguing instead that DoD's calculations are unduly pessimistic, because the majority of the filled munitions (105 mm, 155 mm, and 8 inch mortars) are usable as only six per ten thousand artillery rounds were found to be leaking. Moreover, all stocks in Europe are serviceable.[37] According to the most recent estimates from a Soviet military expert, the U.S. has roughly 90,000 tonnes of toxic agent of which 9,000 tonnes is VX and roughly 45,000 tonnes GB. The Soviets do not subscribe to the view that agents produced twenty to thirty years ago have lost their combat effectiveness.[38] Ironically, the Commission's report substantiates the Soviet view pointing out that tests were unable to show "...significant loss of potency of the

*The Defense Monitor* (Volume 9, number 10, 1980), p. 3.

[34]J.P. Robinson "NATO CWs Policy and Posture," *Armament and Disarmament Information Unit*, (Occasional paper number 4, September 1986), p. 25.

[35]Wayne Biddle, "Restocking the Chemical Arsenal," *New York Times Magazine* (24 May 1981), p. 37; Kevin McKean, "A Safer Poison Gas," *Discovery* (September 1981), p. 70.

[36]Department of the Army, *op. cit.*, p. 6.

[37]Commission, *op. cit.*, pp. 19–24.

[38]Anatoly Kuntsevich, "Silent Killers," *New Times* (14 April 1988), p. 10. Kuntsevich made these statements during an interview. He is a Chief Expert in the Ministry of Defense and Lieutenant–General in the Army. Further into the interview, he argued that, unlike the Soviet arsenal, the U.S. stockpile is stored not only on continental USA, but also on the Johnston Atoll, Diego Garcia, and Western Europe.

existing nerve agent, bulk or in munitions. Mustard agent on hand remains still chemically potent, but may have physically hardened."[39]

The wide discrepency has much to do with the accounting procedures adopted, and with whether or not obsolete agents and munitions are included. Many fail to point out whether they are referring to chemical agents alone or chemical munitions which includes the weight of the projectile or dispenser and therefore, will always be higher. Since the exact figure remains classified the best guesswork ranges from 25,200 tonnes to 40,500 tonnes of chemical agent as this data comes from 'informed sources' or from particulars released by the Department of Defense during Congressional testimony.[40]

The true size and location of the U.S. stockpile in West Germany also is shrouded in mystery, yet this has not hindered public speculation of which there has been much. Officially the location has remained secret although Brauch points, among other places to, Fischbach near Dahn, Miesau near Landstuhl, and Bad Kreuznach and Rockenhausen in Siegelbach as potential CWs depots. The Headquarters is supposed to be in Pirmasens.[41] A German television documentary identified Fischbach as the main CWs depot, while the Soviets usually argue that at least four depots exist.[42]

According to the DoD, the stockpile in Germany consists only of GB and VX nerve gas 155 mm and 203 mm artillery shells, which CINCEUR (Commander–

[39]Commission, *op. cit.*, p. 21.
[40]Spiers, *op. cit.*, p. 163.
[41]Brauch, *op. cit.*, p. 145.
[42]*Bayrische Rundfunk*, television documentary by M. Plügge, telecast on *Bayern III*, 26 March 1985, 2145–2230 hrs., "*Chemische Waffen in der Bundesrepublik: Protokoll einer Recharche*," as quoted in J.P. Robinson, *Chemical and Biological Warfare Developments: 1985* (London: Oxford University Press, 1986), p. 31.

in–Chief of U.S. forces in Europe) said constituted a two to three day supply.[43] If this were the case, the supply would constitute roughly 435 tonnes of agent, 5850 tonnes of chemical munitions, or 100,000 rounds of ammunition.[44] Overall, some in the U.S. government contend that enough chemical munitions exist to retaliate for thirty days, if five percent of all rounds were chemical. The military does not fully agree with this ratio, preferring instead something in the range of 'several times the five percent ratio.' This could mean that one in every six rounds would be chemical, interspersed with all chemical barrages.[45]

## The New Debate

In the forefront of the new weapons acquisition are the 155 mm howitzer shell and the Bigeye binary VX bomb.[46] Also proposed are chemical warheads for multiple rocket systems.[47] A vastly increased chemical budget was tabled for fiscal year 1986 ($1.3 billion), which encompassed all programs related to chemical warfare. [48] The budget was not without its critics, however, and political battles have raged in Congress. Nevertheless, the military establishment had been waiting since the seventies for chemical re–armament and were prepared to fight this battle

[43]Ibid., p. 33.

[44]J.P Robinson, "An Historical Context for European Chemical–Weapons–Free Zone Concepts, with an account of current European Chemical–Warfare Forces," in Ralf Trapp, ed., *Chemical Weapon Free Zones?* (London: Oxford University Press, 1986), p. 13. Brauch suggests that 100,000 to 300,000 rounds of ammunition are stored in Germany. This would equate to between 700 and 1000 tonnes of chemical agent. Brauch, *op. cit.*, p. 143.

[45]T.S. Gold, statement in Hearings before a subcommittee of the Defense Appropriations for 1984, 98th Congress, first session (12 April 1983), pp. 449–450, as quoted in Spiers, *op. cit.*, p. 165. This would, however, conflict with CINCEUR's statement. Given that an inability to estimate an opponents' stockpile was a contributing factor to non–use and deterrence in W.W. II, we should perhaps be grateful for the confusion.

[46]Hugh Stringer, *op. cit.*, p. 31.

[47]Department of the Army, *op. cit.*, p. 8.

[48]Commission, *op. cit.*, p. 35.

to the finish which, if not successful, could mean the end of the Chemical Corps. Enough concern about Soviet chemical warfare capabilities had been stirred up in the American mind, though, for Congress to approve funding. Interestingly, the military used a relatively simple argument, stating that defensively and especially offensively the U.S. did not possess the adequate deterrent capability to prevent a Soviet chemical attack. The evidence to support this view was flimsy at best; nevertheless, the military successfully linked new munitions to a better deterrent capability as the unitary shells were allegedly no longer able to perform this task.

The fundamental assumption made by American thinkers is easily recognizable. Namely, they believe that the Soviets will use chemical weapons from the very outset of a conflict. The only credible deterrent according to these thinkers is a combination of good protective measures and an all encompassing retaliatory capability, hence the need for binaries. Modernization will provide for the strengthening of a faltering deterrent. To prevent any escalation and terminate a chemical war at the lowest possible level, the retaliatory capability must span the whole range of a potential operational theatre.[49] This is used as the justification for the introduction of both binary 155 mm artillery shells and the Bigeye bombs as the current stockpile consists, in part, of 105 mm howitzer shells, which the U.S. army is phasing out and replacing with the 155 mm.[50] Thus, chemical stocks are avail-

[49]General Lynwood B. Lennon, "Defense Planning for Chemical Warfare," in Matthew Meselson, ed., *Chemical Weapons and Chemical Arms Control* (Washington, D.C.: Carnegie Endowment of International Peace, 1978), pp. 3–5.

[50]According to former Secretary of Defense, Harold Brown, the 105 mm only represented a limited retaliatory capability and by the early eighties, only eight 105 mm howitzers were still deployed with the U.S. Army in Europe. Harold Brown, testimony before the Senate Armed Services Committee, 4 September 1980, p. 13, as quoted in John Tower, "The Politics of Chemical Deterrence," *Washington Quarterly* (Volume 5, number 2, Spring 1982), p. 30.

able but there are no guns to actually fire them! Currently, retaliation is limited to localized strikes as the howitzer's range is a maximum of 17 km. The Air Force possesses 590 kg spray tanks for deep strike targets but such missions could only be flown at great physical risk to the pilot and aircraft. The pilot must fly (usually a F–4 Phantom) a steady and consistent course at a speed of no more than 300 kts and at a height below 500 ft; in light of probable anti–aircraft activity this would make for a very unpleasant experience.[51] Implicit throughout the discussion of an outmoded stockpile and the need for a modern one is a shift in emphasis from a purely defensive retaliatory and/or from a retaliation–in–kind capability to an offensive warfighting strategy.

The current inventory consists of chemical munitions incompatible with modern combat doctrine. Though some artillery rounds contain non–persistent GB, the majority of the 105 mm and 155 mm contain persistent mustard gas or VX, both of which are basically area–denial weapons and are thus a hindrance to an enemy advance. The long range retaliatory capability consists of GB bombs, which again are practically useless against hardened or protected targets because the persistence of a lethal dose is measured in minutes. The current situation would require a strictly defensive retaliation, otherwise friendly forces would run into their own contamination. Consequently, the new stockpile will have short range artillery rounds (22 km) with GB and long range aerial bombs and missiles with persistent VX.

[51]The spray tanks cannot be fitted to anything more modern than the F–4, which is being phased out. Commission, *op. cit.*, p. 23. The Air Force also has the MC–1 750 lb gravitational bomb and the Navy stocks the Weteye 227 kg bomb, both of which are filled with non–persistent GB. Macha Levinson, "Chemical Deterrence: Will it work," *International Defense Review* (Volume 19, number 6, 1986), p. 733.

In terms of manpower, U.S. chemical forces in the late seventies were still numerically far behind, having roughly 4,000 specially trained Nuclear–Biological–Chemical (NBC) troops available.[52] By 1985, this figure increased to 9,000 specialists plus 11,000 in the reserves and national guard, yet even this increased size is miniscule in comparison to the Soviets.[53] Each Regular Army Division is supposed to include a chemical defense company with seven officers and 109 enlisted personnel, and is supposed to perform the tasks of chemical reconnaissance and decontamination.[54]

U.S. doctrine has been modified to accommodate a broad spectrum of technology, including CWs, thereby attempting to integrate them into the overall force structure. Rationales were publicized declaring the possible uses in front–line situations such as using CWs in areas that would be difficult to traverse if destroyed by conventional or nuclear means, or for "softening up" positions that would need to be taken relatively intact.[55] Such conceptual notions have to some degree been formalized in the Army's Operations Manual FM 100–5, which indicates the use of CWs as one of many weapons employed to achieve victory. At the core of the manual is the idea of Air–Land–Battle, one component of which is the deployment of CWs in offensive operations, both at the front and far behind the lines. Such an interpretation could require U.S. first use.[56] Former Supreme Allied Commander

[52]H. Stelzmüller, "NBC Defense: A German viewpoint," *International Defense Review* (Volume 11, 1982), p. 1574.

[53]Commission, *op. cit.*, p. 26.

[54]Bay, *op. cit.*, p. 31.

[55]Hoeber and Douglass, Jr., "*Das Problem...*, *op. cit.*, p. 490.

[56]Department of the Army, FM 100–5, Operations (Washington, D.C., 20 August 1982), pp. 1–19. To support his interpretation Schwarz quotes section nine of FM 100–5 which states that the prudent use of either nuclear or chemical weapons would ensure success during the attack. "*Mit genügend Unterstützung durch nukleare oder chemische Kampfmittel kann die Ausbeutung des*

in Europe, General B.W. Rogers, stated emphatically that the Air–Land–Battle doctrine does involve integrating nuclear, chemical, and conventional weapons *but in NATO* "...we separate weapons of mass destruction from conventional. Any time a nuclear or chemical weapon is to be used, the authorities must authorize it. Not just the initial use, but every subsequent use has to be authorized."[57]

Whether or not the new stockpile and strategy will perform their function and deter the Soviets from initiating chemical warfare remains to be seen. The proponents of binary munitions argue that in addition to safer handling and improved environmental protection, the munitions would be more in line with current military doctrine, thereby increasing the credible threat of retaliation. Opponents indicate that a modern stockpile does not necessarily correspond to a stronger deterrent, especially when deep–strike chemical attacks may escalate the situation or even trigger a nuclear response. The disagreement does not specifically lie in the issue of whether a credible deterrent *vis à vis* a chemical stockpile is necessary, but rather how the utilization of such a stockpile can efficiently deter first use.

> Though it is far from ideal, the United States does possess some short–range retaliatory capability in the present unitary artillery shells. If the sole measure of deterrence were to be able to force the enemy to the impediment of wearing protective clothing, to a degree that exists now.... If the means of deterrence includes the ability to retaliate effectively throughout the depth of the battlefield, that capacity is lacking.[58]

Ironically, the U.S. modernization program is heading in the same direction the Soviets have already taken and are being accused of, namely the capacity to strike

*Angriffserfolges kurz nach dem Angriff selbst beginnen." Ibid.*, pp. 1–19, in Wolfgang Schwarz, "*Binärwaffen—chemische Kampfstoffe im Konzept der USA für offensive Kriegführung,*" *Institute für Internationale Politik und Wirtschaft der DDR* (Volume 13, number 3, March 1984), p. 5.

[57]Bob Fulong and Macha Levinson, interview with General B. Rogers, *International Defense Review* (Volume 19, number 2, 1986), p. 151.

[58]Commission, *op. cit*, p. 47.

above the level that "the other side" deems to be sufficient retaliation. However, this posture exemplifies the deterrence lessons noted in earlier chapters, namely of requiring a deterrent that is not simply retaliatory but escalatory in nature. Even though the notions are similar, deterrence at the chemical level is different than at a nulcear level. Chemical escalation is guided by the recognition that assured destruction of an opponent's economic and military infrastructure is neither a function nor a practical consideration of a chemical deterrent regime. The consequences of nuclear escalation, on the other hand, could result in the annihilation of a nation–state.

### 3.1.2 Chemical Warfare and the Soviet Union

The vagaries of western analysis can easily be forgiven since virtually nothing in the Soviet open literature has been published on the USSR's chemical warfare posture. The chemical force structure is a formidable one, its level of integration is second to none. Current Soviet posture is rooted in the historical experience of being inadequately protected against gas attacks during W.W. I, wherein the Soviets sustained proportionally higher casualties than her Western Allies.[59] Though not attempting to present this historical fact as a *de facto* justification for the existence of 60,000 chemical troops, it does indicate the *raison d'être* behind Soviet emphasis on CWs. The precedent of being caught unaware and ill–equipped has molded Soviet thinking into preparing for the worst possible case scenario—fighting in a contaminated environment. The uneasiness felt by the Soviet leadership through-

[59]Out of the 475,340 gas casualties, 56,000 died. Prentiss, *op. cit.*, p. 635. Due to poor Russian records the statistics remain suspect, yet are generally accepted figures.

out W.W. II over potential German use was vindicated in the discovery of a nerve gas plant on the Polish border in 1945.[60] The 1950s and 1960s saw a U.S. preponderance in both chemical and nuclear weapons production and contributed nothing to lessening Soviet national insecurities. The Soviet military reorganized in 1959 and created specialized chemical units "...as a major component of the Soviet Special Troops under the command of senior generals responsible to the Ministry of Defense."[61] Since then, the Soviets have continued to develop and integrate both defensive and offensive chemical capabilities into their force structure, while the U.S. eventually switched to a self-imposed moratorium, allowing its chemical branch to wither away until the recent revival.

### The Soviet Stockpile

As with the U.S. stockpile, much mystery surrounds the true size of the Soviet stockpile—perhaps more so. Before this year, the Soviets themselves had not openly commented on their chemical capability since 1938; therefore, all information on this subject has been published in Western sources.[62] Estimates on their stockpile range from 27,000 tonnes to 630,000 tonnes of agent.[63] The huge disparity is not surprising as estimates are, in part based on apparent production capacities and storage facilities. The extremely high figures are due to the inclusion of all chemical production since the First World War. The Soviets apparently possess a vast array of chemicals ranging from the classic toxic agents AC, phosegene, and

[60]K. Clarke and J.H. Turnbull, "The Chemical Battlefield Part One: The Soviet Threat," *Defence* (Volume 15, number 2, March 1984), p. 124.

