

AD-A263 851



**STUDY
PROJECT**

The views expressed in this paper are those of the author and do not necessarily reflect the views of the Department of Defense or any of its agencies. This document may not be released for open publication until it has been cleared by the appropriate military service or government agency.

**THE CHEMICAL WEAPONS CONVENTION:
WILL IT ASSURE THE END
OF CHEMICAL WARFARE?**

BY

LIEUTENANT COLONEL EDDIE CAIN
United States Army

DISTRIBUTION STATEMENT A:
Approved for public release.
Distribution is unlimited.

**DTIC
ELECTE
MAY 11 1993
S E D**

USAWC CLASS OF 1993



U.S. ARMY WAR COLLEGE, CARLISLE BARRACKS, PA 17013-5050

93-10125



93 5 07 076

REPORT DOCUMENTATION PAGE				Form Approved OMB No. 0704-0188	
1a. REPORT SECURITY CLASSIFICATION Unclassified			1b. RESTRICTIVE MARKINGS		
2a. SECURITY CLASSIFICATION AUTHORITY			3. DISTRIBUTION / AVAILABILITY OF REPORT Approved for public release. Distribution is unlimited.		
2b. DECLASSIFICATION / DOWNGRADING SCHEDULE			4. PERFORMING ORGANIZATION REPORT NUMBER(S)		
5. MONITORING ORGANIZATION REPORT NUMBER(S)			6a. NAME OF PERFORMING ORGANIZATION U.S. Army War College		
6b. OFFICE SYMBOL (if applicable)			7a. NAME OF MONITORING ORGANIZATION		
6c. ADDRESS (City, State, and ZIP Code) Root Hall, Building 122 Carlisle, PA 17013-5050			7b. ADDRESS (City, State, and ZIP Code)		
8a. NAME OF FUNDING / SPONSORING ORGANIZATION		8b. OFFICE SYMBOL (if applicable)		9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER	
8c. ADDRESS (City, State, and ZIP Code)		10. SOURCE OF FUNDING NUMBERS			
		PROGRAM ELEMENT NO.	PROJECT NO.	TASK NO.	WORK UNIT ACCESSION NO.
11. TITLE (Include Security Classification) The Chemical Weapons Convention (CWC): Will it Assure the End of Chemical Warfare? - Uncl					
12. PERSONAL AUTHOR(S) Eddie Cain, LTC, USA					
13a. TYPE OF REPORT Study Project		13b. TIME COVERED FROM _____ TO _____		14. DATE OF REPORT (Year, Month, Day) 93 Feb 22	
15. PAGE COUNT 43					
16. SUPPLEMENTARY NOTATION					
17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)		
FIELD	GROUP	SUB-GROUP			
19. ABSTRACT (Continue on reverse if necessary and identify by block number)					
<p>After more than a generation of negotiations, the Conference on Disarmament (CD) has completed a draft treaty banning the development, production, stockpiling, transfer, and use of chemical weapons (CW). Unfortunately, despite all the successful work put into the CWC, it will not, and cannot assure a permanent halt to chemical warfare. This paper analyzes the merits of having a CWC treaty to thwart chemical weapons proliferation. It will offer a way to strengthen the verification regime. Finally, from this analysis, the paper reaches conclusions concerning what CW policy best supports U.S. national interests.</p>					
20. DISTRIBUTION / AVAILABILITY OF ABSTRACT <input checked="" type="checkbox"/> UNCLASSIFIED/UNLIMITED <input type="checkbox"/> SAME AS RPT. <input type="checkbox"/> DTIC USERS			21. ABSTRACT SECURITY CLASSIFICATION Unclassified		
22a. NAME OF RESPONSIBLE INDIVIDUAL COL MARK R. WALSH			22b. TELEPHONE (Include Area Code) 717/245-3207		22c. OFFICE SYMBOL DNSS

USAWC MILITARY STUDIES PROGRAM PAPER

The views expressed in this paper are those of the author and do not necessarily reflect the views of the Department of Defense or any of its agencies. This document may not be released for open publication until it has been cleared by the appropriate military service or government agency.

**THE CHEMICAL WEAPONS CONVENTION:
WILL IT ASSURE THE END OF CHEMICAL WARFARE?**

AN INDIVIDUAL STUDY PROJECT

BY

LIEUTENANT COLONEL EDDIE CAIN
United States Army

COLONEL MARK R. WALSH
Project Advisor

DISTRIBUTION STATEMENT A: Approved for public
release; distribution is unlimited.

U.S. ARMY WAR COLLEGE
CARLISLE BARRACKS, PENNSYLVANIA 17013

USAWC CLASS OF 1993

Accession For	
NTIS	CRA&I <input checked="" type="checkbox"/>
DTIC	TAB <input type="checkbox"/>
Unannounced <input type="checkbox"/>	
Justification	
By _____	
Distribution /	
Availability Codes	
Dist	Avail and/or Special
A1	

ABSTRACT

AUTHOR: Eddie Cain. LTC, United States Army

TITLE: The Chemical Weapons Convention (CWC): Will it Assure
The End of Chemical warfare?

FORMAT: Individual Study Project.

DATE: 22 February 1993 **PAGES:**43 **CLASSIFICATION:** Unclassified

After more than a generation of negotiations, the Conference on Disarmament (CD) has completed a draft treaty banning the development, production, stockpiling, transfer, and use of chemical weapons (CW). 138 states, including the United States, Great Britain and Russia, have signed the CWC draft treaty. Their signatures signaled world-wide condemnation of chemical warfare as an acceptable means of conducting war. Unfortunately, though, despite all the successful work put into the CWC, it will not, and cannot assure a permanent halt to chemical warfare. Third World countries, will continue to flex their muscles by attempting to produce and hide CW as a deterrent. This paper analyzes the merits of having a CWC treaty to thwart chemical weapons proliferation. It will offer a way to strengthen the verification regime. Finally, from this analysis, the paper reaches conclusions concerning what CW policy best supports U.S. national interests.

TABLE OF CONTENTS

	PAGE
ABSTRACT.....	ii
TABLE OF CONTENTS.....	iii
INTRODUCTION.....	1
U.S. COST/BENEFITS.....	2
IMPACT OF NO-USE CW POLICY ON CWC.....	9
CHEMICAL PROLIFERATION: AN INTERNATIONAL PROBLEM.....	13
BEST WAY TO APPROACH VERIFICATION.....	22
PROLIFERATION CONTROL UNDER INTERNATIONAL AND DOMESTIC LAW...	29
BEYOND EXISTING PROPOSALS FOR HALTING CW PROLIFERATION.....	34
CONCLUSIONS.....	37
ENDNOTES.....	39
BIBLIOGRAPHY.....	42

The Chemical Weapons Convention (CWC): Will It Assure The End Of Chemical Warfare?

Introduction

Chemical weapons have come to the forefront of public attention during the past few years. The world has heard about the widespread use of chemical weapons by Iraq against Iran and Iraq's Kurdish population, and about Iraq's open threat to employ chemical weapons against U.S. forces during the recent Persian Gulf War. Further, the United States and the Soviets reached an agreement on the partial destruction of their chemical weapons stocks. Somewhat less at the center of public attention, but nonetheless important, are the ongoing United Nations General Assembly initiatives to gain full international support of a treaty banning chemical weapons.

After more than a generation of negotiations, the Conference on Disarmament (CD)¹ has completed a draft treaty banning the development, production, stockpiling, transfer, and use of chemical weapons. The anticipated overwhelming endorsement of the Chemical Weapons Convention (CWC), when it is opened for ratification in late 1993, will establish international concurrence against possessing chemical weapons, even if some nations with actual or potential weapons capabilities refuse to endorse the treaty. Unfortunately, the CWC may not create a world free of chemical weapons.

