The Problem of Chemical and Biological Warfare

Volume V

The Prevention of CBW

SIPRI

Stockholm International Peace Research Institute

Almqvist & Wiksell
Stockholm

Humanities Press
New York

SIPRI

Stockholm International Peace Research Institute

SIPRI is an independent institute for research into problems of peace and conflict, with particular attention to the problems of disarmament and arms regulation. It was established in 1966 to commemorate Sweden's 150 years of unbroken peace.

The financing is provided by the Swedish Government. The staff, the Governing Board, and the Scientific Council are international.

The Board and Scientific Council are not responsible for the views expressed in the publications of the Institute.

SIPRI

Stockholm International Peace Research Institute
Sveavägen 166, S-113 46 Stockholm, Sweden
Cable: Peaceresearch, Stockholm Telephone: 08-15 19 00

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 V

The Prevention of CBW

SIPRI
Stockholm International Peace Research Institute

Almqvist & Wiksell
Stockholm

Humanities Press
New York

Sveavägen 166
S-113 46 Stockholm, Sweden

First published by Almqvist & Wiksell
26 Gamla Brogatan, Stockholm 1

in collaboration with

Humanities Press, Inc.
303 Park Avenue South
New York, N. Y. 10010

SBN 391-00204-X

Library of Congress Catalog
Card Number: 76-169793

Printed in Sweden by
Almqvist & Wiksells Boktryckeri AB, Uppsala 1971

Contents of the Study

Volume I. The Rise of CB Weapons

A description of the main lines of development in the technology underlying CBW and in the constraints affecting use of CB weapons. The period covered is approximately 1914–1945, although more recent developments in CW technology are also described. In addition, the volume includes an account of all instances known to SIPRI when CB weapons have been used in war, or when their use has been alleged; in this case the time-span is 1914–1970.

Volume II. CB Weapons Today

A description based on the open literature of the present state of CBW technology and of national CBW programmes and policies. It also includes a discussion of the attractions and liabilities of CB weapons, and of the consequences, intentional or unintentional, that might follow their use.

Volume III. CBW and International Law

A description of the legal limitations on the use of CB weapons. It comprises discussions of the field of application of the Geneva Protocol, particularly as regards non-lethal chemical weapons and anti-plant agents, of the existence, development and scope of the prohibition of CBW provided by the customary law of war, and of the application to CBW of general principles of the law of war. It also reviews the juristic works in this field.

Volume IV. CB Disarmament Negotiations, 1920–1970

A review of the activities of the League of Nations and United Nations in extending and reinforcing the prohibitions concerning CB weapons, including a report of recent negotiations for international CB disarmament. The volume also contains an account of those instances when formal complaints of the use of CB weapons have been made to the two world organizations.

Volume V. The Prevention of CBW

A discussion of possible measures that might be adopted to prevent future CBW. The volume describes steps that might be taken to strengthen the legal prohibition of CBW, and the problems and possibilities, including those of verification, involved in the negotiation of CB disarmament.

Volume VI. Technical Aspects of Early Warning and Verification

A technical account of SIPRI research on methods of early warning and identification of biological warfare agents, together with a description of two ex-

perimental SIPRI projects on CB verification. The first project concerns the non-production of BW agents and involved visits to biological laboratories in several countries; the second concerns the non-production of organophosphorus CW agents and summarizes the results of a symposium.

Preface

The birth of this study of chemical and biological warfare can be traced back to 1964, when a group of microbiologists who were concerned about the problems of biological warfare started meeting under the auspices of Pugwash. After some meetings it became evident that there was need for more intense study than could be achieved through occasional gatherings of people who were busy with other work. In 1966–67 SIPRI, which was then starting up, decided to take on the task of making a major review of biological warfare. The study was soon extended to cover chemical warfare as well. It was found impossible to discuss one without the other. The two have traditionally been grouped together in law, in military organization, in political debate and in the public mind.

The aim of the study is to provide a comprehensive survey of all aspects of chemical and biological warfare and of the problems of outlawing it more effectively. It is hoped that the study will be of value to politicians, their advisors, disarmament negotiators, scientists and to laymen who are interested in the problem.