[61]*Ibid.*, p. 123.

[62]J.P. Robinson, "Chemical Warfare Capabilities....," *op. cit.*, p. 10.

[63]Amoretta Hoeber, *The Chemistry of Defeat: Asymmetries in U.S. and Soviet Chemical Warfare Postures* (Washington, D.C.: Institute for Foreign Policy Analysis, Inc., 1981), p. 43.

mustard gas, to the nerve gases GB, GD, VX, and VR–55, a thickened Soman.[64] The French document the Soviets as possessing 360,000 tonnes of chemical agents, or roughly thirty percent of their munitions.[65] A British military analyst credits the Soviets as having "...as much as fifty percent of all filled munitions for missiles and bombs stockpiled by Warsaw Pact forces in Central Europe."[66] The British government, on the other hand, estimates 270,000 tonnes, markedly less than the other estimates.[67] Finally, the West German government estimates that the Soviet Union has 200,000 to 700,000 tonnes of chemical munitions with the capacity for yearly production of another 30,000 tonnes of munitions,[68] thus managing the diplomatically correct if statistically nonsensical position of having both the highest and the lowest estimates.

The American government has traditionally reserved any public judgements on the size of the Soviet stockpile for the simple reason that no decent estimate exists. This statement view echoed former Secretary of Defense Brown while testifying before the Senate Armed Services Committee. Gary Hart, then Chairman of the Senate Armed Services Military Construction Subcommittee, pointed out that much has been said about the apparent massive Soviet chemical build–up but not

[64]Clarke and Turnbull, *op. cit.*, p. 124.

[65]J. Chaumont, Report to the Senate on behalf of the Commission of Foreign Affairs, Defence and the Armed Forces, *Doc. Sen.1^e s.o. 1981–1982, Tome VI, No. 61; 23 Nov. 1981*, p. 44 and p. 46, as quoted in SIPRI, *World Armament and Disarmament Yearbook: 1983* (New York: Taylor & Francis, Inc., 1983), p. 403.

[66]John Erickson, "The Soviet Union's Growing Arsenal of Chemical Warfare," *Strategic Review* (Fall 1979), p. 65.

[67]British White Paper for Defence, *Statement on the Defence Estimates 1982.* Cmnd 8529–1, pp. 21–22, as quoted in SIPRI, Yearbook 1983..., *op. cit.*, p. 403.

[68]Hans Ruhle, "*Chemische Waffen und europäische Sicherheit 1980–1990,*" *Europäische Wehrkunde* (Volume 27, number 1, January 1978), p. 6.

one bit of concrete evidence exists to support this view.[69] In addition to the lack of Soviet information, one major cause for vastly differing western estimates is based on what the analyst chooses to include as part of the stockpile since, "...the Soviets include smoke, incendiary and all non–lethal agents under chemical weapons, whereas the U.S. does not. Smoke munitions alone could account for the wide difference in western estimates."[70] All this speculation was thrown into high relief and confusion by the Soviet's highly political move of announcing the size of their stockpile as not exceeding 50,000 tonnes, all of which is stored on Soviet soil. The Soviet Foreign Ministry dismissed western estimates as "fantastic."[71] Fifty–thousand tonnes would imply the Soviet arsenal is only twice as large as the U.S.'s based on the smallest estimates (25–36,000 tonnes), about half the size based on Soviet estimates of the U.S. stockpile (90,000), or a mere fraction using the high estimates of 400,000 tonnes. While many applauded the Soviet move as indicative of an openness to arms control, it nevertheless adds to the confusing welter of numbers bandied about by both sides.

## Soviet Chemical Warfare Organization

Of more interest and perhaps more concern than the polemical debate on stockpile size is the Soviet chemical warfare organization. There exists widespread agreement about the highly diverse means available to the Soviets for the deliverance of chemical agents.

> The Soviets possess the ability to attack NATO throughout its operational depth with agents more or less tailor–made for the task...

[69]Center for Defense Information, *op. cit.*, p. 4.

[70]C.N Donnelly, "Winning the NBC War: Soviet army theory and practices," *International Defense Review* (Volume 14, number 8, 1981), p. 990.

[71]"Soviet Foreign Ministry Statement," *Jane's Defence Weekly* (Volume 19, number 6, 13 February 1988), p. 278.

> Basically, any mortar or artillery piece over 100 mm calibre is suitable for chemical delivery;....[72]

The organization responsible for chemical warfare, the VKhV (*Voenno Khimicheskaya Voiska*) is headed by a three star general and numbers more than 45,000 officers and men in the ground forces alone, with 30,000 decontamination vehicles at their disposal.[73] "From the defensive standpoint, the Soviet armed forces are better trained and equipped for operating in a chemical–biological–radiological (CBR) environment than any in the world."[74] During wartime, this cadre force of 45,000 men can be expanded to 80,000 or even 100,000 men. Each Soviet Motor Rifle and Tank Division has a chemical defence battalion with 170 men of all ranks and 66 vehicles, 33 of which are decontamination vehicles. Each regiment has a chemical defence company consisting of 26 men of all ranks and six to seven decontamination vehicles.[75]

The huge number of personnel involved in the VKhV is in reality somewhat misleading as the majority of troops are earmarked for decontamination duties. Yet, it would be foolhardy simply to equate them to a vast janitorial service because decontamination is only one aspect of their duties. They are also responsible for chemical reconnaissance, the operation of smoke generators and flame throwers, and target identification for chemical attacks.[76]

---

[72]C.J. Dick, "Soviet Chemical Capabilities," *International Defense Review* (Volume 14, number 1, 1981), pp. 33–35.

[73]Directorate for Scientific and Technical Intelligence of the Defense Intelligence Agency, *op. cit*, p. 19.

[74]U.S. Congress, House Committee on Armed Services, Statement of General S. Brown, (USAF), Chairman, Joint Chiefs of Staff, *Hearings: Military Posture and H.R. 11500 (H.R. 123438), DoD Authorization for Appropriations for Fiscal Year 1977*, 94th Congress, 2nd Session, 27 January 1976, p. 445, as quoted in Carpenter, et. al., *op. cit.*, p. 3.

[75]Dick, *op. cit.*, p. 33.

[76]Bagwax, "Chemical Weapons: Time for a Fresh Look," *British Army Review* (Number 67,

Reconnaissance plays a key role as it is vital to receive prompt and accurate information along the entire front and depth of the operational area. Besides the timely warning of an approaching vapour hazard, contaminated areas must be clearly marked and the level of contamination continually assessed, to allow for the continued rapid advance so essential to Soviet doctrine.[77] Progressive reconnaissance would curtail combat degradation because troops would only be required to don their masks and suits once the battalion commander has determined the appropriate level of protection for his particular section of the front.[78] This is quite unlike NATO, which goes on general alert along the entire front. Thus the vast and comprehensive "janitorial services" available are geared towards the minimization of time spent in protective suits. Decontamination of equipment is also achieved as rapidly as possible using various decontamination apparatuses; vehicles can be cleaned within one to three minutes depending on vehicle type and level of contamination.[79] The only true and effective method of decontamination is through natural degradation. "This would reduce the hazard, but it is a time consuming process and would greatly hamper military operations."[80] Essentially then decontamination is always time consuming and never absolute and represents another variable that military planners must consider in any use of gas in war.

---

1981), p. 6.

[77]Spiers, *op. cit.*, p. 123.

[78]"Warning of an imminent hazard is given to sub-units (battalions) by a single type of signal laid down by the unit or formation commander in his standing order....These signals are *not* commands but are the basis for commanders to issue orders for the soldiers to put into effect some kind of protection....The battalion commander will have laid down procedures to be followed on receipt of each warning, and it is the duty of subordinate commanders to issue appropriate orders to the troops. Donnelly, *op. cit.*, p. 992.

[79]Dick, *op. cit.*, p. 35.

[80]United Nations, Chemical and Biological..., *op. cit.*, p. 25.

## Soviet Doctrine

What does the Soviet chemical potential indicate to western observers? The answer is quite simple, very little. In deducing intentions from capabilities, many analysts have viewed the defensive aspect as being part of a broader strategy, of rapid decontamination allowing for fluidity of battle. The methodology western analysts use in an attempt to deduce Soviet intent is perhaps most succinctly summarized by a defence specialist who stated:

> Assessing the Soviet leadership's view requires interpretation of indirect references, subtle nuances, and surrogates when trying to decide whether offensive use of chemicals in a non–nuclear war would be authorized. I do not know if there are circumstances in which authorization would be predelegated to field commanders or at what level of command. I suspect there might be, but little can be asserted with confidence. Perhaps such doubt is a Soviet objective.[81]

Recent Soviet exercises have included CWs without the use of nuclear weapons which suggests that CWs are now part of the conventional force structure and therefore, militarily at least, not considered weapons of mass destruction.[82] This would indicate that Soviet doctrine views CWs as less escalatory and hence, in the event of a NATO/WTO war, the full weight of the Soviet military would be brought to bear in concurrence with the doctrine of achieving rapid victory. This perception would automatically bring the notion of a first strike using CWs into the forefront.

> A war must be conducted decisively, using the necessary forces and means to achieve political and military goals. The need for success

[81] Allen S. Rehm, *Soviet Capabilities and Doctrine for Chemical Warfare* (McLean, VA: Foreign Systems Research Center Science Applications, Inc., 2 January 1984), p. 6, in Gay M. Hammerman, *Implications of Present Knowledge and Past Experience for a Possible Future Chemical/Conventional Conflict* (Fairfax, VA: Historical Evaluation and Research Organization, 1 April 1984).

[82] *Ibid.*

> is incompatible with the requirements for limiting the scale of combat operations.[83]

Perhaps, what is stressed most in any official Soviet discussion on offensive operations is the imperative of using overwhelming numbers and surprise. If anything is to be gained from the study of past chemical battles, it is that the first attack will probably be the most effective and that therefore, logic would dictate that the attack should consist of a theatre wide, indepth mass chemical *surprise* assault. Slowing down or even paralyzing the enemy could possibly conclude the war more quickly and forestall the eventuality of a nuclear attack, especially in a NATO confrontation. Yet, it is precisely the idea of a surreptitious attack that has caused disagreement amongst analysts regarding Soviet intent to do so. Surprise, so quintessential to chemical weapons' offensive, seems unlikely according to former SACEUR Commander, General B. Rogers, because nineteen divisions in GSFG [Group of Soviet Forces in Germany], augmented by an East German or Polish division would not be enough. Though the Soviets could attempt to "roll-off" an exercise into a full scale assault, western intelligence, already primed, would be sensitive to any out of the ordinary activity. "Forty-eight hours of warning on our side is probably about the worst case."[84] The view that the Soviet Union has a formidable chemical warfare establishment is shared by most, if not all, western analysts. However, disagreement exists both over whether the Soviets really intend to initiate a gas attack and over what is the most effective way to deter the Soviets from ever using CWs. Nowhere else is this debate more heated and politicized than

[83]V.D. Sokolovsky, translated by Harriet Post Scott, *Soviet Military Strategy* (New York: Crane Russak & Co., 1978), pp. 68-69.

[84]Fulong and Levinson, *op. cit.*, p. 150.

in NATO.

### 3.1.3 The NATO Alliance and Chemical Warfare

NATO has thus far received only cursory attention in this paper. Far from accidental, the intent was to show U.S. and Soviet perceptions and doctrine first, as they can be abstracted from any NATO discussion simply because NATO depends solely on the U.S. chemical deterrent. As well, NATO members are far from unanimous in determining the best solution to the threat. In part, the difficulties in establishing a coherent policy are rooted in the divergent histories of the member states. Of the three key European actors, France, Britain, and West Germany, only France possesses CWs. West Germany declared in October 1954 that it would not undertake the manufacture of any atomic, chemical, or biological weapons. This tenet was formalized and incorporated into the revised Brussels Treaty of 1954.[85] In the late fifties the British government decided not to stock CWs, a policy re-affirmed by the Defence Ministry in 1968.

> We have not felt it necessary, nor indeed did the previous government, to develop retaliatory capability here, because we have nuclear weapons, and obviously we might choose to retaliate in that way if that was the requirement.[86]

The non-armament policy for chemicals is reviewed every two years and could be changed if the political will is strong enough. In 1984 parts of the proceedings of a secret ministerial meeting were leaked causing a row between Prime Minister

[85]Robinson, SIPRI, volume 1, *op. cit*, p. 191.

[86]Secretary of State for Defence (D.W. Healey), statement before the House of Commons, Select Committee on Science and Technology, *Defense Research* (Second Report, Session 1968-69; HC 213, HMSO, 1969), p. 446, as quoted in Robinson "NATO CWs...," *op. cit.*, p. 4. Between 1945 and 1957, Britain disposed of roughly 171,000 tonnes of chemical weapons, primarily through ocean dumping. SIPRI, volume 1, p. 305.

Thatcher and the press compelling the government to re–affirm adherence to non–armament in July 1986.[87] Of the other member states, eight signed the Geneva Protocol without reservations while Belgium, Canada, and the Netherlands have reserved the right to retaliate even though they do not currently have the capability to do so.[88]

France's position on CWs further complicates NATO's attempt at a cohesive policy. The rather enigmatic stance France has decided to uphold within NATO is also reflected in any analysis of its CWs posture. The French government has never disclosed the size of its stockpile although estimates teased out of the open literature suggest anywhere from 1000 tonnes to 3000 tonnes of nerve agent.[89] There is even a suggestion that the French stockpile is equivalent to that of the American one stored in Germany. Accordingly, France might have the ability to fire 5000 gas shells per day for six months, assuming that ten percent of all its shells were nerve gas munitions.[90] Politically, however, France has stated its willingness to rely instead upon on nuclear countermeasures to deter a Soviet chemical attack.[91]

[87]Apparently, at the meeting, there was some intent to force through a decision to renew the manufacture of chemical weapons. D. Campbell, "Touching Mrs. Thatcher on a raw nerve," *New Statesman* (11 January 1985), p. 4. Conflict between elements of the government and military does exist on this issue as was clearly seen when Sir Geoffry Howe stressed that the government remained committed to an international CWs arms control agreement but was contradicted by Sir Martin Farndale (Command of the 1st British Corps in Germany) when he suggested that Britain should consider producing its own stockpile. D. Campbell, "Thatcher goes for nerve gas," *New Statesman* (18 January 1985), pp. 8–10.

[88]The countries that signed the Protocol unconditionally are: Greece (1931), West Germany (1929), Iceland (1967), Italy (1928), Luxembourg (1936), Norway (1932) Denmark (1930), and Turkey (1929). J.B. Neilands, et. al., *op. cit.*, pp. 210–211.

[89]Brauch, *op. cit.*, p. 141.

[90]*Ibid.*, pp. 140–141.

[91]M. Lavaudaire, "*La menace chimique [part 1]: données militaires et aspects diplomatique*," *Défense nationale* (December 1985), pp. 127–136, as quoted in J.P. Robinson, Chemical and Biological..., *op. cit.*, p. 35.