The CWC is likely to be an imperfect tool of security, both nationally and internationally. States in the developing world

no less than those in the developed world will be concerned about the Convention's imperfections and the risks the treaty poses. Individual states will go through their own cost/benefit analyses. The ultimate effectiveness of the regime will be a function of these analyses and the breadth of common observance achieved by the regime. Most nations seem to support approval of a global treaty, but hold-outs will remain. These states are likely to be pressured to become signatories. This pressure-as well as others-will increase, not ease, as the convention gains momentum.²

This paper will analyze the U.S. cost/benefits for its cooperation in chemical weapons disarmament. The paper will assess the impact of U.S. policies on implementing the CWC. Endemic problems that distinguish the control of chemical weapons from that of nuclear weapons will be examined. Control of chemical weapons proliferation through U.S. domestic legislation as well as through observance of existing and proposed international agreements on chemical weapons will also be analyzed. Then the paper will offer insights on how the issue of verification can best be approached. Finally, the paper will propose a way for the U.S. to respond to nations who violate the treaty.

U.S. Cost/Benefits

Given all of the uncertainty about the advantages and disadvantages of a total ban CW treaty, one thing is certain: the U.S. current CW policy - no first use - and the international

political climate regarding the use of CW are not in concert. Therefore it is appropriate to examine both policies and intentions, to determine if one or both require change, and to explore whether the United States should ratify the CWC Treaty.

From a decisionmaker's point of view, a first consideration would be to determine whether a CW warfighting capability is required for U.S. national security. If not, then the requirement is for deterrence only. If this is the case, it would then seem logical to consider whether renunciation of chemical warfare should be the policy adopted; if so, the question of how much and what kinds of chemical weapons will not arise: all chemical weapons should then be taken from the arsenal. If renunciation is rejected, some degree of capability for retaliation in kind is confirmed as a requirement, and the choice is then among the ways and means necessary to guarantee credible retaliation.

There are several general considerations pertinent to policy review, among the most important of which are (1) the military and political utility of chemical weapons and (2) the attitudes of the public and Congress on CW. Concerning the military and political utility of CW, it is clear that there are major differences between the perceptions held in the United States and other developing countries. In the United States, although military planners have long understood the potential military effectiveness of CW, several factors have inhibited the assimilation of CW as an integral part of the U.S. force posture.

From World War I to the present, chemical warfare has been the subject of controversy within the military. The Chemical Warfare Service (which became the Chemical Corps after World War II) had to exert lobbying pressure through the Congress even to continue its existence after World War I.³ Both before and after World War II chemical warfare expertise and the responsibilities for planning and development of CW capabilities were largely left to the chemical specialists. Senior commanders were often indifferent and sometimes hostile to the concept of employing chemical weapons. Hence, CW has been an add-on military capability, rather than an option fully assimilated into U.S. military doctrine. In recent years such widely publicized and controversial issues as the use of herbicides and riot control agents in Vietnam and the accidents and publicly perceived hazards associated with the testing and storage of toxic agents have impelled Congress to pass highly restrictive laws governing the peacetime transportation, deployment and disposal of CW munitions. All this has had a negative effect on both the military and political utility of CW. Further, the overall amount of CW munitions which it has been allowed to deploy overseas greatly reduces the deterrent potential of U.S. CW. In short, the U.S. has not demonstrated significant retaliatory capabilities with CW.⁴

The situation in developing states is nearly the reverse of that in the United States. Developing countries facing significant conventional force threats have acquired CW

capabilities to counter this threat. The Egyptian and Syrian programs are responses to Israel's conventional superiority, particularly its highly effective air force. Burma is said to have sought CW for use against domestic insurgency.⁵

United States Congressional attitudes (which reflect in general the public's views) are crucial to the adoption and implementation of any U.S. CW policy. Any assessment of U.S. attitudes reveals a rather deep-seated American aversion to the whole idea of using chemical weapons. Thus Congress has always been clearly in favor of no-first-use of chemical weapons.⁶ More recently there has been some political support for preparation of an effective defense against enemy CW attack. Congress is also generally in favor of pursuing negotiations seeking the eventual ban of CW. But on the issue of whether the United States should continue what has been the long-established policy of having a capability for retaliation in kind, there are wide differences in Congressional opinion. Some favor abandoning all CW offensive capabilities and relying on a nuclear retaliation for deterrence. At the other extreme some favor the modernization of the U.S. CW stockpile.⁷ Given this widespread disparity and the fact that these views were formulated prior to the end of the Cold War, there is a need to review what CW policy will best serve U.S. national interests.

There are basically three policy options: (1) Diplomatic Initiative on CW Treaty Issue, (2) Conventional Warfare Response to a CW Attack, and (3) Declaratory Nuclear Response to a CW

Attack.

1. Option(1): Diplomatic Initiative on CW Treaty Issue

Through the first option, the deterrence of CW would be accomplished by an international agreement to abolish CW as a form of warfare. Under this policy, the United States would take the lead by renouncing its CW capability. Then the U.S. would unilaterally begin a three-year demilitarization program to destroy CW stocks and production facilities (destroying the entire U.S. chemical arsenal will most likely take 8-10 years). If at the end of three years there were no acceptable agreement on a CW ban, the U.S. policy would be amended to include a warning statement that if any state were to use CW on U.S. forces or its allies, the United States would respond immediately and forcefully with whatever means necessary (short of nuclear weapons) to end the attack.

the impact of this alternative on U.S. and allied CW strategy would not be major inasmuch as existing CW capabilities have virtually been eliminated.⁹ But the U.S. announced plan to unilaterally eliminate CW stocks might well be perceived by Third World countries as an act of weakness. This perception could cause countries like Libya and Iraq to build an even stronger CW capability. From a policy perspective, the only drawback with this option is that it would still leave the U.S. with a CW retaliatory capability. The public and the Congress would not favorably support this policy, since there has been general

disapproval of using CW as an acceptable means of warfare.

2. Alternative (2): Conventional Warfare Response to a CW Attack

The objective of this policy is to eliminate the costs and the political problems associated with maintaining a capability for retaliation in kind. Instead, we would rely upon an announced policy of conventional retaliation.' The impact of this alternative on allies would be favorable since it rules out the possibility of having to deal with problems (storage, handling) associated with CW.

Public, Congressional and military leaders would support this alternative because of the limitations on CW use. There are few tactical missions where it would be significantly advantageous to use chemicals. Conventional alternatives exist for virtually every battlefield contingency in which chemical weapons might be considered, and the alternatives are generally easier to use.

Chemical munitions, since they disperse through the air, are subject to the uncertainty and unpredictability of the weather. The use of chemical weapons in mobile operations is rarely advantageous, and almost always at the cost of mobility. Battlefield use of gas masks hampers the planning and execution of coordinated mobile operations, both one's own and the enemy's.

Deployment and logistical consideration do not favor chemical weapons either. Chemical weapons must be handled in the

same manner as nuclear weapons-under tight control in special command channels. Also, transporting chemical munitions means leaving behind conventional munitions that are more likely to be used on the battlefield.

3. Alternative (3): Declaratory Nuclear Retaliation to CW Attack

The objective of this policy would be to eliminate the requirement for maintaining a capability for retaliation in kind by substituting an announced policy of nuclear retaliation to a CW attack. However, although the nuclear retaliation policy would be declared, the actual nuclear response presumably would not be automatic: some unspecified "CW Threshold" would prompt the decision to use nuclear weapons, in light of the overall tactical situation.¹⁰

In contrast to the "Conventional response" policy described above, in which no specific note is taken of any enemy attack, under this policy CW would be singled out for special attention. That is, any enemy use of CW would be potentially an escalatory step. Through promulgation of this policy, both sides would understand that CW is coupled with nuclear warfare. This policy thus substantiates developing countries' views of chemical munitions as weapons of mass destruction.