The authors of the report have come from a number of disciplines—microbiology, chemistry, economics, international law, medicine, physics and sociology and soldiery—and from many countries. It would be too much to claim that all the authors had come to share one precisely defined set of values in their approach to the problem. Some came to the problem because they were concerned that the advance of science in their field should not be twisted to military uses; others because they had taken a scholarly interest in the law or history of CBW; others because they had particular experience of military or technical aspects of it. What is true is that, after working together for a period of years, they have all come to share a sober concern about the potential dangers of CBW.

In reviewing the issues for policy (in Volume V) the aim has been not to produce a set of recommendations or a plan for action but to analyse the main factors influencing national policies and international negotiations over CBW, to indicate alternative courses of action as they emerge from the analysis, and to present as clearly as possible the perspective on the problem at which an international team of people working for a period of years on neutral soil has arrived.

At an early stage it was necessary to face the question whether, if we

assembled a lot of information on CBW and published all that we thought was relevant, we would risk contributing dangerously to the proliferation of these weapons. This proposition was rejected on the grounds that the service we could do by improving the level of public discussion was greater than any disservice we might do by transmitting dangerous knowledge. Secrecy in a field like this serves mostly to keep the public in ignorance. Governments find things out for themselves.

While the study has been in progress there has been an increase in public discussion of the subject. A group of experts appointed by the Secretary-General of the United Nations has produced a report on *Chemical and Bacteriological (Biological) Weapons and the Effects of Their Possible Use.* In the United States a rising tide of concern about CBW has given rise to Congressional hearings; a policy review, commissioned by the President, has led to the unilateral renunciation by the United States Government of biological weapons and to the decision to renounce first use of chemical weapons and to seek ratification of the Geneva Protocol. At the United Nations and at the Disarmament Conference in Geneva, CBW has received a lot of attention culminating in current negotiations over a biological disarmament treaty.

In response to an invitation from the UN Secretary-General, early drafts of parts of this study were circulated to his group of experts in February 1969. These drafts were also made available to the World Health Organization for the preparation of its own submission to the UN group of experts; this submission, together with the subsequent WHO publication based upon it, *Health Aspects of Chemical and Biological Weapons,* was prepared by a group of consultants that included Julian Perry Robinson from SIPRI.

Provisional editions of parts of this study were issued in Feburary 1970.[1]

The authors are conscious of the problem of avoiding biases. A disproportionate part of the information we have used comes from the United States. This is partly because the United States has been very active in the field of chemical and biological warfare in the post-war period. It is also because the United States is much more open with information than most other countries.

Since this is a team work and since, like most studies of this size, it grew

[1] There have been changes in the layout of the study since February 1970. Of the three parts issued then, the contents of which have been extensively revised and updated, Part I, *History,* corresponds to Volume I of the present edition, *The Rise of CB Weapons;* Part III, *CBW at the League of Nations and United Nations 1920–69,* corresponds to Volume IV, *CB Disarmament Negotiations, 1920–1970;* and Part IV, *Verification,* corresponds to Appendices 2 and 4 of Volume V, *The Prevention of CBW.*

and changed shape and changed hands in some degree as it went along, it is not easy to attribute responsibility for its preparation. The authorship of each part is indicated at the start of it, but these attributions do not convey the whole story. The team of people who produced the study met together often, shared material, exchanged ideas, reviewed each others' drafts in greater or lesser degree, and so on. So it is a corporate product, and those who wrote the final drafts sometimes had the benefit of working papers, earlier drafts, ideas or material provided by others.

At first, Rolf Björnerstedt was briefly in charge of the study. After an interval, Carl-Göran Hedén took over. When he had to return to the Karolinska Institute—from which he has continued to give us his advice and help—I assumed responsibility for the project. The other members of the team have been Anders Boserup, who from the earliest stages has found time to come frequently from Copenhagen to help on the project, Jozef Goldblat, Milton Leitenberg, Theodor Nemec, Julian Perry Robinson and Hans von Schreeb. Åke Ljunggren was a member of the team in Stockholm in the early stages of the project. Sven Hirdman joined in at the later stages.