As to how credible the nuclear threat really is naturally remains to be seen. An indication that the French military would rather not rely on that option can be evidenced in their efforts since 1974 to develop binaries.[92] Logic would dictate that, if France truly believed in the nuclear deterrent option, it would forego the incredible expense of independently developing and producing binaries and solely rely on its nuclear deterrent.

## NATO's Chemical Weapons Posture

NATO's posture depends primarily on interpretations of Soviet capabilities. Thus, scenarios play a crucial role in identifying assumptions about Soviet doctrine, about use of equipment, and about the possible reaction of NATO troops. The scenarios envisioned are often colourful and imaginative stories, yet grounded on some facts. To some degree, these scenarios or vignettes are designed to inform and to dramatize NATO's precarious position. The following vignettes are just a few examples of how military analysts perceive a potential attack, using a more literary style.

> ..., in the light from the explosions Barnes noticed a small group of airmen suddenly seize their throats and crouch over with convulsions. Strange, Barnes thought, but darkness returned to the scene as his attention was immediately drawn elsewhere. Again, a flashing light outlined the small group near the tower. Now they were writhing on the ground and each man seemed to be gasping for air. "My God, it must be gas! A chemical attack!" [With dread] Barnes remembered he had taken his chemical protective gear to the barracks two days ago to mark the mask with his name. The seriousness of his situation now began to become clear. He was horrified and looked about wildly for additional clothing. There was none available. In fact, two others in the tower were in the same predicament. Almost immediately Barnes' eyes began to burn and he felt a tightness in his upper chest and throat.

[92]Brauch, *op. cit.*, p. 140.

> In only a second or two more, he began to have difficulty breathing and felt extremely nauseous. In his final moments of consciousness he took one last look around the field from the tower. The hangars, shops, barracks, refueling pits, fuel storage areas, ordnance storage areas were all damaged. Fire and smoke were everywhere, and the gas emanating from the chemical warheads had begun to take a terrible toll. Air operations ceased. The wounded and dying were rapidly succumbing to the chemical agents. Very few of the base personnel had managed to get into their protective gear in time. Darkness made the visual detection of of any chemical impossible and there were too few detectors on the base.[93]

This vignette described an attack on a NATO base somewhere in Southern Europe as portrayed through the eyes of a Petty Officer. The attack came from Libya.

The next scenario is supposed to illustrate the degradation of combat effectiveness even though unit was warned and prepared.

> The field artillery weathered the chemical strike better than most other elements of the 3d Armored Division. The 3AD imposed severe restrictions on firing from main battle positions until absolutely necessary and many batteries had not fired, and therefore, had not been located by the enemy. Most of the batteries that had fired were attacked heavily with semipersistent agents and several "suspect areas" were subjected to semipersistent agents resulting in the partial coverage of a few others. The immediate impact was not overwhelming, but it was serious. Soldiers were very tired from their actions earlier in the day. Many were sleeping with protective equipment strewn haphazardly, nearby but not handy.
>
> Word that a massive chemical attack had been launched resulted in a great hustle to get in a proper posture. Panic was the exception because these troops had been in battle and the nature of the battery positions permitted junior leaders to exert positive control and direction. Nevertheless, continuing the battle in protective ensemble began very soon to create serious heat casualties. From the time of the Soviet attack, the field artillery worked and fought at a fever pitch and the

[93]General Frederick J. Kroesen (Ret.), et. al., *Chemical Warfare Study: Summary Report* (Bethesda, MD: Institute for Defense Analyses, February 1985), p. 4.

> effort of handling tons of ammunition proved soon to be beyond the physical capacities of the soldiers. The sustained firing rate dropped to only 25 percent of that expected. Normally, the firing rate is limited by the heating of cannon tubes, but the tired troops, debilitated by the heat buildup in their protective clothing, could not fire fast enough to overheat the cannons. This condition resulted in a significant degradation in field artillery performance. Difficulty in seeing with masks on and the difficulty of talking through the mask added to this degradation.
>
> The Soviets were aware that their chemical strike had not hit a high percentage of the artillery batteries, and so in the hours that followed, as they located these positions, they included chemicals in the concentrations of their counterbattery fires. This, of course, kept the NATO field artillery personnel in their protective ensemble all the time.
>
> Within 24 hours, the artillery men ran into another problem. Ammunition at their supply points had been subjected to chemical attack and the result was the forward movement of contaminated ammunition. The paucity of decontamination equipment resulted in a Hobson's choice between accepting contaminated ammunition or not receiving any at all! Contaminated ammunition posed a problem for firing units. They had no on-site capability to decontaminate arriving ammunition, therefore, to unload, store and fire it required troops to be in the full protective ensemble, a very serious problem in the hours that followed....[94]

The well known author and military analyst General Sir John Hackett wrote the next plausible version of a Soviet attack on NATO in which chemicals were employed from the outset.

> In the NORTHAG [Northern Army Group] sector none of the national corps possessed a chemical offensive capability.... There was now widespread use by the enemy of chemicals to support attacks against NORTHAG, principally launched in BM-21 rockets. These equipments operated in battalion groups of eighteen which, when fired in unison, were able to land 720 rockets on a square kilometre within fifteen seconds. The warm weather was ideal for the use of non-persistent agents

[94] *Ibid.*, pp. 7-8.

such as HCN (Hydrogen cyanide). This has a hazard duration of only a few minutes at 10 degrees C in moderate wind conditions with rain, or at 15 degrees C in sunny conditions with a light breeze. Soldiers not wearing respirators within the target area died within a few minutes of inhaling the vapour. The agent evaporated so quickly that Soviet assault troops would be able to move through the target area with only minor precautions. Despite peacetime training, Allied casualties in forward areas as the offensive opened were considerable.

At the same time, major airfields were attacked with chemical agents (usually mustard, or G– or V–type nerve gases) delivered by missiles, each one of which could put down sufficient of a persistent agent to cause severe disruption over the whole airfield complex. Ground crew were forced to wear full personal protective equipment to carry out maintenance and aircraft refuelling and re–arming. This severely handicapped their performance and increased aircraft turn–round times significantly.

Major logistic installations and communication points, where large numbers of the civilians operating them had no protective equipment, received similar treatment. Physical removal of persistent agents was virtually impossible while further missile attacks maintained a high level of lethal contamination. Such attacks upon airfields and logistics installations caused more prolonged disruption than sustained high–explosive bombardment. ...[For days later]...the continued enforcement of chemical defensive measures upon NORTHAG was beginning to cause concern, and pressure from field commanders for some form of retaliation grew. [Authority to release CWs was issued to local commanders.] ...a quantity of US 155 mm chemical ammunition was released to the gunners of the British and German divisions of NORTHAG.

*Phantoms* [fitted with spray tanks] attacked second echelon and reserve Soviet divisions with extensive and heavy concentrations of persistent lethal agents. These attacks forced Soviet units into unplanned moves. The personal protective equipment used by Soviet soldiers was not suitable for prolonged wear and under continued attack by persistent gases grew almost intolerably irksome.... On balance, Soviet commanders considered a chemical exchange to be to their disadvantage, and since the Allies adhere to the rule of only using chemical agents in retaliation, their use on the battlefield, as distinct from the rear areas, soon declined.[95]

[95]General Sir John Hackett, *The Third World War: August 1985* (Toronto: Thomas Nelson & Sons (Canada), Ltd., 1979), pp. 182–183 and pp. 201–203.

Finally, civilian German analyst Brauch's scenario suggests that in a hypothetical NATO/WTO confrontation, the Soviet attack started in a massive chemical assault. During the fourteen day conflict chemicals were employed with the Soviets using roughly 1000 to 2000 tonnes of agents, while NATO expended over 100,000 rounds of binary munitions. Civilian casualties were excessive in comparison to the military ones.[96]

These scenarios represent classic perceptions of how a chemical war will be fought. A number of similarities are evident in each, such as: surprise; the use of gas against an unprepared opponent; the notion of combat degradation; the perceived tactical utility of using gas against airfields, ports, and nuclear ammunition dumps; and the softening up of strongpoints to allow for a breakthrough. There is an attempt to use the lessons of W.W. I and apply them to the Third World War, while at the same time an effort is made to resolve the dilemma of W.W. II—namely how to integrate CWs into mobile warfare. Yet surprisingly, many of the crucial historical lessons went unlearned, with the exception of Hackett's scenario which clearly recognized that retaliation–in–kind does not work as a deterrent. In his scenario the Soviets ceased to use CWs not because of retaliation–in–kind, but because the U.S. escalated by attacking second echelon and reserve divisions. In this instance, retaliation did exactly what it was supposed to do, stop a chemical war at the lowest possible level.

It is the contention of this paper that the ability to remain at a certain level of chemical exchange seems highly unlikely even though the scenarios suggest otherwise. Since the initial attack will in all likelihood be massive, a consequence of

[96]Brauch, *op. cit.*, p. 60.

the properties of CWs, the retaliation to follow would have to be of greater magnitude, or more strategic in nature; otherwise, the initiator may easily accept the immediate risk of in–kind retaliation as the price to be paid for attaining a goal. In addition, first use would clearly be a breach of convention and would therefore, reduce the constraint barriers even more. In other words once the "chemical Rubicon" has been crossed, it seems imperative to continue to escalate since any retaliation, regardless of level, can be justified as in–kind retaliation and only escalation holds out the promise of a quick end. But if both sides perceive this to be the case, the option to return to the *status quo* is forfeited as a result of the inherent escalatory nature of CWs. Simply stated, if pre–war deterrence fails and the first round of chemical attacks and counter strikes fail to initiate intra–war deterrence, further escalation is the likely outcome.

As noted in the scenarios, NATO response to a chemical attack might be difficult to agree upon. This is partly due to the fact that the current overall strategy from which NATO's chemical warfare policy is derived is that of flexible response and forward defence, as stated in NATO Military Document MC14/3, adopted in December 1967.[97] Although it is a secret document, over the years enough

[97]Robinson, NATO CWs..., *op. cit.*, p. 6. The main features of MC 14/3 were described by the U.S. Department of Defense as follows: "Forward Defense reflects NATO's collective commitment that any aggression will be met by an immediate and effective NATO military response to prevent an aggressor from seizing and holding NATO territory. The Flexible Response strategy reflects NATO's determination to prevent a potential aggressor from predicting with any confidence NATO's specific response to aggression. Flexibility in the range of response options available to NATO Authorities, supported by a credible military capability across the full spectrum of the NATO triad [of conventional, non–strategic nuclear [NSNF] and strategic nuclear forces], creates uncertainty for a potential aggressor, forcing him to conclude that incalculable risks would be involved. Flexible Response provides for three types of response to aggression in which NSNF have a central role: Direct Defense, Deliberate Escalation, and General Nuclear Response (GNR). The capability for engaging in selective use of NSNF in Direct Defense and Deliberate Escalation, together with the ultimate response of GNR (in conjunction with other U.S. strategic forces) presents the

has been gleaned from it to form a clear idea of the provisions regarding CWs. A passage in the 1983 German Defence White Paper also has been cited as expressing NATO policy on CWs.[98] The white paper states that a chemical weapons threat does indeed exist; therefore, Germany and its Allies consider it indispensable for NATO not only to have defensive capabilities against CWs but also to maintain the capacity for reprisals, albeit limited in size as conventional and nuclear forces are the primary means to deter CWs. This should deter any aggressor from violating international law by initiating a gas attack.[99] The chemical weapons' provisions in the document concentrate on deterring a chemical attack and say nothing about actually initiating one. Simply stated, the chemical deterrent component of NATO doctrine is neither at par with conventional or nuclear deterrence, nor is it really part of the overall strategy designed to deter the WTO. Instead, U.S., French, and, potentially, British chemical stockpiles—more specifically their retaliatory capability—exist to execute reprisals in the event of chemical deterrence failure. Chemical deterrence is not part of the 'triad' (conventional, non-strategic nuclear,

Soviets with uncertainty as to what NATO's response to aggression might be—any aggression could initiate a sequence of events which could not be determined in advance and which would involve risks out of all proportion to any advantages the aggressor might hope to gain." Department of Defense, *Report on the Nuclear Posture of NATO* (1 May 1984), pp. 4–5.

[98]Department of Defense, Office of the Assistant of the Secretary of Defense for Atomic Energy, Deputy Assistant for Chemical Matters (T.J. Welch), written answer to a question submitted after a Senate Armed Services Committee hearing on 28 February 1985, in U.S. Congress, Senate, Committee on Armed Services, Hearings on *Department of Defense Authorization for Appropriations for Fiscal Year 1986, part 8*, p. 1557, as quoted in Robinson, NATO CWs..., *op. cit.*, p. 7.

[99]The original German text reads as follows: "*Die NATO stützt sich zur Abschreckung eines Einsatzes chemischer Waffen durch den Warschauer Pakt hauptsächlich auf die konventionellen und nuklearan Kräfte. Dennoch müssen die Streitkräfte der NATO fähig sein, chemische Kampfstoffe zur Vergeltung in begrenztem Umfang einzusetzen....Solange die C-Waffen-Bedrohung jedoch forbesteht, hält die Bundesregierung wie ihre Bündnis partner es für unerläßlich im NATO-Bereich nicht nur die C-Waffen-Abwehrfähigkeit zu verbessern, sondern auch eine im Umfang begrenzte Repressalienkapazität aufrechtzuerhalten, um einen Aggressor von einem völkerrechswidrigen C-Einsatz abzuhalten.*" *Bundesminister der Verteidigung, "Weißbuch 1983: Zur Sicherheit der Bundesrepublik Deutschland,"* pp. 154–155, para. 288.

and strategic nuclear) which is supposed to deter war itself; rather the chemical aspect is to function as an intra–war deterrent. Thus a retaliatory capability exists but does not have to be the primary deterrent against WTO chemical attack. Yet, here lies the inherent contradiction between policy and objective. In accordance with creating uncertainty, MC 14/3 is a set of options. It does not state that a CW attack should be met with in–kind retaliation; rather it identifies both conventional and nuclear weapons as the possible means of response to a chemical attack.

By allowing in–kind retaliation to be optional, NATO countries have over the years become heavily dependent on nuclear weapons. The problem with committing oneself to a highly probable nuclear response is an obvious one, namely it lacks credibility as the deterrent is heavily dependent on the political climate of the time. Moreover, nuclear retaliation would be a disproportionate response. Operationally this would entail the deployment of tactical nuclear weapons to front line units, a move that currently seems highly unlikely in addition to being a security nightmare. As a chemical attack may not be confined to the FEBA (Forward Edge of the Battle Area) but also may reach into the rear areas, nuclear retaliation may necessitate deep strikes "...with the attendant risk of blurring the national boundaries between strictly tactical and theatre–wide use of nuclear weapons."[100] Further damage associated with a nuclear attack would increase the havoc and chaos already associated with conventional war and thus, may not be an attractive option to invoke. Indeed, in terms of recovery from a chemical attack, even from a defensive position, the time taken is far less than from a nuclear attack.

[100]Manfred R. Hamm, "Deterrence, Chemical Warfare, and Arms Control," *Orbis* (Volume 29, Spring 1985), p. 128. Opponents of binaries would agree with Hamm's assessment.

However, implicit throughout the argument of using nuclear weapons is the assumption that the absence of a chemical weapons' retaliatory capability lowers the nuclear threshold level to the point of inducing the use of nuclear weapons much earlier than would otherwise be the case. This, of course, utterly negates the primary directive of MC14/3, the ability to achieve military objectives using CWs and conventional forces.