Among those allies (France, Germany and Great Britain) who believe that even the limited probability of a surprise attack from the Russian Republics would lead to general nuclear war, this option is sufficient to warrant preparations to deter such

an attack. On the other hand, there is a growing disposition among all allies to question the credibility of the U.S. commitment to use its strategic force in the event the former Soviet Union attacks. Germany and Great Britain no longer perceive a nuclear threat. Those who hold such views would tend to look on this option with skepticism.¹¹

Public and Congressional opinion on this policy would be negative. Most would simply believe that the U.S. moral responsibility as a world leader would rule out this response as "Un-American."

But 138 states, including the United States, Russia and Great Britain, have already co-sponsored the CWC Treaty. Thus the message is loud and clear: chemical warfare is no longer an acceptable mean of conducting war. Therefore, it seems that the only logical conclusion to draw from this overwhelming condemnation of chemical warfare is to adopt policy option (2). This option would essentially ban the use of CW. Given this fact, it would be useful to review the impact this policy would have on implementing the CWC Treaty.

Impact of No-Use Policy on CWC

The CWC is a historic agreement, banning all chemical weapons worldwide and imposing wide-ranging inspections to verify that ban. The CWC goes far beyond the 1925 Geneva Protocol, which bans only the use of chemical weapons in warfare. Article I of the CWC prohibits all development, production, acquisition, stockpiling, transfer, and use of chemical weapons. Moreover,

Article I of the draft treaty requires each party to destroy chemical weapons and production facilities, as well as any chemical weapons that may have been abandoned on another states's territory. Riot control agents such as tear gas "as a method of warfare" are also banned. The language in Article I of the draft CWC is precisely what the U.S. should have adopted as its national policy long ago: No-Use, as opposed to a controversial policy of No-First-Use.

Being the first state to sign and ratify the treaty will provide invaluable benefits. First, this action will place enormous international pressure on other states to follow the U.S. lead. Russia, for example, the only other nation to publicly declare a CW capability, would probably support the treaty because of her current political and economic problems. Second, a binding international ban will delegitimize chemical weapons. It will thus reverse the perception, supported recently because of the widespread use of poison gas during the Iran-Iraq War, that CW provides acceptable instruments of military power.

Third, a ban would prevent the many countries that are capable of producing chemical weapons, but have not yet done so, from taking this step. The spread of chemical weapons has so far been limited to Asia and the Middle East. Even if specific countries in these regions choose not to sign the treaty, much will have been gained by preventing chemical weapons from spreading to other countries and other regions. The Nuclear Non-Proliferation Treaty may offer a useful analogy. Although

certain key states refuse to sign it, the treaty has nonetheless strengthened the international norm against the spread of nuclear weapons. Clearly, the treaty has not prevented a handful of countries from continuing to pursue their nuclear ambitions, but it has been costly and without the treaty, John F. Kennedy's fear of 15 or 20 nuclear powers by 1975 might well have been realized.¹² Similarly, without a chemical weapons convention, the world may face a situation a decade or so from now in which many more countries will possess chemical weapons. Perhaps this may mean little, but even if the convention does nothing but delay the inevitable, this will be far better than no treaty at all.

Fourth, a treaty banning CW will provide a legal basis for actions against countries that produce CW. It will thus provide the international community with a strong legal basis for dealing with activities that threaten the sovereignty of other countries. Because signatories will assume a binding legal obligation not to provide such assistance, this commitment is much more likely to be implemented and enforced by a now more powerful United Nations.

In the final analysis, policymakers in the United States must address one question: should a handful of Asian or Middle Eastern states that choose to retain their chemical weapons be allowed to deny this country, and the rest of the world, the obvious benefits that would flow from a chemical weapons ban? The answer to this question undoubtedly should be based on the

answer to a related question: does the existence of a U.S. chemical weapons arsenal deter developing countries from undertaking chemical weapons activities? On this point, it seems clear that there can be little debate. Recent experience has shown that U.S. chemical weapons do not deter developing countries either from acquiring chemical weapons or from using them against one another. Moreover, Iran's and Iraq's mutual possession of the capability did not deter the use of CW against Islamic brethren during the 1982-1988 Gulf War.¹³

Nor does the United States need chemical weapons to deter the use of such weapons against the United States. The array of advanced conventional weapons in the U.S. arsenal can be used to deter and, if necessary, respond to any chemical threat by a developing country. Saddam Hussein's failure to follow through on his promise to use chemical weapons during the Persian Gulf War may well have been influenced by this very strategy, the threat of retaliation by massive conventional weapons to defeat the enemy. The United States, therefore, has little to lose, and much to gain, from the implementation of a treaty banning all chemical weapons. Having said this, the one subject that still baffles policymakers is how to deal with the issue of CW proliferation? Control of CW proliferation will for the most part determine success or failure of the CWC. Given this fact, it is important that CW proliferation be addressed from an international perspective.

Chemical Proliferation: An International Problem

The mechanics of chemical weapons proliferation are complex because they are fueled by sensitive international and domestic politics and by the concern of powerful economic interest groups. Poor nations covet chemical weapons because these munitions provide a potent and available alternative to nuclear weapons.¹⁴ Furthermore, these nations resent the possibility of export controls which would not only cut off the source of chemical weapons but would also halt the flow of chemicals needed for their legitimate chemical industries. Finally, chemical manufacturers balk at export controls which would hinder profits and free trade.

A. Political and Strategic "Incentives" for CW Proliferation

Toxic weapons have often been described as the "poor man's atomic bomb,"¹⁵ and they are attractive to developing countries for many of the same reasons that motivate nuclear-capable states to retain nuclear arsenals. Nations without nuclear weapons see chemical weapons as significantly strengthening their regional security and international influence. As in the case with nuclear weapons, chemical weapons can serve as a strategic deterrent. In light of increasing acquisition by developing countries of ballistic missile delivery systems that are capable of reaching an enemy hundreds of miles away,¹⁶ chemical weapons can offer a "window of protection" for non-nuclear states against more powerful neighbors. Arab states often argue that this is a

legitimate justification for their acquisition of chemical weapons, which some of them feel are necessary to offset their fears of a Israeli nuclear capability.¹⁷ When deterrence fails and a state becomes involved in war, chemical weapons can be used to avert a desperate losing situation. Iraq demonstrated this tactic during the Gulf War in which chemical munitions turned back Iranian "human wave" attacks that threatened to dislodge Iraqi defenders from key positions.¹⁸ This strategy was somewhat similar to NATO's strategy of employing short-range nuclear weapons prior to ratification of the INF Treaty. Developing countries recognize the value of a weapon with such defensive potential at so little cost. Immunity from military threat can give a state with such a powerful defensive capability a greater range of flexibility in its own domestic and foreign policy.

Like most weapons, the potential use of chemical weapons is not limited to defense or deterrence. Offensive chemical weapons capability, whether or not they are used, confers a significant military advantage because protective measures are expensive and cumbersome and can severely restrict an opponent's combat effectiveness.¹⁹ A state with a chemical weapons capability might seek to further its interests against a neighboring state unable to deter a chemical weapons attack through a strategic offensive use such as the "big threat." The chemical capable state might, for example, demand the removal of a government leader or the elimination of support for a rebel group.

Threatened use of chemical weapons against the United States could affect U.S. flexibility to respond in regional conflicts because required protective measures could encumber military operations and reduce combat effectiveness to the point that U.S. forces no longer represent a credible presence. Surprise use of chemical agents by a developing country or by a terrorist group against exposed, overseas U.S. targets such as air and naval bases could lead to high casualty levels. The resulting outcry of public opinion could cause a U.S. administration to severely restrict the use of military force as an instrument of national policy in subsequent regional conflicts.²⁰ Offensive use of chemical weapons by that same state or by a subnational group against an unprotected developing country could set off a similar public reaction and lead to quick capitulation by the targeted state.

In addition to state use of chemical weapons to manipulate less powerful neighbors and to thwart superpower flexibility, terrorist use of toxic weapons, either on a large or small scale, looms as an ominous threat. As security measures against traditional terrorist attacks improve, terrorist groups may be increasingly tempted to turn to cheap, easily obtainable chemicals as weapons of choice. In spite of the operational disadvantages of chemical weapons,²¹ a terrorist could cause enormous damage in an enclosed area such as a subway station or an aircraft with a relatively small quantity of a chemical agent.