The work on rapid detection of the use of biological warfare agents (Volume VI) was undertaken separately from the main study by Konstantin Sinyak, who came from the Soviet Union to work at the Karolinska Institute in Stockholm, and Åke Ljunggren, who went from Sweden to work at the Microbiological Institute in Prague. Both worked in close contact with Carl-Göran Hedén who contributed a study on automation. We are indebted to the two host institutes for the facilities and help they generously provided.

It is usually wrong to single out one person from a team but in this case there is no doubt that one person has contributed more than anyone else to the study. He is Julian Perry Robinson who has written more of the study than anyone else and has had a great influence on the whole shape and quality of it.

Rosemary Proctor undertook the formidable task of acting as editorial assistant for the whole study and preparing an index for it.

A great debt is also owed to many people outside the institute—too many to name—for the help they have given us. This includes those who attended the early Pugwash meetings on biological warfare, those who attended meetings at SIPRI on biological and chemical warfare, those who wrote working papers for us, those who gave their time to the biological inspection experiment and many people who have visited us or helped us with advice and material at different times. It includes people from many countries, East and West, and many disciplines. It includes people with many different kinds

of expertise. The amount of help they gave us—and it was far greater than we had expected at the start—was clearly an expression of their concern about the problem. We are very grateful to them all. The responsibility for what is said is, of course, ours.

September 1971

Robert Neild

Director

ATTRIBUTION

The main text of this volume was written by Anders Boserup and Julian Perry Robinson (Chapters 1 and 2) and Robert Neild (Chapter 3) assisted by Sven Hirdman.

Appendix 1, *The claims that CB weapons are less inhumane than other weapons,* was prepared by Robert Neild and Julian Perry Robinson.

Appendix 2, *Verification of CB disarmament,* was prepared by Robert Neild and Julian Perry Robinson, and includes contributions by all members of the SIPRI CBW group, notably Carl-Göran Hedén on microbiological production facilities and Theodor Nemec on the SIPRI biological inspection experiment.

Appendix 3, *The CB weapons controls of the Western European Union Armaments Control Agency,* was prepared by Julian Perry Robinson.

Appendix 4, *Investigations of use of chemical and biological weapons,* was prepared mainly by Julian Perry Robinson (the Yemen case study), and Milton Leitenberg (Korea case study).

Appendix 5, *List of states which have signed, ratified, acceded or succeeded to the 1925 Geneva Protocol,* was prepared by Jozef Goldblat.

CONTENTS

TABLES AND CHARTS

Chapter 3. CB disarmament

Appendix 1. The claims that CB weapons are less inhumane than other weapons

Appendix 2. Verification of CB disarmament

Appendix 3. The CB weapons controls of the Western European Union Armaments Control Agency

Appendix 4. Investigations of the use of chemical and biological weapons

Introduction

There is now a wave of concern in the world about chemical and biological warfare. It has been provoked by a coincidence of events—accidents with CB weapons, the outcry of scientists against the development of biological weapons,[1] and, most important, the use of chemical weapons in Viet-Nam. It has found expression in criticism of national policies within nations and also in debates in the international fora about how to get rid of CB warfare more effectively. The wave of activity and concern seems now to be near its peak. So the important question is whether, while it lasts, new international agreements to prevent CB warfare can be achieved.

In this volume we discuss the policy issues involved in making progress in this direction. There is at the present time a substantial body of international law against the use of CB weapons; our concern is with ways and means for strengthening that prohibition, and for achieving international CB disarmament.

In order to provide a perspective for the discussion, it is useful first to recapitulate some of the features of earlier volumes.

Chemical weapons were first used on a large scale during World War I, when there were well over a million poison-gas casualties. Since then, the only occasion on which a comparable tonnage of chemical weapons has been used in combat has been during the present war in Indo-China. In the course of World War I, some 110 000 tons of warfare chemicals were used by the seven major belligerents; about 90 000 tons were used in Viet-Nam during 1965–70. For the most part, the latter were anti-plant chemicals, used to destroy crops and defoliate vegetation rather than to kill people. The anti-personnel chemicals used in Indo-China have been irritant agents (colloquially and euphemistically known as "tear gases").