> For if, having due regard to the present state of the anti–CW protection deployed by both NATO and WTO, the relative ability to achieve those objectives does not obviously favour CW weapons, it would follow that retaliation in kind would make no military sense, either as a deterrent threat or as an operational part of NATO's defence.[101]

Consequently for NATO, the issue at hand is not whether the Soviet Union's chemical posture is a threat to collective security; rather it revolves around the question of which option should be implemented to prevent chemical intra–war deterrence from failing.

## NATO's New Direction

The introduction to this chapter announced that NATO had no CW deterrent policy. The preceding discussion illuminated the conflagration of national policies, while at the same time, suggested that the very flexibility of MC14/3 becomes a liability in implementing a coherent and credible NATO CWs policy. The difficulty in finding common ground is exacerbated by two dominant schools of thought: one proposes the idea of a massive first use of CWs in substitution for nuclear weapons along the entire operational depth of the battlefield; the opposing camp maintains that CW are not central to Soviet strategic planning since the trade–offs involved

[101]Robinson, NATO CWs..., *op. cit*, p. 12.

in using chemicals over conventional weapons are potentially unacceptable. The employment of chemicals in amounts large "... enough to saturate NATO's forward defenses might actually constrain the Pact's offensive by hampering the ability of Pact commanders to sustain a high rate of HE shell fire."[102] Also, hitting selective rear targets may not produce the expected results of hindering NATO's combat operations, while attacking many rear targets may trigger a nuclear response. All these views can be criticized. The first, without any concrete evidence, places too much emphasis on using CWs from the outset, while the second neglects the possibility that under given circumstances CWs, may be a highly valuable asset or even the only alternative to avoiding nuclear weapons. Further, first–strike scenarios may lack precisely what defines them, namely that an attack will be massive and a surprise. If such were to happen, then deterrence of any kind will have been futile. Since CWs are so specialized and so environmentally dependent, and since the risks of invading Western Europe are so high, it seems unlikely that the Soviets would place a high degree of reliance on a weapon which requires the proper meteorological conditions for optimum performance. Recognizing the rather sophisticated anti–chemical protection available to NATO, the use of agents on the front would have to be truly massive. Depending on the depth of the defences, between 45 tonnes and 450 tonnes of Soman would be required along an 8 km front. Using all delivery means available in a Soviet army formation, no more than 45 tonnes could be unleashed within a minute or double that in five minutes. Since all shells would be chemical, there is a strong probability that many targets

[102]The Aspen Strategy Group & The European Strategy Group, *Chemical Weapons and Western Security Policy* (Lanham, MD: University Press of America, Inc., 1987), p. 14.

would go unscathed. The implications are immediate and obvious: against an alert NATO, a chemical attack could be self-defeating.[103]

The high quality anti-chemical defences currently in possession by NATO troops make strikes against rear areas more attractive. In fact, U.S. procurement of the Bigeye bomb is supposed to counter a similar Soviet ability. Here again, skeptics point out that the U.S. may be investing in a weapon which is not particularly cost effective in relation to conventional bombs. Indeed, during a British exercise the airbase at *Bruggen* was under constant simulated chemical attack, yet even while wearing full protective gear, the ground personnel were able to turn around the incoming *Jaguar* aircraft at roughly the same rate. The problem becomes apparent when many of the service functions are performed by civilians who may not be able to sustain work under those conditions due to lack of adequate training.[104] According to the chemical warfare expert Meselson, "even if the Bigeye has been engineered to work well, it is still a lousy weapon" because the mode of delivery is fairly dangerous; "...it is highly predictable just where in the sky the aircraft has to release the Bigeye. That means the Soviets can focus a good share of their radars in that part of the sky."[105] Moreover, a study for the Pentagon by the Institute for Defense Analysis suggested that chemical weapons are not cost effective in comparison to conventional ones when used against airfields.[106] Nevertheless, funding for binary Bigeyes has been secured with full scale production to commence at the

[103]J.P. Robinson, "Chemical Weapons and Europe," *Survival* (Volume 24, number 1, January/February 1982), p. 15.
[104]Ibid., p. 16.
[105]Lois R. Ember, "Pentagon Pressing Hard For Binary Chemical Arms Funds," *Chemical & Engineering News* (25 February 1985), p. 27.
[106]Ibid.

Pine Bluff Arsenal by 1990.[107]

Paradoxically, NATO's chemical weapons' posture has not significantly changed as the result of the U.S insistence on binaries and force goals, since national policies by member states still reflect national versus alliance concerns. Additionally, the agreed upon removal of CWs from Germany has caused serious concern as it is difficult to envision deterrence based on a retaliatory capability when such capability is not at hand but will be flown in during times of "crisis." Though politically a popular move, militarily it was not particularly a wise one, especially after the Department of Defense had been arguing for years in favour of a modern stockpile specifically for a stronger deterrent posture in Europe. In practical terms, the decision means that storage of CWs will be located on American soil; if necessary the CWs are now to be flown over quickly, by keeping them on or near SAC or Military Airlift Command bases. Perhaps too, the munitions will be redeployed on ships. "In that regard, it is essential that the Department of Defense develop detailed and realistic plans for deployment of binary weapons abroad in the event need arises."[108] Not maintaining a chemical weapons' stockpile would certainly enhance the credibility of NATO's no–first–use policy but, bringing in CWs during times of crisis may act as a destabilizer since the action could easily be interpreted as provocative.

Perceptual considerations aside, there are currently a number of practical reasons why "extended deterrence" lacks complete credibility. "Given the other demands that would be placed on US airlift capacity in transition to war, it seems

[107] "Bigeye Aerial Bomb," Jane's, *op. cit.*, p. 278.
[108] Commission, *op. cit.*, p. 63.

questionable whether [CWs] would arrive in time."[109] Robinson used 1983 Department of Defense testimony to the Congress to make a similar assertion. According to these observers, it would take a near Herculean, time consuming effort for the U.S. Military Airlift Command to deliver what the military would consider to be an adequate stockpile. A preliminary 59 sorties (40 sorties for the shells and 19 for the bombs) would be necessary to deliver 22,000 rounds of 155 mm and 1000 Bigeye bombs to European bases. Using all the 234 C–141B aircraft currently available to the U.S. Military Airlift Command, roughly 1618 sorties would be required to deliver half of the currently proposed 1.2 millon 155 mm and 44,000 Bigeye bombs. Under optimum conditions binary munitions could take up to as much as ten percent of the airlift capacity, so that assuming a utilization rate of 12.5 hours per day and one–route stopover between a mid–U.S. airbase and a West European one—120 days would be necessary to deliver the stocks. "It would have to be a very loose definition of 'crisis' for this to be a deployment option on which US forces could rely."[110] Though hypothetical, the statistics do reveal that the positioning of chemicals during times of crisis would add a significant and perhaps insurmountable problem to the overall logistics of organizing U.S. troops for war in Europe. The pre–positioning of component parts would reduce the required sorties but would still necessitate a smoothly functioning logistical system in order to bring the components together and supply the assigned forces with them.

The current debate then is essentially about constructing a doctrine, a conclusion most effectively perceived by one of Britain's defence ministers:

[109]Valerie Adams, "A Retaliatory Chemical Warfare Capability—Some Problems for NATO," *Journal of the Royal United Services Institute* (Volume 130, number 4, December 1985), p. 16.
[110]Robinson, NATO CWs..., *op. cit.*, p. 43.

> No chemical weapons are declared to NATO and no machinery has been established within NATO specifically to decide on the use of U.S. chemical weapons in war. However, were consideration to be given to using such weapons in the NATO area, there would no doubt be consultation at the highest political level.[111]

If nothing else, American interest in chemical weapons and the appropriation of funds for the production of modern binaries has forced NATO leaders to address the issue of chemical armament in a more public fashion. That policy makers were persuaded by the Soviet threat can be seen by NATO's adoption of the U.S. force goal on CWs in May 1986. In essence, this compromise was necessary in order for Congress to release funds and for NATO to consider the highly sensitive issue of chemical re-armament. The bargain struck included among other things European acquiescence to the U.S. chemical force goal and binary production. The other basic elements of the bargain were:

> U.S. withdrawal of existing unitary stockpiles in order to permit their destruction by 1994 along with all existing U.S. chemical weapons as mandated by Congress.....A plan for contingency deployments of U.S. stockpiled binary weapons in times of NATO crisis; and...openness to future opportunities to provide for noncrisis European deployments of binaries, if the political environment or perceived military situation changes.[112]

Whether the perceived threat is in fact plausible has become rather irrelevant since the decision, possibly invoking the dynamics of a classic action-reaction arms race has already been made. In fact, the Soviet Union stated that the introduction of

[111]Great Britain, Minister of State for the Armed Forces, (J. Stanley), written answer, *Hansard*, volume 100, number 36 (25 June 1986), columns 163-164.

[112]Brad Roberts, ed., *Chemical Warfare Policy: Beyond the Binary Production* (Washington, D.C.: Center for Strategic and International Studies, 1987), p. 31.

binaries was part of an overall U.S. strategy of "neoglobalism."[113]

Prior to the binary debate, the U.S. Defense Department spoke of a retaliatory capability not as something designed to ensure large numbers of casualties, but (through the resultant degradation in combat performance) as a means to compel the aggressor to stop using CWs. The introduction of a broad spectrum of binary weapons, however, seems to have supplanted this minimalist approach of off-setting tactical advantages in favour of inflicting punishment, especially against targets vulnerable to CWs.[114] Proponents of binaries naturally argue that rather than attempting to re-define the existing deterrence regime, these new weapons will enhance current deterrence based on in-kind retaliation. This claim finds widespread support since many of the scenarios envisioned view long-range attack against rear NATO installations as highly plausible. Accepting such scenarios, one immediately recognizes the value of the new stockpile as it seems highly unlikely that the Soviets would be deterred if the U.S. lacked the capacity to strike back against targets of comparable value.[115] The retaliatory ability debate, or the concept of deterrence through denial versus deterrence through warfighting escalation, marks the place where NATO policy makers seem to be in a state of flux. One way or the other, NATO has committed itself in the past to placing greater emphasis on the subsidiary option of an in-kind retaliatory capability, which may or may not increase the likelihood of nuclear warfare given the escalatory nature of chemical retaliation. Moreover, if NATO lacks the ability to escalate with chemicals,

[113] "USA criticized over binary warheads," *Jane's Defence Weekly* (Volume 19, number 6, 13 February 1988), p. 278.
[114] Jonathan Dean, "Chemical Weapons in Europe," in Roberts, ed., *op. cit.*, p. 11.
[115] *Ibid.*, p. 12.

the primary escalatory option available, if in–kind retaliation fails to deter further chemical attacks, is the tactical nuclear one. If retaliation–in–kind is necessary it does not, as past interpretations suggest, automatically restore chemical deterrence; indeed the historical record strongly suggests that escalation is the most likely outcome. It must be recognized, however, that deterrence through chemical warfighting escalation does not imply the same end results as warfighting at a nuclear level. Even though the language and notions are similar, chemical escalation is different from nuclear escalation. In the case of the latter but not the former, the conceptual baggage of warfighting deterrence carries with it the ultimate threat of assured destruction—a threat neither credible nor practical at the chemical level.

Implicit throughout the previous pages has been the fact that, for all practical purposes, the difference between capabilities necessary for in–kind retaliation based on the assumptions of enemy first and massive use and actual first use is a tautological one, expect perhaps in scale. A retaliatory capability could easily be nurtured "...to the point where it could support any first–use intentions that may develop."[116] Though, advocates currently are constrained by the political unwillingness to assimilate CWs, there exist no long–run constraints against the acceptance of first–use, even if this lies behind the cloak of in–kind retaliation. Ironically, the lack of assimilation of CWs into the NATO force structure made the in–kind retaliation policy credible whereas the new force goal policy will require political–level action in such matters as:

> forward deployment, chemical weapons release procedure and the development of joint NATO CW–weapons employment doctrine, bringing into existence a real 'NATO chemical deterrent,' not just one that exists

[116]Robinson in Trapp, ed., *op. cit.*, p. 23.

only on paper or under the sole control of one or two member states.[117]

Presently, the mismatch between policy and posture brought on, in part, by contradictory national policies has perpetuated the failure to implement a chemical weapons' deterrent policy as proscribed by MC14/3. Since no chemical forces have been committed to NATO, the "...NATO chemical deterrent is thus a future possibility, not a current reality."[118] If the U.S. and NATO continue on their present course, key lessons from the history of chemical warfare will have been learned because chemical deterrence is best accomplished through a combination of denial and escalatory–retaliatory capabilities. Rather than threatening the forward areas, chemical aggression is more easily deterred by the capability of threatening rear areas such as ports, supply depots, and staging areas. The nuclear option so highly valued in the past, now suffers from a lack of credibility as such an option is likely to cause more problems than were created by the initial chemical attack. Since CWs cannot be abstracted from the national arsenal as nuclear weapons, can the logical solution for achieving an intra–war chemical deterrent is to implement the above mentioned combination although the consequences, if deterrence fails, would be horrific. This particular deterrence regime, bolstered by the high probability of use associated with the implementation of an integrated force structure, gambles on the high cost side of the deterrent equation. Unfortunately, the current European political climate seems to suggest that the modernization requirements so essential to the implementation of the new force goal will be very difficult to achieve. If such is truly the case, NATO's chemical deterrent posture will once

[117] *Ibid.*, p. 24
[118] Robinson, NATO CWs..., *op. cit.*, p. 1

again depend on MC14/3, fraught with all its ambiguities and misinterpretations.

# Conclusion

Using the conceptual framework of deterrence, we have studied the question of the efficacy of CWs. To help our answer, a historical approach was incorporated in order to analyze past utilization of CWs and to provide a number of conclusions relevant for the discussion about the current military status of CWs. Adoption of a military perspective presented the advantage of being able to filter out the intense passions and extreme sophistry prevalent in the literature on chemical weapons. Hence, this paper was hopefully able to draw one's attention directly to the question of the utility of CWs in war. Sadly, however, the answer remains vague and inconclusive, primarily because of the schism within military establishments between those caught up in the bureaucratic inertia of wanting to retain CWs and those viewing CWs as a grotesque perversion on the Elysian Fields of war. For the latter, the time honoured virtues of glory and chivalry on the battlefield were gone, supplanted by a science which "...symbolized the ruthlessness and inhumanity of modern war."[119]

The research indicated that once established, even if only precariously, CWs forced the military to develop appropriate doctrines for their use, many of which are to this day still in dispute. Partly as a result of doctrinal confusion and partly due to public disgust, deterrence became the *modus operandi* of the chemical warfare regime. Governments wished to believe that with a credible stockpile and proper defensive equipment, an aggressor could be deterred from initiating a chemical weapons' attack, as the response would debilitate the aggressor just as much as

[119]Brown, *op. cit.*, p. 10.

the defender, or in essence, neutralize the gained advantage, thus germinating the retaliation–in–kind cult. Prevalent not only throughout the military establishment, this concept also was formalized as a reservation by many of the signatories of the 1925 Geneva Protocol. Since W.W. I, the non–use of CWs consequently has been attributed to deterrence through in–kind retaliation. Unfortunately and perhaps dangerously so, such interpretation negates any recognition that CWs are inherently escalatory in nature. Certainly the historical record of W.W. I bears witness to the idea that retaliation–in–kind is a fallacious notion since, if correct, British retaliation would have deterred further German use. Instead, the Germans initiated retaliatory strikes of their own, ushering in a type of warfare they soon lost control over. Neither side was able to stop escalation and to return to a more 'conventional' mode of warfare.