For both nations and subnational groups, chemical weapons

appear to offer substantial military and strategic benefits. The increasing militarization of developing countries has led to more frequent and critical incidents of international friction. Religious and political fractionalization in these societies expand the number of players seeking to exercise power. Each player in this complex equation looks for tools to gain or hold advantage in increasingly delicate regional and international balances of power. It is little wonder that chemical weapons proliferation is a real and growing problem in such an environment.

B. Structural Barriers to Halting CW Proliferation

One of the most difficult factors in arresting chemical weapons proliferation is the broad and complex international trade in chemicals, plant technology, and engineering processes required to produce chemical products. Chemicals that can be used in toxic weapons can also be found in many of the basic industries, such as textiles, agriculture, and pharmaceutical, in even the least developed nations. Chemical weapons negotiators face, as a result, a much more difficult task than the one that confronted nuclear-capable states as they negotiated the Nuclear Non-Proliferation Treaty.

Nuclear weapons capability turns on the availability of two key elements: fissionable material, either plutonium or highly enriched uranium, and the sophisticated engineering capability required to construct a nuclear warhead." Since nations with stockpiles of fissionable material tightly monitor stocks and

since only a few suppliers provide the required highly sophisticated engineering processes and specialized equipment, there are "choke points" at which nuclear proliferation can be controlled. Also, controls on the transfer of nuclear technology were put into place soon after the development of nuclear weapons.²³ By contrast, the manufacture of chemical weapons is a much simpler procedure. Ambassador Ledogar, Chief negotiator for Chemical Disarmament in Geneva, says that "chemical weapons can be manufactured in almost anybody's garage, as long as you have a little high-school chemistry behind you."²⁴ Because of their simplicity, chemical weapons cannot be controlled by monitoring or regulating the trade in the underlying technology. Also, a myriad of trade channels resulting from the broad long-standing international chemical trade permits easy availability of chemical components, many of which have legitimate and peaceful uses. For example, thiodiglycol, the primary chemical in nerve gas, is used extensively to produce plastics.

Another example relates to the Libyan plant in Rabata, which was recently built with extensive European and Japanese assistance. Many participating companies, to include American firms, believed that their goods were either being used for a desalinization equipment factory or for a pharmaceutical plant in Hong Kong.²⁵ U.S. equipment and computers supplied by third parties may even have been used in the plant.²⁶ Manipulation of shipping documents and filing of false papers can obscure the intended destination of chemical components and defeat efforts by

government officials to control the ultimate destination of exported goods. Two recent cases illustrating the depth and complexity of the problem involved the illegal re-export of thiodigylcol. By listing a false destination on export declaration, two enterprises succeeded in shipping the chemical from European or Asian countries to the Middle East.²⁷

The creation or enforcement of export controls necessary to halt clandestine transfers of weapons-related chemicals often meets opposition from countries seeking to protect developing chemical industries or valuable export markets. India, fearing that controls would harm its chemical industry, strongly opposed any mention of export controls as part of the Paris declaration.²⁸ India's position has been echoed by other industrializing nations such as Brazil. Industries within developed nations also exert pressure on their governments to resist tough export controls. For example, the U.S. Commerce Department and the House of Representatives reacted strongly to industry pressure resulting from the Defense Department's review of free world technology export licenses under the Export Administration Act of 1979. Under this legislation, the Defense Department sought to restrict the export or re-export of U.S. technology.²⁹ Fearing that licensing delays would harm U.S. exporters, the House decried the idea of giving the Defense Department a "veto" over free world exports. This is going to be a really difficult "nut to crack," given the world's economic woes. In fact, President Clinton has already publicly stated

that he will aggressively defend America's trade interests and help support U.S. industries as U.S. firms struggle against foreign competition.³⁰ Some resistance in industrialized states to the use of export controls as a tool to regulate chemical weapons proliferation has begun to break down in the face of the growing proliferation threat. The tension between free trade and the control of weapons proliferation, however, remains a daunting problem in verifying compliance to the CWC.

The effectiveness of an attempt to slow chemical weapons proliferation through the use of export controls depends on the rigor of accompanying verification and compliance measures. Indeed, as the limitations imposed by treaty on a given category of weaponry becomes more complete, the consequences of violation and the value of verification also increase. Where the goal is to complete elimination of an entire class of arms, as in the case of chemical weapons, verification becomes a critical issue. Verification has suffered through a difficult evolution in arms control agreements, and verification procedures often have proven the most difficult and complex portions of arms control negotiations to resolve.

The dual-use nature of chemicals and the complexity of the world chemical trade make the verification of chemical and plant equipment transfer restrictions more difficult than similar controls used in the nuclear or high technology fields. Stockpiled chemical weapons can be easily hidden. Further, despite the sophistication of modern intelligence

capabilities,³¹ empirical verification problems unique to chemical arms remain unsolved. Tracking the worldwide spread of chemical and biological weapons strains national intelligence resources because much of the equipment and many of the chemicals involved may be used for legitimate purposes. Because of the close relationship between toxic agents and chemical products used for a wide variety of peaceful purposes, chemical weapons can be manufactured in facilities that can be converted quickly from commercial uses to weapons manufacture. Chemical plants may have little in the way of external signatures to indicate that weapons production is taking place.³² Experts say that with the turn of some valves, or the change of a catalyst, a plant can convert from pesticide manufacture to weapons production in as little as twenty-four hours with no external signs of the change."

Not only does the dual-use nature of chemicals make the verification of a ban on weapons production resemble a shell game, but any effort at verification also must take into account deep political tensions that arise from the intrusive nature of verification. Verification will be intrusive because it will involve constant monitoring of chemical production facilities, either by on-site observers belonging to an international authority or by tamper-proof equipment and sensors inside chemical plants. Quick notice inspections with as little as twenty-four hours notice have also been included in contemplating CW verification regimes.³⁴ For the agreement banning chemical

weapons to be effective, it must enjoy broad participation and balanced reciprocity in the agreement's verification scheme. Reciprocity, however, is by definition a two-way street. Thus if the U.S. is to credibly demand a right to quick-notice inspections of other nations' chemical facilities, it would have to submit its manufacturers to the same inspections. Fear of industrial espionage by developing states who would relish a closer look at American chemical facilities is just one barrier to a successful verification scheme from the U.S. perspective.

Current international agreements such as the 1972 Biological Weapons Convention (BWC) include verification methods such as adversary investigations, consultative meetings of nations, U.N. General Assembly investigations, and Security Council meetings. These methods are oriented toward verifying allegations of biological weapons use; the methods are not designed to verify the transfer or development of biological weapons. While these procedures could be applied to transfer and development verification as part of a new chemical weapons agreement, the inspection process suffers from critical drawbacks that would hamper inspection effectiveness." In the absence of a broad international verification regime covering the transfer of chemical weapons technology, the difficult verification task is largely left to domestic agencies such as the U.S. Customs Service and the intelligence communities of individual nations.

The Best Way to Approach Verification

Despite all these problems, a Chemical Weapons Convention will require verification - verification that stockpiles are destroyed, that new agents are not being produced in civilian industries, and most importantly, that such weapons are not being used. Moreover, the verification procedures will have to take into account the possibility of the development of previously unknown "novel" agents.

The equipment needed for verification will vary. To verify non-production in a civilian plant, for example, inspectors will need mobile equipment that can completely process chemical samples at the plant site (U.S. companies might be extremely reluctant to allow samples to be taken away from the site, since that could compromise their technological secrets).³⁶ On the other hand, verifying the use of chemical agents will require collection equipment and sophisticated scientific instruments, probably located at a number of fixed-sites laboratories. Finally, the entire process must stand up to intense international scrutiny.