Apart from these two conflicts, the only major instances of CW have been during the Italian invasion of Ethiopia in 1935–36, and during the Japanese invasion of China in 1937–45. There is also a substantial body of evidence suggesting that chemical weapons were used during the Yemeni Civil War of the mid-1960s. The evidence is not conclusive, although many people are convinced by it.

[1] The most important manifestation of the opinion of scientists has been the resolution passed by the International Congress for Microbiology in Mexico City, in August 1970 (see Appendix 6, p. 278).

The history of chemical warfare since World War I has thus been one of relative restraint. There have been only three or four significant cases when chemical weapons have been used. In every case the usage has been one-sided and "downhill". That is to say, chemical weapons have been used only by strong belligerents against weak enemies who lacked both the means of protecting themselves and the means to retaliate.

Since World War I, the development of anti-personnel chemical weapons has advanced to a point where they are now hundreds of times more potent than they were then. Biological weapons have also appeared—a development of the last three decades. Potentially they are far more destructive than chemical weapons, and on a weight-for-weight basis their mass-destruction capabilities are believed comparable with those of nuclear weapons. They have never been used in regular combat operations.

While chemical weapons were not used during World War II, almost all the belligerent powers maintained stocks of them. After the war, however, most of these stocks were discarded, and so far as can be judged from the published literature, the only countries that today possess significant quantities of chemical weapons are the United States and the Soviet Union. Many other countries are, of course, capable of producing them. As for biological weapons, the USA has been the only country to acknowledge that it has possessed them; as we note in Volume II of this study, the indications are that the US Government no longer believes that the USSR has a significant BW capability. As with chemical weapons, however, there can be little doubt that many countries could build up stocks of biological weapons if they chose to, although the business of doing so would by no means be as easy or as cheap as some commentators have suggested.

One factor which has served to constrain CBW activities over the past fifty years is that for a great many people, whether military or non-military, CB weapons represent a peculiarly loathsome and despicable method of fighting. In the years immediately after World War I, it was this factor more than anything else that sustained attempts to negotiate international agreements that would abolish CBW for good. These attempts resulted in the 1925 Geneva Protocol, which today forms the cornerstone of the legal prohibition of CBW and the starting-point for the negotiation of new agreements.

The upsurge in public awareness and hostility towards CBW over the past few years is comparable with that of the 1920s. Already its effects have been substantial. During the period 1966–70, the number of parties to the Geneva Protocol increased by two-thirds, with as many states committing themselves as during the previous peak period of 1928–32. In a ten-month period, the President of the United States has made three major policy

statements on CBW, each of which placed new limitations on US CBW activities. The first major policy change was announced in November 1969: this specified that the USA would never initiate the use of lethal or incapacitating CW agents, and would never resort to biological warfare under any circumstances. Previous US policy excluded only the first-use of lethal chemical and biological weapons; the policy on incapacitating CB weapons had hitherto not been specified. The second policy change came in February 1970 when the total renunciation of BW was extended to the class of CW agents known as "toxins"; existing stocks of toxin weapons, like those of biological weapons, were to be destroyed. (The texts of the November 1969 and February 1970 policy statements are reproduced in Appendix 6.) Finally, in August 1970, President Nixon forwarded the Geneva Protocol to the US Senate for its advice and consent to ratification. If the Protocol is ratified, all the major world powers, and most of the minor ones, will be parties to it. In July 1968, the Geneva Disarmament Conference began talks on CBW; since then the conference has paid increasing attention to the subject, and the conclusion of some sort of international agreement seems imminent.

We begin this volume with a chapter describing the existing constraints on use of CB weapons—the political, military, psychological and legal inhibitions against initiating CBW—and attempt to analyse the factors that may weaken these constraints. The implications of irritant and anti-plant agent employment form a substantial part of this discussion. The chapter closes with a treatment of the possible steps that might be taken to strengthen these constraints within the framework of the international laws of war. In the subsequent chapters we discuss CB disarmament, beginning with a short chapter on its benefits, and ending with a chapter on the problems that arise in its pursuit. The latter includes an analysis of the present state of the CB disarmament negotiations, and of the issues behind the various disagreements.