Paradoxically, the belligerents continued escalating both the quality and quantity of agents in the mistaken belief that if only the proper combination between HE and gas shells could be found, gas could make a difference in battle. Considerable controversy still abounds over the question of the tactical benefits of employing gas. Beyond doubt, the April 1915 Ypres gas attack enabled Germany to capture territory which it otherwise probably would not have gained. Whether or not the capturing and holding of the territory for nearly two years was worth gas is another question.

Apart from first attack, jarring discrepancies *vis á vis* the effectiveness of chemicals remain. The capture of Riga in 1917, the March–April 1918 German offensive, and the slowing down of the massive Allied counter–attack of September–November 1918 are only a few examples in which disagreement exists, contributing to some de-

gree to the 'mystique' of CWs.[120] The occasional, localized gas successes suggested that, if gas discipline were careless and the soldiers inexperienced, gas casualties were relatively high. The evidence tends to indicate that gas, especially during the latter part of the war, served for little more than harassment and reconaissance raids. So voluminous was the overall ammunition expenditure that gas shells represented only a small percent of all the ammunition used during the war, and gas casualties made up only a small percent of all casualties. Hence, the main conclusions drawn from the W.W. I experience were: tactical surprise was imperative but even so, tactical use was limited; the retaliation–in–kind regime did not function; and continued chemical attacks led to escalation.

The Second World War is always held forth as a shining example of the success of deterrence through retaliation–in–kind. While this conclusion cannot be ruled out entirely, it cannot be the sole reason since there were numerous occasions in which gas could have been employed without the fear of a damaging response from the enemy. Moreover, a plethora of other reasons for non–use also existed. Constraints, ironically enough, were often self–imposed as military preparedness and doctrine lagged behind technologies conducive to a fluid battlefield. Except for HCN and Tabun, the majority of the gases available were slow acting casualty–producing agents well suited for a static but not for a mobile form of warfare. The stocks at hand at the outbreak of the war were inadequate and, if used, would only have been effective against known positions or troop concentrations.

In the technical and operational sphere, the use of gas always necessitated an abnormally high degree of joint planning. This was especially true in operations,

[120]Haber, Gas Warfare..., *op. cit.*, p. 10.

and if persistent agents were used they could seriously impede successive operations along the same sector. In view of both the high level of unpredictability of success and the uncertain reaction of the enemy, it is not surprising that CWs remained a relatively low priority throughout the war and were rarely kept at forward supply depots. Any use, therefore, would have imposed a severe strain upon logistics, to the detriment of other supplies. Military professionals themselves were not too eager to use CWs finding them both distasteful and remembering the increased disciplinary difficulties of W.W. I.

Politics naturally played a role in restraining use but its impact was felt long before W.W. II. The retardation of CWs policies assisted in preventing assimilation into the armed forces and foreclosed vested military interest in using CWs. The international legal constraint should not be underestimated either, as it re–inforced the reluctance to assimilate CWs in the first place. During war, a breach of the Protocol would have signaled that the aggressor planned to pursue his war aims with extreme measures and as a result, would have to anticipate an extreme response from his opponent. As stockpiles increased, the declared policy of retaliation came more and more to mean retaliation against cities. This was a highly effective policy since civilians remained supremely vulnerable to CW attacks. This, however, is not in–kind but escalatory retaliation, as counter–city strikes are strategic in nature, and affect the ability of the nation to continue the war. Germany's non–use during the waning months of the Second World War clearly was due to the inability to protect the skies over Germany rather than to fear of battlefield retaliation. The Japanese went further than simple non–provocation by not only publicly renouncing first use but also by dismantling their chemical warfare preparations and, in

the process, letting it be known that they were doing so.

At war's end, the atom came to supercede fears of chemical annihilation by relegating the latter to a secondary concern. Chemical establishments once again atrophied. However, chemicals were not fully discounted as the lessons learned from the Italian and Japanese campaigns clearly indicated that against an unprotected opponent who also lacked a deterrent capability, success was guaranteed. Both campaigns showed that gas could effectively be employed, not necessarily to win the overall conflict, but to reduce the overall costs of man and materiel since gas did considerably more damage to an unprotected opponent than did conventional weapons and with lesser financial burden. This "down-hill" utility of CWs continued after the Second World War, when chemicals were used only in peripheral conflicts. Until the Iraqi use of gas in its war with Iran, previous use was confined to a metropolis employing gas against a satellite region. The metropolis had nothing to fear by using gas and, for example, both the U.S. and perhaps the Soviets have found it useful in conducting their respective operations. The use of CWs in the Iraq/Iran war has cast ominous clouds on the future of CWs as this war marks the first time since W.W. I that gas has been employed in a full scale conventional conflict. Iraqi use of CWs has increased fears of chemical weapons' proliferation outside the traditional European sphere. Historically, the chemical deterrent paradigm is strained by tension. While in-kind retaliation failed, resulting in escalation, escalatory and denial capabilities coupled with the unpredictability of intent allowed deterrence to function.

Returning to the Central European front, current U.S., Soviet, and NATO doctrines were explored. U.S. doctrine evolved out of both the controversy over the

Vietnam war and continued international pressure, which resulted in the curbing of CWs use and culminated in acceding to the 1925 Protocol. Nevertheless, the lack of verification procedures and mechanisms allowed for the tenuous existence of the U.S. chemical establishment. The USSR felt obliged to maintain a vast complex of both defensive and offensive capabilities. This imbalance was taken by the U.S. to mean a Soviet *de facto* acceptance of first–use, especially since the Soviet Union did not follow suit on the American unilateral moratorium on chemical weapons' production. As a result, since the late 1970s efforts have been underway in the U.S. to equalize the situation. Under U.S. pressure, NATO has had to address the very unpleasant and politically charged topic and this has resulted in the exposure of glaring contradictions between national and alliance policies.

There exists a natural tendency within national policies to neglect CWs because they are part of a no–first use regime under the Protocol. Consequently, there is no desire or need to integrate and allocate resources to a weapon system that is constrained from being used in the first place. The contradiction lies in the fact that the threat of in–kind retaliation, never on firm ground, is less credible if the armed forces, as the result of non–assimilation, have only a limited ability to carry out the threat.

> The no–first–use regime has thus created a deep contradiction within national CW armament programs, which, because it necessarily complicates the task of managing those programs efficiently, must significantly affect the reality of the CW threat. The contradiction may be seen as generating pressure on national CW policy, which could push the latter in one or other of two directions: resolve the contradiction by abandoning the armament, or resolve it by abandoning the no–first–use policy.[121]

[121] Robinson, Chemical Warfare and Arms Control..., *op. cit.*, p. 51.

The introduction of binaries into the American arsenal and NATO "force goal" does nothing to address this inherent paradox but, in fact, may exacerbate it. Modernization and the associated partial integration into operational plans will, however, probably enhance the deterrent posture by making escalation in retaliation a credible option.

Where NATO should go from here is perhaps the most difficult question to answer. What is clear, however, is that NATO needs a common focus in terms of unifying defensive measures and non–CW conventional responses, while not necessarily requiring a warfighting capability. This implies that binaries are not particularly necessary; instead modernization of the old delivery means would achieve similar results. A relatively modest stockpile would be adequate and a deep strike capability desirable as a short range response to Soviet long range attacks seems less credible. Anything more substantial may in fact cut into NATO's conventional ability and in light of the highly lethal and accurate munitions being developed and deployed, a conventional response may be far more devastating against an enemy already primed for a chemical attack. The history of chemical weapons has shown that in order to prevent the use of gas, the capability to retaliate must be escalatory. Indeed, this notion is further strengthened because the level of chemical escalation falls far short of that attained with nuclear weapons. Although the jargon employed by nuclear and chemical thinkers is similar, in reality the threat of escalation through a warfighting doctrine is limited by the physical properties of CWs and by the realization that CWs cannot be abstracted from national arsenals. Ultimately, a credible threat of city nuclear destruction cannot be approximated with CWs.

Deterrence through in-kind retaliation is not sufficient and NATO is in the process of acknowledging this fact. The only successful combination in the past has been that of deterrence through denial and escalation. The former has already been addressed by NATO, while the latter still needs full implementation; something which will not easily be forthcoming as the European political climate is not receptive towards a warfighting chemical deterrent strategy. Whether the Soviets will "cross *their* Rubicon" and use CWs remains to be seen. Certainly the decision to do so will be as difficult and irreversible as Caesar's was when he marched onwards to Rome.

# Bibliography

American Chemical Society's Committee on Chemistry and Public Affairs and the Scientists' Committee on Chemistry and Biological Warfare. A symposium *Chemical Weapons and U.S. Public Policy.* Los Angeles: n.p., 1 April 1974.

American Chemical Society. *Nonmilitary Defense: Chemical and Biological Defenses in Perspective.* Washington, D.C.: American Chemical Society, July 1960.

Barnaby, Frank; Baroyan, Organes, et. al. *The Supreme Folly: chemical & biological weapons.* Edited proceedings from an international conference on chemical and biological warfare. London: n.p., 21 to 23 November 1969.

Baxter, R.R., and Buergenthal, Thomas. *The Control of Chemical and Biological Weapons.* New York: Carnegie Endowment for International Peace, 1971.

Baylis, John; Booth, Ken; Barnett, John; and Williams, Phil. *Contemporary Strategy.* New York: Holms & Meier Publishers, Inc., 1984.

Bradley, Omar N. *A Soldier's Story.* New York: Henry Holt and Company, 1951.

Brodie, Bernard. *The Absolute Weapon.* New York: Harcourt Brace, 1945.

Brown, Frederic. *Chemical Warfare: A Study in Restraints.* Princeton: Princeton University Press, 1969.

Brauch, Hans Günter. *Der chemische Alptraum: oder gibt es einen C-Waffen-Krieg in Europa? Bonn: Verlag J.H.W. Dietz Nachf. GmbH, 1982.*

Butler, J.R.M. *History of the Second World War: United Kingdom Military Series. Grand Strategy.* Volume II. London: Her Majesty's Stationery Office, 1957.

Carpenter, William, et. al. Prepared for the Office of the Assistant Secretary of Defense. *Evaluation of Chemical Warfare Policy Alternatives—1980-1990.* Alexandria, VA: Defense Technical Information Center, February, 1977.

Churchill, Winston S. *The Hinge of Fate.* Boston: Houghton Mifflin Company, 1950.

Clarke, Robin. *We All Fall Down: The Prospect of Biological and Chemical Warfare.* London: Allen Lane, The Penguin Press, 1968.

_____. *The Silent Weapons.* New York: David McKay Co., 1968

Cookson, John, and Nottingham, Judith. *A Survey of Chemical and Biological Warfare.* London: Sheed and Ward Ltd., 1969.

*Der Prozess gegen die Hauptkriegsverbrecher vor dem Internationalen Militärgerichtshof. Nürnberg 14 November 1945-10 Oktober 1946. Nürnberg: Obersten Kontrollrats für Deutschland, 1949.*

Douglass, Joseph D. Jr., and Livingstone, Neil C. *America the Vulnerable: The Threat of Chemical and Biological Warfare.* Lexington, MA: D.C. Heath and Company, 1987.

Douhet, Giulio. *The Command of the Air.* New York: Arno Press Inc., 1972.

Dupuy, Trevor; Johson, Curt; and Hayes, Grace P. Eds. *Dictionary of Military Terms.* New York: The H.W. Wilson Company, 1986.

Flynn, Nigel. Ed. *The Strategy Of Combat.* New York: Arco Publishing Inc., 1985.

Gervasi, Tom. *The Myth of Soviet Military Supremacy.* New York: Harper & Row, Publishers, Inc., 1986.

Green, Philip. *Deadly Logic.* Columbus: Ohio State University Press, 1966.

Haber, L. F. *The Poisonous Cloud: Chemical Warfare in the First World War.* Oxford: Oxford University Press, 1986.

_____. *Gas Warfare 1915-1945: The Legend and the Facts.* The Stevenson Lecture, University of London: Bedford College 25 November 1975. Xerox, n.d., Cambridge: Harvard University Library.

Hackett, General Sir John. *The Third World War: August 1985.* Toronto: Thomas Nelson & Sons (Canada) Ltd., 1979.

_____. *The Untold Story: The Third World War.* New York: Bantam Books Inc., 1983.

Ferguson, L.T.; Hylton, A.R.; and Mumma, C.E. *Studies on the technical arms control aspects of chemical & biological weapons.* Kansas City: Midwest Research Institute, 1972.

Haldane, J.B.S. *Callinicus: A Defence of Chemical Warfare.* New York: E. P. Dutton & Company, 1925.

Hamm, Manfred. *Chemical Warfare: The Growing Threat to Europe.* The Institute for European Defence & Strategic Studies, 1984. London: Alliance Publishers Ltd.,

Hammerman, Gay M. *Implications of Present Knowledge and Past Experience for a Possible Future Chemical/Conventional Conflict.* Final Report. Fairfax, VA: Historical Evaluation and Research Organization, 1 April 1984.

Hanslian, Rudolf. *Der Chemische Krieg, Erster Band: Militärischer Teil. Berlin: Verlag von E.S. Mitler und Sohn, 1937.*

Harris, Robert, and Paxman, Jeremy. *A Higher Form Of Killing.* London: Chatto & Windus Ltd., 1982.

Heller, Major Charles E. *Chemical Warfare in World War I: The American Experience, 1917-1918.* Leavenworth Papers No. 10, September 1984.

Heller, M., et. al. *The Middle East Military Balance, 1983.* Tel Aviv University: The Jaffee Center For Strategic Studies, 1983.

Hersh, Seymour M. *Chemical and Biological Warfare: America's Hidden Arsenal.* New York: The Bobbs–Merrill Company, Inc., 1968.

Hoeber, Amoretta M. *The Chemistry of Defeat: Asymmetries in U.S. and Soviet Chemical Warfare Postures.* Washington D.C.: Institute for Foreign Policy Analysis, Inc., December 1981.

Horne, Alistair. *The Price Of Glory.* Toronto: MacMillan & Company Limited, 1963.

International Military Tribunal. *Trial of the Major War Criminals before the International Military Tribunal: Nuremberg 11 June 1946–24 June 1946.* Volume 16. Nuremberg: Allied Control Authority for Germany, 1948.

_____. *Trial of the Major War Criminals before the International Military Tribunal: Nuremberg 25 June 1946–8 July 1946.* Volume 17. Nuremberg: Allied Control Authority for Germany, 1948.

_____. *Trial of the Major War Criminals before the International Military Tribunal: Nuremberg 14 November 1945–1 October 1946.* Volume 19. Nuremberg: Allied Control Authority for Germany, 1948.

"Iraq's Nerve Gas Factory." *Newsweek.* (27 August 1984), p. 47.

"Iraq's Scare Tactic." *Newsweek.* (2 August 1982), p. 11.

Kaplan, M.M., and Robinson, J.P. *Verification of chemical disarmament.* Austria, *Gmunden am Traunsee*: 37th Pugwash Conference on Science and World Affairs, 1–6 September 1987.