Because of these varying considerations, a wide range of analytical techniques - each appropriate to the task at hand - is needed. Further complicating the verification task is the fact that the chemical structure of warfare agents varies widely from simple, small molecules (such as hydrogen cyanide and phosgene) to complicated chemical compounds similar to VX (nerve gas that attacks the central nervous system). Correct identification of

these diverse substances requires an array of laboratory procedures. There is, however, one overriding criterion for the verification effort: reliability. The methods used must yield results that will hold up "in a court of law." Test results become even more reliable if laboratories can use at least two distinct methods for confirming results; that is, the results of one test can verify the accuracy of another, completely different analytical procedure. In other words, the Convention must have redundant and reliable verification procedures in order for the agreement to be credible (procedures that have yet to be worked out). Two procedures should be employed.

Gas Chromatography

In 1973, gas chromatography promised to be a major technique for analyzing chemical warfare agents. It was, accordingly, chosen as the first technique to be explored by the Verification Committee, a committee established by the Conference on Disarmament for banning CW. At that time, however, there were no high quality commercial instruments available. In particular, high-resolution analysis required the use of capillary columns. Gas chromatography reveals a unique chemical signature or "fingerprint" of each chemical warfare agent. These are called retention indexes, and they have been stored in a computerized library. Comparing environmental samples with these computerized "fingerprints" allows virtually automatic identification of chemical weapons (See Figure 1). The reliability of gas chromatography identification is increased when, instead of a

single column, two parallel columns coated with different stationary phases are used together with retention index standard compounds, employing both universal and selective detectors. The retention index values of the monitored compounds are determined and stored in the computer memory. When the sample contains any of the agents, the instrument compares the index values with those in its memory and identifies the compound and reports its name. This method is called Retention Index Monitoring (RIM).

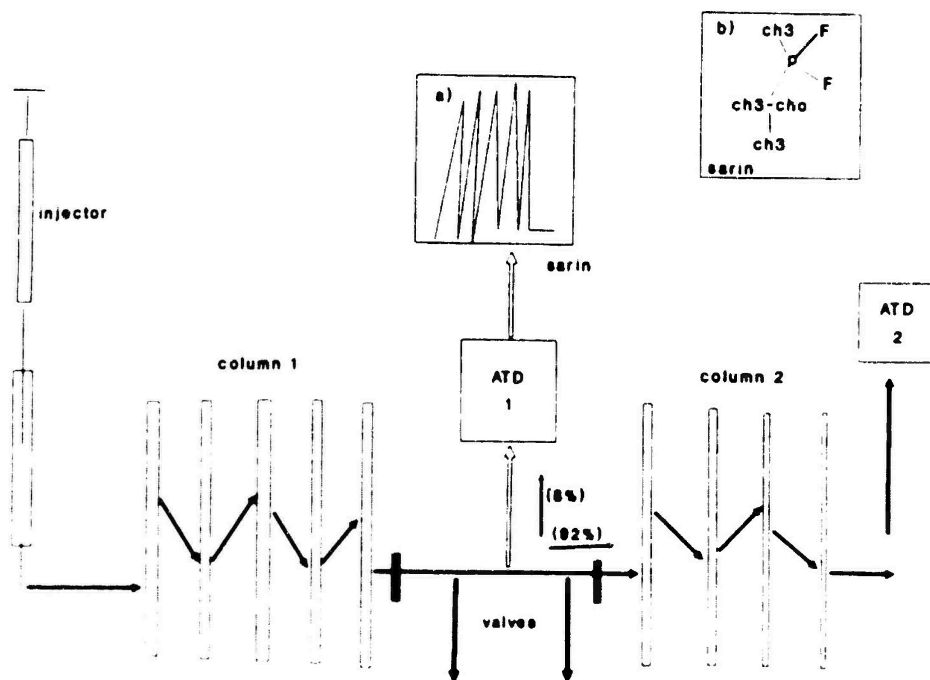


Figure 1: Retention Index Monitoring

Gas chromatography involves the separation of chemical compounds into their component parts and subsequent analysis. It is a highly reliable method of identifying both chemical warfare agents and other chemicals that can be used to produce chemical weapons (precursors). To increase the reliability of gas

chromatography, two other methods can also be used, nuclear magnetic resonance (NMR) spectrometry, and infrared spectrometry (see figure 2). These methods use simultaneously six short capillary columns. When a single compound passes through the column unit, it gives as many peaks as there are columns in the unit and gives a retention spectrum which is characteristic of the compound. This method is ideal for identifying small traces of chemical agents as well as unknown compounds, such as novel agents; whereas RIM is more suitable for identifying large quantities of chemical agents. All three methods employed in strategic locations could provide the CWC with the necessary "smoking guns." Another reliable verification procedure is air monitoring.

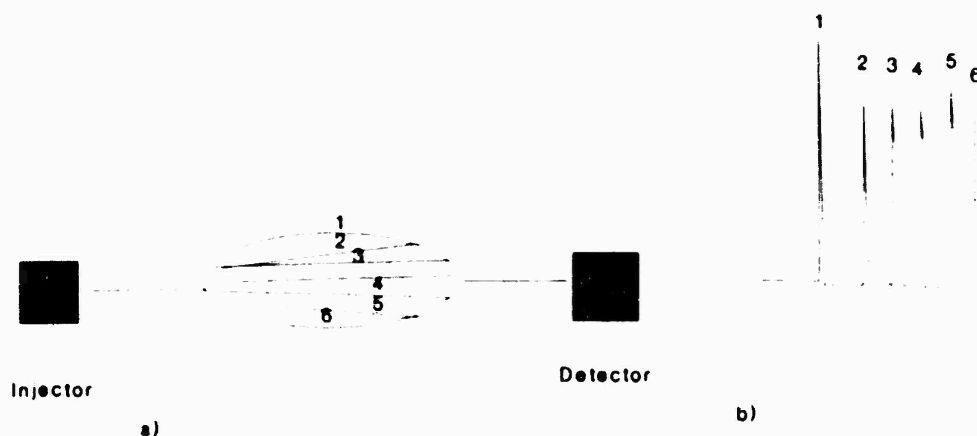


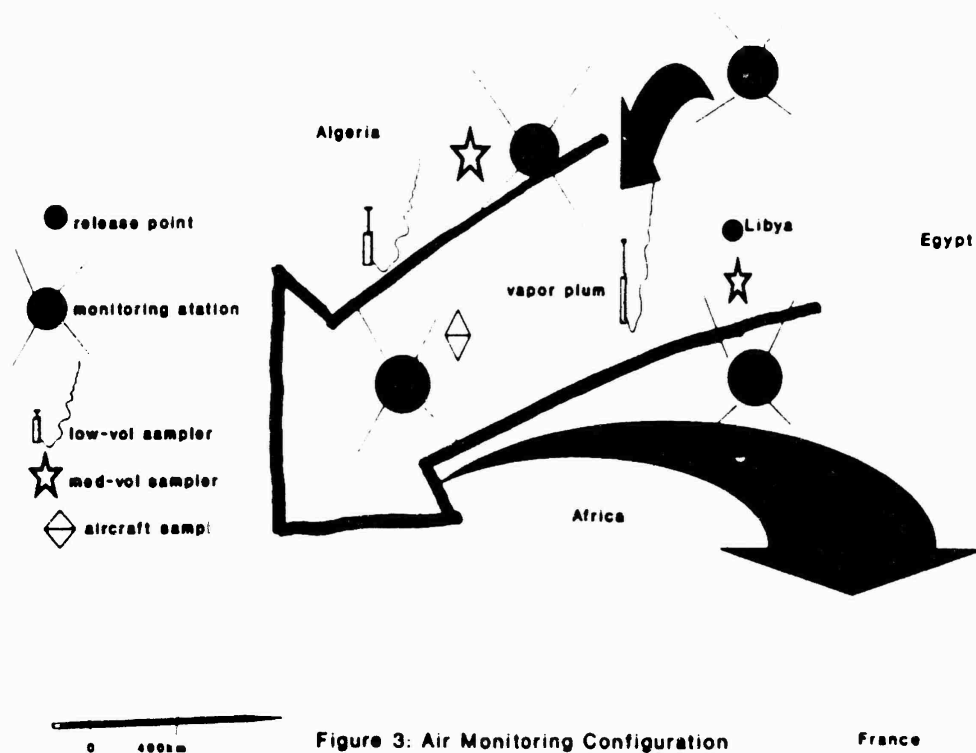
Figure 2. NMR and IR Spectrometry

Air Monitoring

Since 1985, researchers have explored air monitoring as a possible off-site verification procedure. Unfortunately, states are reluctant to employ this technique because of the political issue of sovereignty. Most states, including the United States, believe that this technique is too intrusive. But the fact of the matter is that this method is the only way states can check to see if other states are complying with the treaty.