Kielmansegg, Peter Graf. *Deutschland und der Erste Weltkrieg. Frankfurt am Main: Akademische Verlagsgesellschaft Athenaion, 1968.*

Kroesen, General F.J. (Ret.), et. al. *Chemical Warfare Study: Summary Report.* Bethesda, MD: Institute for Defense Analyses, February 1985.

Lasswell, Harold D. *Propaganda Technique in World War I.* Cambridge, MA: The M.I.T. Press, 1971.

Ley, Willy. *Bombs and Bombing.* New York: Modern Age Books, Inc., 1941.

Liddell Hart, Captain B. H. *The Real War: 1914-1918.* London: Faber & Faber, 1930.

Livingstone, Neil C., and Douglass, Joseph D. Jr. *CBW: The Poor Man's Atomic Bomb.* Foreword by Senator John Tower. National Security Paper: 1. Washington, D.C.: Institute for Foreign Policy Analysis, Inc., February 1984.

Lohs, Karlheinz. Ed. *Der kalte Tod: Chemische Waffen und Massenvernichtungsmittel. Köln: Pahl-Rugenstein Verlag, 1982.*

Macdonald, Lyn. *They Called It Passchendaele.* London: Michael Joseph Limited, 1978.

March, Francis A. Introduction by General Peyton C. March. *History of the World War: An Authentic Narrative of the World's Greatest War.* New York: Leslie–Judge Company, 1918.

March, General P. *The Nation At War.* New York: Doubleday–Doran, 1932.

McCarthy, Richard D. *The Ultimate Folly.* New York: Alfred A. Knopf, 1969.

McWilliams, James L., and Steel, James R. *Gas! The Battle for Ypres, 1915.* St. Catharines: Vanwell Publishing Limited, 1985.

Meeker, Thomas. *Chemical/Biological Warfare.* Center for the Study of Armament and Disarmament. Los Angeles: California State University, December 1972.

Meselson, Matthew. Ed. *Chemical Weapons and Chemical Arms Control.* Washington, D.C.: Carnegie Endowment for International Peace, 1978.

Middlebrook, Martin. *The Kaiser's Battle.* London: Allen Lane, The Penguin Press, 1978.

*Military Balance 1986-1987.* London: International Institute for Strategic Studies, 1987.

Morgan, Patrick M. *Deterrence: A Conceptual Analysis.* Beverly Hills, California: Sage Publications, Inc., 1977.

Munson, James. Edited with introduction by James Munson. *Echoes of the Great War: The Diary of the Reverend Andrew Clark 1914-1919.* Oxford: Oxford University Press, 1985.

Murphy, Sean; Hay, Alastair; and Rose, Steven. *No Fire No Thunder.* London: Pluto Press Limited, 1984.

Neilands, J.B.; Orians, Gordon H.; Pfeiffer, E. W.; Vennema, Alje; and Westing, Arthur H. *Harvest of Death: Chemical Warfare in Vietnam and Cambodia.* Foreword by Gunnar Myrdal. New York: The Free Press, 1972.

Parry, Clive LL.D. *The Consolidated Treaty Series.* Volume 225 (1919). New York: Oceana Publications, Inc., 1981.

Pershing, John J. *My Experiences In The World War.* Volume I. New York: Frederick A. Stokes Company, 1931.

Pitt, Barrie. *1918: The Last Act.* London: Cassell & Company Ltd., 1962.

Prentiss, Augustin Mitchell. *Chemicals in war: A treatise on chemical warfare.* New York: McGraw-Hill Book Company, Inc., 1937.

Quester, George H. *Deterrence before Hiroshima.* New York: John Wiley & Sons, Inc., 1966.

Ranger, Robin. *The Canadian Contribution to the Control of Chemical and Biological Warfare.* Toronto: Canadian Institute of International Affairs, 1972.

Rehm, Allen S. *Soviet Capabilities and Doctrine for Chemical Warfare.* McLean, VA: Foreign Systems Research Center Science Applications, Inc., 2 January 1984.

Roberts, Brad. Ed. *Chemical Warfare Policy: Beyond the Binary Production.* Washington, D.C.: Center for Strategic and International Studies, 1987.

Robinson, Julian Perry. *Chemical and Biological Warfare Developments: 1985.* London: Taylor & Francis, 1986.

_____. "NATO CWs Policy and Posture." *Armament and Disarmament Information Unit.* Occasional Paper Number 4. University of Sussex Print Unit, September 1986.

_____. *Chemical Warfare Arms Control: A Framework for considering policy alternatives.* London: Taylor & Francis, 1985.

_____, and Boserup, Anders. *The Problem of Chemical and Biological Warfare: A study of the historical, technical, military, legal and political aspects of CBW, and possible disarmament measures. Volume 5: The Prevention of CBW.* Stockholm: Almqvist & Wiksell, 1975.

_____. *The Problem of Chemical and Biological Warfare: A study of the historical, technical, military, legal and political aspects of CBW, and possible disarmament measures. Volume 2: CB Weapons Today.* Stockholm: Almqvist & Wiksell, 1973.

_____. Ed. *The Problem of Chemical and Biological Warfare: A study of the historical, technical, military, legal and political aspects of CBW, and possible disarmament measures. Volume 1: The Rise of CB Weapons.* Stockholm: Almqvist & Wiksell, 1971.

Rose, Steven. Ed. *CBW chemical and Biological Warfare: London Conference on CBW.* London: George G. Harrap & Co. LTD., 1968.

Sbacchi, Alberto. *Ethiopia Under Mussolini: Fascism and the Colonial Experience.* London: Zed Books Ltd., 1985.

Schelling, Thomas. *The Strategy of Conflict.* Cambridge, MA: Harvard University Press, 1960.

Sigmund, Elizabeth. *Rage Against The Dying.* London: Pluto Press Limited, 1980.

Sims, Nicholas A. *Chemical Weapons— Control or Chaos?.* Faraday Discussion Paper No. 1. London: The Council for Arms Control, Faraday House, 1984.

Smith, Denis Mack. *Mussolini.* London: Weidenfeld and Nicolson Ltd., 1981.

_____. *Mussolini's Roman Empire.* London: Penguin Ltd., 1970.

Snow, Edgar. *Scorched Earth.* Book One. London: Victor Gollancz LTD., 1941.

Sokolovsky, V.D. Translated by Harriet Post Scott. *Soviet Military Strategy.* New York: Crane Russak & Co., 1978.

Speer, Albert. *Inside The Third Reich.* Translated from German by Richard and Clara Winston. Introduction by Eugene Davidson. New York: The MacMillan, 1970.

Spiers, Edward M. *Chemical Warfare.* Urbana: University of Illinois Press, 1986.

Stacey, C.P. *Canada and the Age of Conflict: A History of Canadian External Politics.* Volume I: 1869–1921. Toronto: The MacMillan Company of Canada Limited, 1977.

Stockholm International Peace Research Institute. *World Armament and Disarmament Yearbook: 1985.* New York: Taylor & Francis Inc., 1985.

_____. *World Armament and Disarmament Yearbook: 1984.* New York: Taylor & Francis Inc., 1984.

_____. *World Armament and Disarmament Yearbook: 1983.* New York: Taylor & Francis Inc., 1983.

_____. *World Armament and Disarmament Yearbook: 1982.* New York: Taylor & Francis Inc., 1982.

_____. *Chemical Weapons: Destruction and Conversion.* London: Taylor & Francis Ltd., 1980.

Stringer, Hugh. *Deterring Chemical Warfare: U.S. Policy Options for the 1990s.* Washington D.C.: Institute for Foreign Policy Analysis, Inc., April 1986.

*Suetonius.* With an English translation by J.C. Rolfe. London: William Heinemann Ltd., 1913.

The Aspen Strategy Group & The European Strategy Group. *Chemical Weapons and Western Security Policy.* Lanham, MD: University Press of America, 1987.

The Royal United Services Institute for Defence Studies. *Defence Yearbook: 1987.* London: Brassey's Defence Publishers, 1987.

Thomas, Andy. *Effects of Chemical Warfare: A selective review and bibliography of British state papers.* London: Taylor & Francis, 1985.

Thomas, Ann Van Wynen, and Thomas, A.J., Jr. *Legal Limits On The Use Of Chemical And Biological Weapons.* Foreward by Charles O. Galvin. Dallas: Southern Methodist University Press, 1970.

Trapp, Ralf. Ed. *Chemical Weapon Free Zones?* London: Oxford University Press, 1986.

_____. *The Detoxification and Natural Degradation of Chemical Warfare Agents.* London: Taylor & Francis, 1986.

Vachon, Captain Gordon K. *Chemical Weapons: Certain Seldom Heard Views.* Ottawa: Department of National Defence, Operational Research And Analysis Establishment, June 1981.

Waitt, Colonel Alden H. *Gas Warfare: The Chemical Weapon, Its Use, And Protection Against It.* New York: Duell, Sloan, and Pearce, 1942.

Yost, David S. Ed. *NATO'S Strategic Options: Arms Control and Defense.* New York: Pergamon Press Inc., 1981.

U.S. Arms Control and Disarmament Agency. *Studies on the technical arms control aspects of chemical & biological warfare.* Kansas City: Midwest Research Institute, November 1972.

Zimmermann, Dieter and Schneider, Werner. *Grundwissen für die Einsatzkräfte. Berlin: Militärverlag der Deutschen Demokratischen Republik, 1977.*

*JOURNALS AND ARTICLES*

Adams, Valerie. "A retaliatory chemical warfare capability—Some problems for NATO." *Journal of the Royal United Services Institute.* (Volume 130, number 4, December 1985), pp. 15–19.

Anderson, Jack. "Iraqis Trained for Chemical Warfare." *Washington Post.* (3 November 1980), p. B13.

Associated Press. "Soviets Absolved of 'Yellow Rain' use." *Calgary Herald.* (1 September 1987), p. B5.

_____. "U.S. Officials say Iraq stockpiles nerve gas." *Washington Post.* (3 November 1984), p. 20.

_____. "Japan used gas." *Calgary Herald.* (15 June 1984), p. A12.

Bagwax. "Chemical Weapons: Time for a Fresh Look." *The British Army Review.* (Number 67, 1981), pp. 5–13.

Bay, Austin. "Chemical Warfare Perspectives and Potentials." *Strategy and Tactics.* (July/August 1980), pp. 23–33.

Bay, Lieutenant Colonel Charles H. (US Army). "Chemical Warfare and the Military Balance." *Parameters.* (Volume 7, number 2, 1977), pp. 39–53.

Biddle, Wayne. "Restocking the Chemical Arsenal." *New York Times Magazine.* (24 May 1981), p. 37.

Biersner, Captain Robert J. "Needed: Chemical Warfare Defense Doctrine." *United States Naval Proceedings.* (Volume 112, November 1986), pp. 116–120.

"Bigeye CW Aerial Bomb." *Jane's Defence Weekly.* (Volume 19, number 6, 1986), p. 278.

Brooks, Major Franklin R., and Ebner, Colonel Donald G. "Psychological Reactions During Chemical Warfare Training." Military Medicine. (Volume 148, March 1983), pp. 232–235.

Campbell. D. "Thatcher goes for nerve gas." *New Statesman.* (18 January 1985), pp. 8–10.

_____. "Touching Mrs. Thatcher on a raw nerve." *New Statesman.* (11 January 1985), p. 4.

Center of Defense Information. "Old Fears, New Weapons: Brewing a Chemical Arms Race." *The Defense Monitor.* (Volume 9, number 10, 1980), pp. 1–8.

Clarke, K., and Turnbull, J.H. "The Chemical Battlefield–Part One: The Soviet Threat." *Defence.* (Volume 15, Number 2, March 1984), pp. 122–127.

_____. "The Chemical Battlefield–Part Two: Equipment for Protection." *Defence.* (Volume 15, number 7, July 1984), pages n.a.

_____. "The Chemical Battlefield–Part Three: Equipment for Protection." *Defence.* (Volume 15, number 9, December 1984), pages n.a.

Cole, Major Richard D. "Heat Stroke During Training with Nuclear, Biological, and Chemical Protective Clothing: Case Report." *Military Medicine.* (Volume 148, July 1983), pp. 624–625.

Courtland Moon, John Ellis van. "Chemical Weapons and Deterrence: The World War II Experience." *International Security.* (Volume 8, number 4, Spring 1984), pp. 3–35.

Davidson, Major C.J. "Situation Report on Chemical Warfare." *Journal of the Royal United Services Institute for Defence Studies.* (Volume 125, number 2, 1980), pp. 63–65.

Dick, C.J. "Soviet Chemical Capabilities." *International Defense Review.* (Volume 14, number 1, 1981), pp. 31–38.

_____. "The Soviet Chemical and Biological Warfare Threat." *Royal United Services Institute for Defence Studies.* (Volume 126, number 1, March 1981), pp. 45–51.

Donnelly, C.N. "Winning the NBC War: Soviet army theory and practices." *International Defense Review.* (Volume 14, number 8, 1981), pp. 989–996.

Douglass, Joseph D. Jr. "BioChem Warfare: New Dimensions and Implications." *Defense and Foreign Affairs.* (15 April 1987), pp. 41–45.

_____. "Chemical Weapons: An Imbalance of Terror." *Strategic Review.* (Summer 1982), pp. 36–47.

Dunn, Peter. "The Chemical War: Journey to Iran." *Nuclear Biological Chemical Defense & Technology International.* (Volume 1, number 1, April 1986), pp. 28–35.

_____. "The Chemical War: Iran Revisited—1986." *Nuclear Biological, Chemical Defense & Technology International.* (Volume 1, Number 3, 1986), pp. 32–39.

Elbe, Frank. *"Zone ohne C- Waffen— ein untaugliches Konzept." Europäische Wehrkunde.* (Number 4, 1985), pp. 216–220.

Elfried, Lieutenant Colonel G. "Russian and Chemical Warfare: Our Achilles Heel." *Army* (December 1979), pages n.a.

Ember, Lois R. "Pentagon Pressing Hard For Binary Chemical Arms Funds." *Chemical & Engineering News.* (25 February 1985), pp. 26–29.

Erickson, John. "The Soviet Union's Growing Arsenal of Chemical Warfare." *Strategic Review.* (Fall 1979), pp. 63–71.

Fair, Lieutenant Colonel Stanley D. "Gas and a Just War." *Ordnance.* (Volume 51, 1966), pp. 272–276.

Flowerree, C.C. "Chemical Weapons—A case study in verification." *Arms Control Today.* (Volume 13, number 3, April 1983), pages n.a.

Fuller, John W. "International Law and B/C Warfare." *Orbis.* (Volume 10, number 1, Spring 1966), pp. 247–273.

Furlong, Bob and Levinson, Macha. "SACEUR Calls for Research on a European ABM System." *International Defense Review.* (Volume 19, number 2, 1986), pp. 149–152.

Gold, Theodore. "Land War, number 3: Chemical Warfare." *Journal of Defense & Diplomacy.* (September 1984), pp. 40–44.

Goldblat, Jozef. "Chemical Disarmament: From the ban on use to a ban on possession." *Canadian Institute For International Peace and Security Background Paper.* (Number 17, February 1988), pp. 1–8.

Graveley, Squadron Leader A.F. "Defence or Deterrence? The Case for Chemical Weapons." *Royal United Services Institute for Defence Studies.* (Volume 126, December 1981), pp. 13–20.

_____. "The Voices of Experience: Learning for the future from the chemical war of 1915–1918." *Army Quarterly and Defence Journal.* (Volume 110, number 4, 1980), pp. 410–435.

Greenhalgh, Roy; Miller, David J.; Neish, Gordon A.; and Schiefer, H. Bruno. "Toxigenic Potential of Some *Fusarium* Isolates from Southeast Asia." *Applied and Environmental Microbiology.* (Volume 50, number 3, August 1983), pp. 550–552.

Groehler, Olaf. *"Die Entwicklung der technischen Mittel des chemischen Krieges im imperialischen Deutschland 1915–1945". Militärgeschichte.* (Berlin), (Volume 15, number 6, 1976), pp. 718–728.

_____. *"Vorbereitung für die chemische Kriegführung durch die deutsche Armee zwischen erstem und zweitem Weltkrieg." Revue Internationale d'Histoire Militaire.* (Volume 43, 1979), pp. 167–180.

Haase Ewin, J.V. "Chemical and Biological Warfare: The New Frontier." *Asian Defense Journal.* (Volume 6, 1986), pp. 84–86.

Haber, Fritz. "Gas Warfare: A German Expert's Views." *The Times of London.* (3 July 1926), p. 3.

Hamm, Manfred R. "BioChemical Warfare: Deterrence vs. Arms Control." *Contemporary Review.* (Volume 246, number 1430, March 1986), pp. 127–134.

_____. "Deterrence, Chemical Warfare, and Arms Control." *Orbis.* (Volume 29, Spring 1985), pp. 119–163.

Hans, Rühle. *"Chemische Waffen und europäische Sicherheit 1980-1990." Europäische Wehrkunde.* (Volume 24, number 1, January 1978, pp. 5–10.

Harris, D. Elisa. "Sverdlosk and Yellow Rain: Two Cases of Soviet Noncompliance," *International Security* (Volume 2, number 4, Spring 1987), pp. 41–95.

Hay, Alastair. "At war with Chemistry." *New Scientist.* (22 March 1984), pp. 12–18.

Heller, C.E. "The perils of unpreparedness: The American Expeditionary Forces and chemical warfare." *Military Review.* (Volume 65, number 1, January 1985), pp. 12–25.

Hersh, Seymor M. "U.S. Aids Say Iraqis Made Use of a Nerve Gas." *New York Times.* (30 March 1984), p. 1.

Hoeber, Amoretta M., and Douglass, Joseph D. Jr. *"Das Problem Chemische Kriegführung." Europäische Wehrkunde.* (Volume 27, number 10, October 1978), pp. 489–495.

Hutchinson, Robert. "NATO Ministers can't abdicate CW decision says SACEUR." *Jane's Defence Weekly.* (Volume 3, Number 17, 27 April 1985), pp. 719–725.

Jervis, Robert. "Deterrence Theory Revisited." *World Politics.* (Volume 31, number 2, January 1979), pp. 289–324.

Karsh, Efraim. "The Iran–Iraq War: A Military Analysis." *Adelphi Papers Number 220.* London: International Institute for Strategic Studies, Spring 1987.

Kleber, B.E., and Birdsell, D. "The unused weapon." *Military Review.* (Volume 44, number 1, 1965), pp. 54–62.

Kuntsevich, Anatoly. "Silent Killers." *New Times.* (14 April 1988), pp. 10–12.

Lapska, B.C. "Dress Rehearsal for Doomsday." *United States Naval Proceedings.* (April 1982), p. 109.

Levinson, Macha. "Chemical Deterrence: Will It Work?" *International Defense Review.* (Volume 19, number 6, 1986), pp. 731–736.

Lindsey, Lieutenant Colonel Douglas. "Selective Malfunctioning of the Human Machine: New Horizons in Chemical Warfare." *Military Medicine.* (September 1960), pp. 589–605.

"Iraq Reportedly uses mustard gas in war." *Los Angeles Times.* (26 January 1984), p. 8.

Matas, Robert. "Agreeing to end the use of poison." *Globe and Mail.* (17 October 1987), pp. D2–D3.

McKean, Kevin. "A Safer Poison Gas." *Discovery.* (September 1981), p. 70.

Meselson, Matthew, and Robinson, J.P. "Chemical Warfare and Chemical Disarmament." *Scientific American.* (Volume 242, number 4, April 1980), pp. 38–46.

Miles, Wydham D. "The idea of Chemical Warfare in Modern Times." *Journal of the History of Ideas.* (Volume 31, April–June 1970), pp. 297–304.

Miller, Edward A., and Cooksey, Howard A. "Speaking on...Evaluation of Soviets' Overall Threat: Analysis of Potential Factors." *Army and Development: News Magazine.* (March–April, 1977).

"Nerve Gas Alarm." *Military Review.* (Volume 42, number 12, 1962), p. 102.

Osborne, Mike, and Perera, Judith. "Chemical Warfare: the superpowers' deadly game." *The Middle East Magazine.* (April 1983), pp. 20–25.

Oulton, Squadron Leader P.D. "Is there a Case for Chemical and Biological Warfare?" *The British Army Review.* (Number 43, issue 4, April 1973), pp. 63–68.

Pardee, R.E. "CBR Warfare and Logistics." *Military Review.* (Volume 43, number 4, 1963), pp. 90–97.

Raser, John. "Theories of Deterrence." *Peace Research Reviews.* (Volume 3, number 1, February 1969), pp. 1–52.

Roberts, Gwynne. "Use of Chemical Weapons in Asia." *New Statesman.* (4 April 1980), pp. 504–505.

Robinson, J.P. "Chemical Weapons and Europe." *Survival.* (Volume 24, number 1, January/February 1982), pp. 9–18.

_____. "Chemical arms control and the assimilation of chemical weapons." *International Journal.* (Toronto). (Volume 36, number 3, Summer 1981), pp. 515–534.

Rogers, Cornwell B. Ed. "American War Documents." *Current History.* (Volume 4, August 1943), p. 405.

Rothschild, J.H. "Propaganda and Toxic War." *Ordnance.* (Volume 50, 1966), pp. 617–619.

--------. "Germs and gas: The weapon nobody dares talk about." *Harper's Magazine.* (June 1959), pp. 29–34.

Sbacchi, Alberto. "Legacy of Bitterness: poison gas and atrocities in the Italo–Ethiopian war 1935–1936." *Genève–Afrique.* (Volume 13, 1974), pp. 30–53.

Scheichl, Ludwig. *"Bedrohung der Panzer durch B– und C– Waffen sowie Gedanken über geeignete Abwehrmaßnahmen." Wehrtechnische Monatshefte.* (Volume 65, 1966), pp. 518–523.

Schwarz, Wolfgang. *"Binärwaffen— chemische Kampfstoffe im Konzept der USA für offensive Kriegführung." Institute für Internationale Politik und Wirtschaft der DDR.* (Volume 13, number 3, March 1984), pp. 1–7.

"Soviet Foreign Ministry Statement." *Jane's Defence Weekly.* (Volume 19, number 6, 13 February 1988), p. 278.

Spiers, Edward M. "Gas and the North–West Frontier." *Journal of Strategic Studies.* (Volume 6, number 4, December 1983), pp. 94–112.

Stelzmüller, H. "NBC Defense: A German Viewpoint." *International Defense Review.* (Volume 11, 1982), pp. 1571–1577.

Summerhayes, David. "Chemical Weapons: Postures, Plans and Prospects for Control." *Armament & Disarmament Information Unit.* (Volume 5, number 6, November/December 1983), pp. 1–3.

Terrill, Andrew W. Jr. "Chemical Weapons in the Gulf War." *Strategic Review.* (Spring 1986), pp. 51–58.

"Blow for Blow in Russia." *Times of London.* (11 May 1942), p. 4.

"Nazi Poison Gas, Warning by the Office of War." *Times of London.* (21 October 1939), p. 3.

Tower, John. "The Politics of Chemical Deterrence." *Washington Quarterly.* (Volume 5, number 2, Spring 1982), pp. 25–37.

Trumpener, Ulrich. "The Road to Ypres: The Beginnings of Gas Warfare in World War I." *Journal of Modern History.* (Volume 47, September 1975), pp. 461–480.

United Press International. "U.S Is Told Soviets Use Poison Gas on Afghans." *The New York Times* (24 January 1980), p. A7.

Voigt, Karsten D. *"Chemiewaffenfreie Zone in Europa." Blätter für Deutsche und Internationale Politik.* (Number 9, 1985), pp. 1067–1078.

Wagner, Richard C., and Gold, Theodore S. "Why We Can't Avoid Developing Chemical Weapons." *Defense.* (July 1982), p. 2–11.

"U.S. Officials says Iraq stockpiles nerve gas." *Washington Post.* (3 Novermber 1984), p. 20.

Watson, Brigadier General Gerald G., and Anderson, Lieutenant Colonel (P) Raymond L. "An Urgent Need: Stockpiling Modern Chemical Munitions." *Military Review.* (January 1984), pp. 59–66.

Whymant, Robert. "The brutal truth about Japan." *Manchester Guardian Weekly.* (22 August 1982), p. 6.

"USA criticized over binary warheads." *Jane's Defence Weekly.* (Volume 19, number 6, 13 February 1988), p. 278.

Vachon, G.K. "Chemical Weapons and the Third World." *Survival.* (Volume 26, number 2, March/April 1984), pp. 79–86.

"Yellow Rain Enigma: Ghent meeting sheds little new light." *Chemical & Engineering News.* (28 May 1984), pp. 6–8.

Young, Lewis P. "The Iran–Iraq War: Into the Fourth Year of Conflict." *Asian Defence Journal.* (Issue 6, 1984), pp. 58–63.

Ziemke, Earl F. "Superweapons". *Parameters.* (Volume 12, number 4, December 1985), pp. 32–42.

*GOVERNMENT PUBLICATIONS*

Brophy, Leo P., and Fisher, George J.B. *The Chemical Warfare Service: Organizing For War.* Washington: Office of the Chief of Military History, United States Army, 1959.

Canada. *Systems Study of an International Verification Organization on Chemical Weapons.* Ottawa, October 1987.

_____. *Background Study to the Handbook for the Investigation of Allegations of the use of Chemical or Biological Weapons.* Ottawa, September 1987.

_____. Arms Control and Disarmament Division of the Department of External Affairs. *UN Conference of the Committee on Disarmament Chemical Weapons.* Ottawa, 1986.

_____. *Handbook for the Investigation of Allegations of the use of Chemical or Biological Weapons.* Ottawa, November 1985.

Federal Republic of Germany. Minister of Defence. *White Paper 1985: The Situation and the Development of the Federal Armed Forces.* Bonn, 19 June 1985.

_____. *Bundesminister der Verteidigung. Weißbuch 1983: Zur Sicherheit der Bundesrepublik Deutschland.*

Gilchrist, Colonel Harry L. *A comparative study of World War Casualties From Gas and other weapons.* Washington, D.C.: United States Government Printing Office, 1928.

Great Britain. Minister of State for the Armed Forces (J. Stanley). Written answer. *Hansard.* (Volume 100, number 36). 25 June 1986, column 163–164.

Kobrick, John L., and Sleeper, Lynn A. *Effects of wearing NBC Protective Clothing in the heat on detection of visual signals.* Report No. T7/85 U.S. Army Research Institute of Environmental Medicine. Natick, MA: November 1985

Kobrick, John L., and Fince, Bernard, J. *Assessment of the effects of heat and NBC Protective Clothing on performances of critical military tasks.* U.S. Army Research Institute of Environmental Medicine. Natick, MA: June 1985.

Shultz, George P. "Chemical Warfare in Southeast Asia and Afghanistan: An Update," Department of State, Special Report No.104, November 1982.

Stoessel, Walter J. *Report on the Chemical Warfare Review Commission.* Washington, D.C.: Government Printing Office, June 1985.

United Nations. Conference on Disarmament. *Report of the Ad Hoc Committee on Chemical Weapons to the Conference on Disarmament.* CD/782. (26 August 1987).

_____. World Health Organization. *Health Aspects of Chemical and Biological Weapons.* Report of a WHO Group of Consultants, 1970.

_____. Report of the Secretary–General. *Chemical and Bacteriological (Biological) Weapons and the effects of their possible use.* New York: United Nations Publications, 1969.

_____. UN Document A/PV.1836. 16 December 1969.

United States. Directorate for Scientific and Technical Intelligence of the Defense Intelligence Agency. *Soviet Chemical Warfare Threat.* DST–1620F–051–85. Alexandria, VA: Defense Intelligence Agency, 1985.

_____. Department of the Army. *Chemical Warfare: Deterrence Through Strength.* Washington, D.C., July 1984.

_____. of Defense. *Report on the Nuclear Posture of NATO.* Washington, D.C.: 1 May 1984.

_____. Congress. House. Committee on Foreign Affairs. Subcommittee on National Security Policy and Scientific Developments. *Chemical-Biological Warfare: U.S. Policies and International Effects.* Washington D.C.: U.S. Government Printing Office, 1970.

_____. Congress. Senate. Committee on Labor and Public Welfare. Special Subcommittee on the National Science Foundation *Chemical and Biological Weapons: Some Possible Approaches for Lessening the Threat and Danger.* Washington, D.C.: U.S. Government Printing Office, 1969.

_____. and Air Force. Technical Manual. *Military Chemistry and Chemical Agents.* (TM 3–215). December 1963.

_____. *Military Biology and Biological Warfare Agents.* (TM 3–216, 1956).

_____. Office of the United States Chief Counsel for Prosecution of Axis Criminality, *Nazi conspiracy and aggression (Supplement A).* Washington, D.S.: U.S. Government Printing Office, 1947.

_____. War Department. *Military Chemistry and Chemical Agents.* Washington, D.C.: United States Government Printing Office, 21 April 1942.

# Appendix A

# Chemistry at War

The purpose of this appendix is to briefly describe the more technical aspects of chemical warfare. Toxicity, protective equipment, and the effects of working in a chemically contaminated environment are all extremely relevant factors in the decision to use chemical agents.

## A.1 World War I Agents

Of all the gases developed and tested during W. W. I, mustard gas has remained the premier, but not the only, agent over time. The attractiveness of mustard gas lies to some degree in the insidious nature of the agent and also in the relative ease of production. Its weakness, on the other hand, lies in its low level of toxicity in comparison to nerve gases. Roughly twenty pounds of mustard are necessary to achieve the same effect that one pound of nerve gas could.[1] The symptoms of mustard gas usually do not occur for four to six hours after being poisoned.[2] Mustard is a cell irritant eventually resulting in cell poisoning causing redness followed by blistering of the skin. The agent makes the blood vessels incapable of carrying out their functions, thereby preventing the healing mechanisms to operate. Extreme exposure can cause death within twenty–four hours. If contaminated by

[1] Seymour M. Hersh, *Chemical and Biological Warfare: America's Hidden Arsenal* (New York: The Bobbs–Merrill Company, Inc., 1968), p. 48.