Air provides a suitable matrix for verification analyses, since the Convention will regulate many activities that will likely release chemicals into the atmosphere. Air also traverses the borders of countries; agents released in one country can be detected downwind in a neighboring state. The knowledge that even a few kilograms of a chemical warfare agent released into the air can be detected hundreds of kilometers downwind can have a powerful deterrent effect on would-be Convention violators. Accordingly, an executive monitoring committee can install remote monitoring devices (tamper free) at strategic locations around the world (See Figure 3). The network would consist of automatic monitoring stations, spaced 400 to 500 km apart. At selected stations, additional equipment would collect and analyze high-volume samples. Should a monitor detect banned substances in the air, meteorological data could be used to determine the possible emission site. If more samples were needed, aircraft could be dispatched for collection. Parties to a Chemical Weapons Convention could use these stations to document their own

compliance, as well as to check on neighboring states.



A workable Convention must contain effective compliance measures. Without the guidance of a comprehensive international agreement covering chemical weapons, compliance measures for prohibited transfers have been left either to ad hoc international measures taken in response to specific incidents or to the domestic laws of individual nations. To date, compliance measures used to halt prohibited weapons proliferation have involved actions on several different fronts. The most common

measures used by the United States in pursuing compliance with trade control measures have been economic sanctions. These include limits on U.S. government programs such as foreign assistance and landing rights, restrictions on exports from or imports to the United States, limits on private financial transactions, and restrictions on access to international financial institutions. The U.S. legal regime supporting economic sanctions, however, has been roundly criticized as haphazard and ineffective, and targeted states are increasingly becoming immune to U.S. economic sanctions.³⁷ Despite their continuing popularity, economic sanctions applied by the United States in furtherance of nonproliferation policies have not been entirely successful.³⁸

In the face of a recent flurry of activity on the part of individual states, the chemical industry, and the international community, efforts at controlling proliferation to date have worked at best only to delay the transfer of chemical weapons technology. Middle Eastern states continue to stockpile the weapons, and some of these nations represent an additional risk regarding the transfer of chemical weapons to terrorist organizations. Many developing countries seek the military and political advantages gained from possession of a weapon of such destructive capability. The scope and complexity of the international chemical trade make the development of a regime to control proliferation more difficult than curbing the spread of nuclear or conventional weapons. Countervailing political,

military, and trade interests impede the development of export controls and verification measures. Meanwhile, compliance schemes are in disarray and rely almost completely on extraterritorial application of domestic law for enforcement. It is no wonder that agreement on a comprehensive CW ban has taken so long to complete. Yet the more difficult challenge of getting all nations to ratify and comply may take even longer.

Proliferation Control Under International and Domestic Law

Proliferation control under international and domestic law is currently ineffective because of gaps in the international treaties and serious difficulties with U.S. export control legislation. A new chemical weapons treaty should fill the gaps left in earlier treaties. It should as well suggest ways for countries to exercise powerful domestic export controls."

The 1925 Geneva Protocol, which forbids the use of poison gases or bacteriological methods of warfare, banned neither production nor stockpiling and did not address the issue of chemical weapons proliferation. Some nations, including the United States, only ratified the treaty subject to a reservation permitting retaliatory use. Beyond failing to address proliferation, the Protocol has been criticized for ambiguous and outdated language and for ignoring the issues presented by verification. Moreover, the Protocol fails to address compliance issues. The treaty states only that parties to the agreement will use their best efforts to induce other nations to accede to the Protocol's terms. Under the Protocol, the only available

sanction for violation of its terms is international pressure.⁴⁰

The BWC directly addressed the issue of biological agent proliferation by banning transfer. However, the BWC does not provide a model for successful proliferation control since the Convention's treatment of verification is very general, relying heavily on the United Nations and on cooperation among parties. Further, the BWC fails to provide for verification controversies. The document also suffers from many of the difficulties of ambiguous language that hamper the Geneva Protocol's effectiveness. The BWC, while prohibiting development, stockpiling, production, acquisition, or retention of microbial or other biological agents or toxins, and specifically barring their transfer, fails to ban their use.⁴¹ Because it does not restrict use, it is unclear under the Convention whether proof that a nation has used biological weapons that are not otherwise subject to the Geneva Protocol's ban on use is sufficient to establish a violation of international law.

Article X of the BWC also permits the use of biological equipment and agents for peaceful purposes. By failing to define peaceful purposes, this clause created a loophole that leaves room for proliferation. Chemical or biological substances meant for peaceful purposes such as biological research, easily can be used for non-peaceful purposes, especially in the absence of a comprehensive verification scheme.

The only existing international agreement that addresses the proliferation of a class of dangerous weapons is the Nuclear Non-

Proliferation Treaty. In Article III, non-nuclear weapons states agree to accept International Atomic Energy Agency (IAEA) verification procedures to ensure that nuclear energy is not being diverted from peaceful purposes to weaponry. Nuclear states agree not to provide nuclear material or technology to non-nuclear states for peaceful purposes, as allowed elsewhere in the agreement, unless it is subject to those verification safeguards. The Nuclear Non-Proliferation Treaty, by responding to developing nations' concerns, acts principally by controlling end-use of nuclear technology through the regulation and supervision of the IAEA, rather than by prohibiting the transfer of nuclear technology outright.⁴² This has been a viable system because of the visibility and limited number of nuclear facilities in recipient states and because the technology underlying nuclear weapons production lends itself more readily to verification.

The IAEA may be a useful model for an international chemical weapons verification agency, and end-use control will be an important part of any effort to put a stop to chemical weapons proliferation. But the larger number of facilities requiring supervision and the dual-use nature of chemical plant technology make verification of peaceful chemical production far more difficult. Nonetheless, end-use control alone is not a sufficient system for the control of toxic weapons proliferation.

The international chemical trade is quite broad and complex, and most chemical weapons components have plausible peaceful

uses. Chemical plants for pharmaceutical or insecticides also have the capability to transfer quickly from peaceful to weapons production. These endemic problems call for a chemical weapons verification regime requiring much broader, more intrusive and more expensive administration than the verification measures provided in the Nuclear Non-Proliferation Treaty. In addition to monitoring end-use, the chemical weapons verification scheme will have to focus on controlling the transfer of toxic and precursor chemicals and plant equipment, even those destined for peaceful uses.⁴³

Existing international agreements have not directly addressed the proliferation of chemical weapons. Those that have focused on the proliferation of analogous weapons, such as biological and nuclear weapons, provide some useful lessons. They have not, however, addressed a problem as complex or broad as chemical weapons proliferation. The development of trade control measures, verification methods, and compliance schemes for the purpose of controlling proliferation will be pulled in different directions by competing interests. If a new agreement on chemical weapons is to have comprehensive appeal and participation, compromises will be necessary. These compromises, while appeasing certain interests, could threaten the agreement's effectiveness in controlling the proliferation of chemical weapons.