[2] *Ibid.*, p. 47.

lower dosages, death can take as long as two weeks (from cardiac failure).[3] Since mustard is a liquid at room temperature it evaporates even more slowly in colder temperatures, persisting anywhere from a day to a week or more.[4] Currently, its military value is still disputed but is generally viewed as being obsolete by industrialized nations. Serious consideration must be given to mustard and other 'old fashioned' agents not only because of the relative ease of production but also because substantial supplies remain on the world market. A UN report released in 1969 indicated that phosgene is produced in some highly developed countries at a rate of 90,000 tonnes per annum as an intermediate compound for the production of commercial products. Ethylene–oxide, which is used in the manufacture of mustard gas, is produced at a rate of 1.8 million tonnes a year (world wide). The process is simple and 225,000 tonnes of this primary compound are sufficient to yield about 450,000 tonnes of mustard gas.[5]

Blood agents, also developed during W. W. I, such as hydrogen cyanide (AC) and cyanogen chloride (CK), are highly toxic and fast acting casualty agents. These agents have retained some interest because of their high toxicity and "... may be released simultaneously with nerve agent to mislead or confuse exposed personnel."[6]

---

[3]Ann Van Wynen Thomas and A.J. Thomas, Jr, *Legal Limits On The Use Of Chemical And Biological Weapons*, foreword by Charles O. Galvin (Dallas: Southern Methodist University Press, 1970), p. 7.

[4]*Ibid.* The rate of detoxification has very much to do with the degree of toxicity of the agent. For a complete and highly technical discussion of the detoxification process of various chemical agents see Ralf Trapp, *The Detoxification and Natural Degradation of Chemical Warfare Agents*, SIPRI, (London: Francis & Taylor, 1986).

[5]United Nations, report of the Secretary–General *Chemical and Bacteriological (Biological) Weapons and the effects of their possible use* (New York: United Nations Publications, 1969), p. 79.

[6]U.S. Army Chemical School Fort McClellan, Alabama, *The Story of Chemical and Biological Agents and Weapons*, 1964, p. 79 as quoted in Ann Van Wynen Thomas and A.J. Thomas, Jr., *Legal Limits On The Use Of Chemical And Biological Weapons*, foreward by Charles O. Galvin

A major problem with blood agents lies in the fact that AC is difficult to disseminate in sufficient concentrations owing to its low vapour and liquid densities and its tendency to inflame when disseminated by an explosive burst. A high dose, (200 mg/$m^3$) will cause death within ten minutes and inhaling 5000 mg/$m^3$ causes respiratory arrest within a minute.[7] According to U.S. field manuals death can occur within fifteen minutes for AC and within fifty minutes for CK, after a lethal dose has been inhaled.[8]

## A.2 Nerve Gas

The G–agents (Tabun (GA), Sarin (GB), and Soman (GD)) were mentioned in Chapter One. Nerve gases are the backbone of the superpowers' CWs arsenals and, for those nations acquiring CW status, represent entry into an exclusive club. Research did not end once the G–agents were discovered. In 1952, Dr. Ranajit Ghosh, while working for the Imperial Chemical Industries (UK) discovered a substance of incredible toxicity. ICI applied in 1955 for a patent to cover the phosphonothiolates to prevent Bayer from receiving one. One of the names on the later Bayer patent was Gerhard Schrader, discoverer of Tabun and Sarin.[9] The liquid was heavier and more viscous than the G–agents having a consistency similar to that of motor oil. Scientists realized that although different in appearance, it worked in the same way as the old nerve agents. A sample was sent to the Edge-

(Dallas: Southern Methodist University Press, 1970), p. 6.

[7]WHO, *op. cit.*, pp. 29–30.

[8]Department of the Army and Air Force, Technical Manual, *Military Chemistry and Chemical Agents* (TM 3–215, December 1963), p. 18.

[9]Steven Rose, ed., *CBW* (London, 1966), p. 24, as quoted in John Cookson and Judith Nottingham, *A Survey of Chemical and Biological Warfare* (London: Sheed and Ward, 1969), p. 221.

wood Arsenal, refined and given the name of "VX".[10] Both the G and V agents work by inhibiting a key enzyme, acetylcholinesterase, from controlling muscle movements. Once the nerve agent enters the system it hinders the constant production of acetylcholinesterase, thereby disrupting nerve impulse transmissions.[11] The final symptoms are uncontrollable vomiting, defecation, convulsions and finally respiratory failure. Acute nerve gas poisoning results in death by asphyxia within minutes of exposure. Nerve gases are stored as liquids, and depending upon their volatility, can be either dispersed through munitions as a cloud of vapour or in aerosol form.[12]

With nerve gases, science and the military finally achieved the combination German scientists were searching for during W. W. I, namely rapidity of action, high toxicity, and effectiveness through skin and lungs. There is no dispute over the lethality of nerve gases and especially V–agents. The lethal dosage of a V–agent for man is 2–10 mg of liquid on the skin and 5–10 mg–min/$m^3$ of aerosol in the air absorbed through the respiratory tract. This compares to Sarin with 100–200 mg to 1700 mg (depending on reference source) on the skin and 50–100 mg–min/$m^3$ of vapour. The old stand–by mustard gas, on the other hand, is mild in comparison necessitating 4–5 g on the bare skin and 1500 mg–min/$m^3$ for a lethal respiratory dose. 3200 mg–min/$m^3$ of phosgene is needed to cause respiratory failure although half that dose would severly incapacitate the individual.[13] If a nerve gas dose

[10]Robert Harris, and Jeremy Paxman, *A Higher Form Of Killing* (London: Chatto & Windus Ltd., 1982), p. 184. Other G and V agents exist codenamed GF, VE, VM, of which little is known in the open literature. WHO, *op. cit.*, p. 35.

[11]Hersh, Chemical and Biological..., *op. cit.*, p. 45.

[12]Matthew Meselson and Julian Perry Robinson, "Chemical Warfare and Chemical Disarmament", *Scientific American* (Volume 242, no. 4, April 1980), p. 39.

[13]WHO, *op. cit.*, pp. 28–40.

is only sublethal, evidence suggests that long term neurological and psychiatric disorders can develop as the agent is cumulative.[14]

Unlike other agents, V–agents not only require suitable gas masks but also full protective clothing. Mustard gas is percutaneous, but only at supralethal dosages and skin contamination can be prevented by wearing heavy clothing, which is not so with nerve gases. With their introduction onto a battlefield, the scene changes significantly with troops forced to wear cumbersome suits and to don gas masks. Ironically the military finally found the 'ultimate' chemical weapon, yet required even more elaborate defensive equipment, reconnaissance, and logistics than were needed for the earlier primitive gases. The protective suits do prevent the penetration of nerve gases but compound the psychological and psychological stress already associated with fighting in a chemical environment. Thus even the CW aggressor, must have at least a minimal defensive capability posture as the fluidity of modern–day battles can easily force the aggressors to pass through their own contamination.

### A.2.1 Protective Clothing

Unlike most other weapons, the effects of chemicals can be almost entirely mitigated through an individual protective posture and/or collective air filtered shelters. Generally speaking respirators are capable of reducing the concentration factor of the agent in the air by at least 100,000 times. "The filters contain activated charcoal for vapour adsorption and paper or some similar material for retaining

[14]Meselson and Robinson, *op. cit.*, p. 39.

particulates."[15] In addition the charcoal is impregnated with copper compounds or other reactants to protect against small–molecule agents such as AC.[16] Efforts are continually underway among concerned nations to decrease the discomforts and stresses associated with wearing a gas mask. The American M17A1 mask currently in the Army, for example reduces marksmanship by 60 percent; the naval aviator version impedes visual acuity and depth perception; and the naval version cannot be worn with corrective glasses without substantial leakage. Compounding these difficulties are the psychological ones relating to the fact that the filter restricts proper, quick breathing, and hampers effective voice communication.[17]

Generally, western protective suits consist of a two–piece overgarment with butyl–rubber gloves and overboots. The suit is water repellent, weighs 2 kilos, and is air permeable.[18] Fully encapsulated, the soldier is at the highest level of Military Oriented Protective Posture, or MOPP–IV. There are four levels of MOPP (I, II, III, IV) in the U.S. military, which indicate the increasing degrees of encapsulation. At MOPP IV, though, the paramount physical danger the soldier faces is heat stress even at moderate temperatures (75 to 80 degrees Fahrenheit).[19] At the highest

[15]Meselson and Robinson, *op. cit.*, p. 41.

[16]*Ibid.*

[17]Army's mask: Alastair Hay, "At war with Chemistry", *New Scientist* (22 March 1984), p. 16; Naval Aviator's mask: B.C. Lapska, "Dress Rehearsal for Doomsday", *United States Naval Proceedings* (April 1982), p. 109; Naval mask: S.A. Lauria and J.H. Dougherty, Jr., "Effectiveness of the Mark–V Chemical–Biological Mask worn over Goggles", *Naval Submarine Medical Research Laboratory Report No. 1006* (6 July 1983), pp. 1–7, as quoted in Captain Robert J. Biersner , "Needed: Chemical Warfare Defense Doctrine", *United States Naval Proceedings* (Volume 112, November 1986), p. 117. For an interesting and indepth discussion of current attempts at improving gas masks, especially in Britain, see: K. Clarke and J.H. Turnbull, "The Chemical Battlefield—Part Two: Equipment for Protection," *Defence* (Volume 15 issue 7, July 1984).

[18]Meselson and Robinson, *op. cit.*, p. 41.

[19]An interesting case report is presented by Maj. Richard D. Cole, "Heat Stroke During Training with Nuclear, Biological, and Chemical Protective Clothing: Case Report", *Military Medicine* (Volume 148, July 1983). This report discusses the symptoms commonly encountered with heat

level, the wearer quickly begins to trap body moisture. This accumulated moisture soon becomes a major problem both as a direct stressor and as an impediment to performance. "Other problems generated by the MOPP system, more of the human factors type, concern limitations of mobility; psychomotor and sensory–perceptual capability due to the encumbrances involved in providing total NBC protection."[20] After four to five hours at MOPP–IV the "...cognitive performance of a group of highly trained soldiers,... began to deteriorate markedly."[21]

Increased water intake is necessary within six hours, after which a special mixture of carbohydrates and a sodium chloride additive are required if a normal workload is to be maintained for eighteen hours.[22]

> After approximately three hours of exposure to the heat, [91 degrees F.; 61 percent RH] it was noted that many subjects had sweated through at least some part of the NBC protective garment [thus compromising the integrity of their protective clothing].... Beyond three hours, serious impairment in the performance of some individuals will occur, typically manifested as increases in errors of omission or in lowered productivity....[23]

In addition, sweat can seriously impair the filtration characteristics of the garments and mask filter and the gloves impede sensitivity and manual performance.[24]

Secure in a toxic environment, the greatest personal threat to the soldier is

---

stroke victims, provides diagnostic treatment procedures and medical recommendations to limit heat stress at MOPP-IV.

[20]John L. Kobrick and Lynn A. Sleeper, U.S. Army Research Institute of Environmental Medicine, *Effects of wearing NBC Protective Clothing in the heat on detection of visual signals*, report no. T7/85, (Natick, MA: November 1985), p. 1.

[21]Bernard J. Fince and John L. Kobrick, U.S. Army Research Institute of Environmental Medicine, *Assessment of the effects of heat and NBC protective clothing on performance of critical military tasks* (Natick, MA: June 1985), pp. 19–20.

[22]Biersner, *op. cit.*, p. 116.

[23]Kobrick and Sleeper, *op. cit.*, p. 1.

[24]Institute of Human Performance, *Observations and Comments: Kernel Usher 83–1*, project report, 31 January 1983, pp. 10–12, as quoted in Biersner, *op. cit.*, p. 116.

ironically his/her own psychological reaction to being "trapped". Cocooned, the soldier undergoes experiences analogous to sensory deprivations of which potential symptoms include: "...apprehension, paranoia, disorientation, loss of time sense, depersonalization, dissociation, distorted bodily sensations, hallucinations, confusion and panic."[25] It should be noted that the additional stress:

> ...of being exposed to an actual toxic agent or even the threat of it and/or other hostile enemy action in all likelihood will dramatically increase the negative impact on performance....In view of the great importance of maintaining efficient and effective artillery cover, communications, and decision–making capabilities while under an NBC attack, the seriousness of this problem should not be underestimated.[26]

These deficiencies in current Individual Protective Equipment (IPE) are critical as they must be taken into account in operational planning. Defensive training becomes crucial to avoid excessive casualties and the phenomenon of "gas hysteria," which occurred frequently during W. W. I.[27] NATO standard requires that troops don their masks in about nine to twenty seconds. However the mean average seems to be twenty to thirty second after the alarm has been sounded.[28] The *a priori* consideration the attacker must face is whether or not the defender's MOPP and IPE is adequate enough to deter the use of CWs. Though the protective garment will cause a degradation in performance in battle, it is an unquantifiable variable and therefore another uncertainty to contend with. Against unprotected troops,

[25]P. Solomon and S.J. Klieman, *Sensory Deprivation*, in Friedman, Kaplan, and Sadock, eds., *Comprehensive Textbook of Psychiatry III* (Baltimore: Williams and Williams, 1980), pp. 600–607, as quoted in Maj. Franklin R. Brooks and Col. Donald G. Ebner, et. al., "Psychological Reactions During Chemical Warfare Training", *Military Medicine* (Volume 148, March 1983), p. 232.

[26]Fince and Kobrick, *op. cit*, p. 20.

[27]During W. W. I, chemical strikes roughly accounted for 15 percent casualties as many troops were physically separated from their equipment. Clarke and Turnbull, *op. cit.*, p. 123.

[28]This figure is based on Swedish data. *Ibid.* U.S. troops train for nine seconds or less. Bay, *op. cit.*, p. 27.

CWs are as competitive as any conventional weapon. However, as soon as one is attacking prepared troops with good anti–chemical protection, the advantage leans towards conventional weapons. To achieve a 30 percent casualty rate among a platoon size unit (with a radius of 150 meters), a battalion of 18 155 mm howitzers must fire 18 rounds of fragmentation submunitions shells, if attacking and 72 if defending. Using airburst HE shells, the ratio between attack and defence is 72 to 918 respectively. If the target is carrying gas masks but not wearing them, 36 GB shells are needed for attacking and 1188 for defence. If the target is wearing gas masks but not protective clothing, both in attacking and defending 1322 rounds are necessary. Being hit while at MOPP–IV level, a casualty level exceeding a few percent would be unattainable. The figures given here are midrange ones for a cool, dry, overcast day with a gentle breeze.[29]

### A.2.2 Soviet Individual Protective Equipment

The Soviet Union has established an extensive defensive network in case of a gas attack. The level of integration of both offensive and defensive capabilities far exceeds Western efforts. The standard respirator is a rubber protective mask that covers the entire head and is connected by rubber hose to a canister filter. Various versions exist to accomodate the needs of specialized troops. The mask with accouterments weighs two kilos and is said to be uncomfortable and visually poor.[30] Apparently, Soviet masks are also harder to don quickly.

[29]Unfortunately, the authors do not define what they mean by "defending" and "attacking". Meselson and Robinson *op. cit.*, p. 42.

[30]C.J. Dick, "Soviet Chemical Warfare Capabilities," *International Defense Review* (Volume 14, number 1, 1981), p. 34.

The Soviet protective suit is viewed by western experts as being inferior as it is an air–impermeable rubberized suit. This means that heat degradation will occur far sooner than in western suits. Since the suit weighs three kilos and is impermeable, it is both uncomfortable and easily traps perspiration. The soldier can wear the suit for roughly four hours before heat stress builds up to casualty levels.[31] An interesting aside is the fact that contained within the soldier's personal medical kit, are antidote syrettes and tablets to counter Soman, toxic smoke, and hydrogen cyanide, all of which are not part of NATO inventory.[32]

[31]Meselson and Robinson, *op. cit.*, p. 41.
[32]Dick, *op. cit.*, p. 34.