In the absence of an international agreement to deter chemical weapons proliferation, the United States has passed a

number of laws, principally in the export control area, to slow the spread of weaponry. Domestic legislation aimed at dangerous weapons proliferation includes the Arms Export Control Act, the Atomic Energy Act, and the Nuclear Non-Proliferation Act. Transfer of chemical components and weapons plant technology are for the most part controlled by a piece of legislation with a more checkered history: the Export Administration Act (EAA). Passed initially in 1969, the EAA is generally enacted for short periods, usually four years, to allow Congress to reconsider its earlier policy decisions at each extension. In passing and renewing this legislation, Congress has had to consider the tension between the export industry's desire for less restrictive trade measures and the Defense Department's position favoring more stringent controls. In its present form, the EAA allows the President considerable discretion in imposing export controls on companies and goods outside U.S. territory. But in fact current domestic legislation in the United States does not provide a satisfactory answer to the challenge of controlling chemical weapons proliferation among chemical firms in the U.S. through export controls or by enforcing compliance through economic sanctions. The difficulties in balancing free trade and proliferation control, as revealed in the legislative history of EAA section 10(g) and in Congress' inability to resolve tensions between industry and government, demonstrate the delicate balance needed to draft legislation that meets the needs of both interests. Extraterritorial application of U.S. law, especially

with regard to the re-export of foreign-origin goods based on American technology, presents unresolved problems of international law. Also, the unmanageable regime of American domestic legislation forces the President to rely on economic sanctions when a prohibited transfer occurs and encourages the use of export controls even when contrary to American interests.⁴⁴

Beyond Existing Proposals For Halting CW Proliferation

To be effective, a new chemical weapons treaty will need potent dispute-resolution provisions and tangible support from the international community. In the United States, strong public support of domestic legislation controlling the export of chemicals is needed.

Few international accords present the potential difficulties in implementation that loom before the new Chemical Weapons Convention. To effectively control proliferation, the Convention will require trade control, verification and compliance measures that affect international trade, and domestic policy decisions on an unprecedented scale. Undoubtedly, the volume and severity of disputes associated with the Convention's implementation will outstrip those that have been experienced with previous international accords. Without a credible dispute-resolution mechanism, unresolved disputes can lead to the erosion of a treaty that, after full and deliberate consideration, both parties would prefer to maintain. Lingering disputes also can cloud the overall political atmosphere, preventing essential

cooperation in other sensitive areas embraced by the Convention, such as verification and trade control. Governments can distort the significance of a dispute that has not been submitted for resolution and use the international media to gain sympathy or advantage. Even the most carefully crafted multilateral treaty relationship can dissolve in the wake of undisciplined reaction to dispute. If the Convention is to survive as a credible and effective means to control proliferation, more "teeth" need to be put in Article XIV: Settlement of Disputes. The article is vague and relies on Signatory States to resolve their own differences.

Professor Phillip Trimble, former Ambassador to Nepal and State Department expert on arms control, recently proposed a model for an institute to deal with arms control controversies that incorporates elements of dispute resolution embodied in recent international economic agreements. The model relies principally on the joint effects of an obligation to notify and consult with other treaty signatories in the event of a dispute and an obligation to submit those disputes to non-binding arbitration procedures. Language in the current treaty simply says that "The Executive Council may contribute to the settlement of a dispute by whatever means it deems appropriate, including offering its good offices, calling upon the States Parties to a dispute to start the settlement process of their choice and recommend a time-limit for any agreed procedure."

The international chemical authority contemplated by the convention should be the arbiter of the dispute-resolution

process. In keeping with the dispute-resolution model developed from successful economic treaties, the Chemical Weapons Convention should require all parties represented in the consultative committee to be notified and consulted on all material developments, such as disputes that affect the Convention, as set forth in article IX of the Convention. It should also require disputes to be resolved by a special panel, working under the executive committee, using arbitration procedures consistent with the overall goals of the agreement. By relying on negotiated results among the signatories, continued participation by the signatories is encouraged, and international invective that could damage the convention's credibility and effectiveness is discouraged.⁴⁵

A dispute-resolution process would help parties avoid difficulties of the sort that arose when the United States discovered Germany's role in supplying assistance for the development of the chemical plant in Libya. Under intense U.S. pressure in the international media, Germany first denied, then admitted the role of German companies in building the plant. The German press reflected the significant discomfort felt by many Germans over the U.S. browbeating, and the Bonn government was damaged by the open accusations. Had the convention been in force and a dispute-resolution process provided for, a quicker and less damaging solution to this incident could have been found.

Conclusion

A CW treaty will indeed be difficult to monitor and verify; however, countries that ultimately use CW will violate the intent of the treaty and risk international sanctions. The United States has over forty years of experience in attempting to regulate sensitive high-technology trade. Further, in a variety of episodes, the U.S. has imposed punitive measures against countries that broke U.S. laws or reneged on international agreements. From these experiences Washington has learned many lessons that would apply to enforcement efforts of a Chemical Weapons Convention. Enforcement mechanisms are more likely to be effective if they are multilateral in nature, carefully targeted against key industries, and anticipate easy means of circumvention. If controls are to have "teeth", they should include a broad variety of responses, including tough punitive measures against violators, as well as a forfeiture of rights at international financial institutions like the World Bank and the International Monetary Fund. In the past, sanctions have often been circumvented by using third-country markets. The Convention should contain language that makes it clear that countries aiding and abetting targeted countries will also be subject to sanctions. The current text fails to address this issue.

The pressures are going to be enormous for states to sign on to the Convention. The Persian Gulf War demonstrated that a modern, well-trained military force can develop a clear chemical weapons threat and take care of itself without using chemical

weapons. Thus the war did much to dispel the idea that chemical weapons are a poor nation's nuclear deterrent. The world is beginning to see the end of CW as a weapon of mass destruction. But it's going to take a lot of work to get all nations signed up, to make sure the Convention is implemented properly, and to run a serious and credible inspection program that will deter cheating.

Unfortunately, though, despite all the successful work put into the CWC, it will not, and cannot assure a permanent halt to chemical warfare. Some states, particularly, Third World countries, will continue to flex their muscles by attempting to produce and hide CW as a deterrent. Rather than expecting the elimination of chemical weapons proliferation, government and military planners would be wise to think in terms of proliferation controls. In any treaty, comprehensiveness calls for compromises, compromises usually mean imprecision, and imprecision almost always invites exploitation. The Chemical Weapons Convention Treaty is not likely to be an exception. Therefore, U.S. policy must reflect the foregoing analysis and tailor its doctrine to compensate for the disparity of interests, motivation, and hidden agenda of all parties involved.

Endnotes

1. This international body located in Geneva, Switzerland consists of representatives from forty different countries. Initially their mission was to monitor compliance of the Geneva Protocol of 1925. More recently the organization has taken on the role of Arms Control Executive Committee. Once the treaty goes into effect, the CD will be responsible for monitoring international compliance.
2. Brad Roberts, The Security Implications For Third World Regions of a Chemical Weapons Ban. Security Implications of a Global Chemical Weapons Ban. Westview Press Inc, Boulder, Colorado, 1991.
3. Charles E. Heller, "Chemical Warfare in World War I: The American Experience, 1917-1918", Leavenworth Papers. Pg 6.
4. As a result of political pressure from the German government, the only known U.S. chemical stocks stored in a foreign country were removed and relocated to Johnston Atoll in 1991.
5. Valeria Adams, Chemical Warfare, Chemical Disarmament, ed (Bloomington and Indianapolis: Indiana University Press, 1990), Pg 216
6. William M. Carpenter, "Evaluation of Chemical Warfare Policy Alternatives 1980-1990" Strategic Research Institute, February 1977 Pg 6-10.
7. Ibid, Pg 12.
8. President Bush announced in December 1990 during a bilateral meeting with the Soviets, that the U.S. would destroy unilaterally all but 2% of its CW stock. Constitutionally, this must be completed by 1997.
9. William M. Carpenter, Pg 17-18, (See endnote 5).
10. Ibid, Pg 19
11. Ibid, Pg 20.
12. Former President John F. Kennedy echoed his concerns during the 1961 State of the Union message to Congress.
13. Elisa D. Harris, "Steaming the Spread of Chemical Weapons," Brooking Review, Vol 8, winter 89-90, Pg 39-42.

14. Tom Vraalsen, "Non-proliferation of Chemical Weapons", Disarmament, Vol 12, Autumn 1989, Pg 3-5.
15. "Fact Sheet: Curbing the Spread of Weapons of Mass Destruction." U.S. Department of State Dispatch, Vol.3, 11 March 1991, Pg 178-179.
16. Thomas L. McNaugher, "Ballistic Missiles and Chemical Weapons: The Legacy of the Iran-Iraq War". International Security, Vol. 15, Fall 1990, Pg 6.
17. Ibid, Pg 8.
18. Ibid, Pg 10.
19. Edward M. Spear, Chemical Warfare. Urbana: ed(University of Illinois Press, 1986), Pg 15.
20. Id. Recall for example, the public outcry following the Marine casualties in the 1983 Lebanon terrorist bombing attack and the subsequent withdrawal of U.S. military forces from that area.
21. John Barry, "The Practical Limits on chemical Warfare", Newsweek, January 16, 1989, Pg 25. Many chemical agents are difficult to use, requiring sophisticated dispensing mechanisms, and their success can depend on environmental conditions such as wind, air pressure, and humidity.
22. Michael Rogers, "The Winds of Death", Newsweek, January 16, 1989. Pg 22.
23. The U.S. Atomic Energy Act, for instance, was passed in 1954, five years after the first Soviet nuclear detonation and before the signature of the Nuclear Non-proliferation Treaty in 1968.
24. Ambassador Stephen J. Ledogar interview with Lee Feinstein, Arms Control Today, September 7, 1992. Pg 8.
25. "The New Merchants of Death: Libya's West Germany Connection" World Press Review., March 1989, Pg 14.
26. Thomas F. O'Boyle, "Bonn Reports on Knowledge of Libyan Plant", Wall Street Journal, February 16, 1989, Pg A11, col 1.
27. 6th International Trade Report. (BNA) 144 February 1, 1989.
28. A international conference hosted in Paris by French President Francois Mitterrand and former President Ronald Reagan in January 1989. 149 nations joined to solemnly affirm their commitment not to use chemical weapons. Participants also pushed for conclusion of a Convention to ban CW.

29. Kelvin Sawchak, "The Department of Defense's Role in Free-World Export Licensing Under the Export Administration Act", 1988 Duke I.J. 785.

30. David Hage "Today's Trade Setback Will Worsen Economic Conflicts Worldwide", U.S. News and World Report, December 28, 1992/January 4, 1993. Pg 72.

31. David White and Peter Marsh "Does He or Doesn't He? Only Qaddafi's Engineers Know, World Press Review, March 1989, Pg 16.

32. Ibid.

33. Jill Smolowe, "The Search for a Poison Antidote", Time, January 16, 1989. Pg 22.

34. See Text of Chemical Weapons Convention Treaty, Article III and annex 2.

35. The UN General Assembly lacks the authority to issue orders allowing on-site access to investigate possible violations, and it suffer from a poor "track record" and delays in collecting information. For example, it took two years to collect the necessary data on "Yellow Rain" use in SE Asia.

36. The Chemical Manufacturers Association (CMA) in their 1990 Annual Report. On the subject of CW treaty verification, they cited the issue of trade espionage as their greatest concern.

37. Recent targets of economic sanctions have been less dependent on trade with the United States, and other countries, such as Germany, have come forward more often to assist states targeted by the U.S.

38. John Burton The politics of Peace, ed (Westview Press Inc, Boulder, Colorado, 1981) pg 45-47.

39. Mark D. Budensiek "A New Chemical Weapons Convention", Naval Law Review, January 1990, Vol 40 Pg 15-17.

40. Ibid, Pg 18.

41. Ibid, Pg. 19.

42. Ibid, Pg 22.

43. Ibid, Pg 24.

44. Ibid, Pg 35.

45. Ibid, Pg 38.

BIBLIOGRAPHY

- Adams, Valerie. Chemical Warfare, Chemical Disarmament:
Bloomington: Indiana University Press, 1990.
- Barry, John. "The Practical Limits on Chemical Warfare",
Newsweek, January 16, 1989, Pg 25.
- Beardsley, Timothy M. "Clearing The Air: Chemical Weapons Can Be
Banned, Given The Political Will." Scientific America,
Spring 1989: 17-18.
- Benneth, Charles E. "U.S. Needs New Vision on Non-proliferation."
The Christian Science Monitor. September 8, 1992.
- Brown, Frederic J. Chemical Warfare A Study In Restraints.
Princeton, Princeton University Press: 1968.
- Budensiek, Mark D. "A New Chemical Weapons Convention." Naval Law
Review, 1990: 15-42.
- Burton, John. The Politics of Peace, ed (Westview Press Inc,
Boulder, Colorado, 1981) Pg 45-47.
- Carpenter, William M. "Evaluation of Chemical Warfare Policy
Alternatives 1980-1990", Strategic Research Institute,
February 1977, Pg 6-10.
- Clark, Robin. We All Fall Down. London: Allen Lane The Penguin
Press, 1968.
- Clarke, Richard A. "Conference Against Chemical Weapons."
Department of State Bulletin, Winter 1989: 45-47.
- Cohen, Raymond, and Ranger, Robin. "Enforcing Chemical Weapons Ban."
International Perspective, Summer 1989: 9-12.
- Findlay, Trevor. Chemical Weapons and Missile Proliferation.
Boulder & London: Lynne Rienner Publishers, 1991.
- Flowerree, Charles C. "The Chemical Weapons Convention: A Milestone
in International Security", Arms Control Today, October 1992,
Pg 3-7.
- Gross, Richard C. "Chemical Weapons." Defense Science, Spring
1988: 11-13.
- Gordon, Michael R. "Paris Conference Condemns the Use of Chemical
'Arms", New York Times, January 12, 1989, Pg A1, col.2.

- Hage, David. "Today's Trade Setback Will Worsen Economic Conflict Worldwide", U.S. News and World Report, December 28, 1992/January 4, 1993. Pg 72.
- Heller, Charles E. "Chemical Warfare in World War I: The American Experience, 1917-1918", Leavenworth Papers. Pg 6.
- Harris, Elisa D. "Stemming The Spread of Chemical Weapons." Brooking Review, Winter 89-90: 39-45.
- Jones, David T. "Eliminating Chemical Weapons, Less Than Meet The Eye." International Defense, 1989: 83-92.
- McNaugher. Thomas L. "Ballistic Missile and Chemical Weapons: The Legacy of the Iran-Iraq War", International Security, Vol 15, Fall 1990, Pg 6.
- O'Boyle, Thomas F. "Bonn Reports on Knowledge of Libyan Plant", Wall Street Journal, February 16, 1989, Pg A11, col.1.
- Roberts, Brad. "The Security Implications for Third World Regions of a Chemical Weapons Ban", Security Implications of a Global Chemical Weapons Ban. ed (Westview Press Inc, Boulder, Colorado, 1991) Pg 69.
- Rogers, Michael. "The Winds of Death", Newsweek, January 16, 1989. Pg 22.
- Sawchak, John. "The Department of Defense's Role in Free-World Export Licensing Under the Export Administration Act", Duke I.J. Pg 785.
- Smolowe, Jill. "The Search for a Poison Antidote", Time, January 16, 1989, Pg 22.
- Spier, Edward M. Chemical Warfare. Urbana: ed (University of Illinois Press, 1986) Pg 15.
- Qichen, Quin. "China Urges Total Ban on Chemical Weapons." Beijing Review, January 1989: 14-15.
- Quinn-Judge, Paul. "Poison On The Wind." The Christian Science Monitor, December 11-14, 1988.
- Vraalsen, Tom. "Non-proliferation of Chemical Weapons." Disarmament, 1989: 3-15.