More detailed descriptions and analyses are contained in the appendices to this volume. The view that CB weapons are in some way more "humane" than other types of weapons is discussed in Appendix 1. The problems of verifying CB disarmament are described in Appendix 2, and illustrated further in Appendix 3 with reference to the CB weapons controls of the Western European Union Armaments Control Agency; some of them are taken up in more detail in Volume VI. Appendix 4 is concerned with the problems of verifying allegations of CBW. Appendix 5 contains the text of the 1925 Geneva Protocol, together with a list of states party to it. Appendix 6 comprises the texts of recent major documents concerning CB disarmament.

The three main chapters of this volume were completed in February

1971 and issued as a proofs edition in limited numbers during March. Since then, a draft treaty to outlaw the production of biological weapons has been submitted by the Socialist members of the CCD. (See Appendix 6 for the text.) Negotiations are currently (August 1971) taking place in the CCD on the basis of this draft and of the earlier draft British biological disarmament treaty, with the aim of reaching agreement on a treaty which could be approved by the United Nations General Assembly. On 5 August 1971, the Soviet Union and the United States tabled identical texts of a draft biological disarmament treaty, on which they had reached agreement. (For the text, see Appendix 6.) It was not possible to discuss this new development in this volume; the reader is referred to the *Postscript* to Volume IV, *CB Disarmament Negotiations, 1920–1970,* for an account of it.

Chapter 1: Strengthening the existing prohibition of CBW

This chapter is concerned with the factors that may inhibit resort to CBW[1] and with possible measures short of CB disarmament for strengthening these constraints. The underlying theme is the relationship between different constraints and the formal prohibition of CBW provided by the international laws of war. The main focus of the chapter, then, is on ways in which the existing legal prohibition may most productively be strengthened. The question of CB disarmament is discussed in Chapters 2 and 3.

In Volume III of this study, the nature and scope of the legal limitations on use of CB weapons are discussed in some detail. The conclusion there is that the international laws of war, both conventional and customary—taken together—prohibit the use of CB weapons for all nations. While a few countries have recently called into question the precise scope of the prohibition, particularly as regards tear gases and chemical herbicides, there are no serious dissensions from the opinion that the war use of CB casualty agents[2] is illegal, save for the purpose of reprisals in kind.

The view is often expressed that the laws of war do not provide a significant check on the behaviour of belligerents—that they will be observed only when it is politically and militarily expedient to do so. Because of this, the argument continues, attempts to refine and expand the laws of war have little practical importance. The fact that certain countries maintain

[1] In this study, the term *chemical warfare* means the use for hostile purposes, in armed conflicts in which armed forces are engaged in hostilities, of agents having a direct toxic effect on man, animals or plants. On this usage, which as regards the word "toxic" follows the definition used by the World Health Organization [*Health Aspects of Chemical and Biological Weapons* (Geneva: WHO, 1970) p. 12], CW agents thus include the nerve gases and the traditional poisons of warfare, including tear gases, together with toxins, whether of bacterial or any other biological origin, and chemical herbicides. *Biological warfare* means the use for hostile purposes, in armed conflicts in which armed forces are engaged in hostilities, of agents causing death or disease in man, animals or plants following multiplication within the target organism. BW agents thus include all pathogenic micro-organisms and infective materials derived from them. We discuss these and alternative definitions in Volume II of this study.

[2] The term *CB casualty agents* means toxic or infective agents capable of producing death, serious injury or prolonged disablement in anyone exposed to the dosages that weapons disseminating them are capable of delivering. The agents thus include all those which are defined below as "lethal" and "incapacitating".

massive stockpiles of CB weapons is thought to support this argument, for the stockpiles can have little value if their owners really believe that the laws will be observed. While we do not claim that international law provides an overriding constraint on use of CB weapons, we do not believe that it has no significance. The legal constraint is one among several; while it may not often be the dominant one, it nonetheless has a highly important function in reinforcing other constraints and in extending their overall array. It is in this perspective that we wish to discuss possible ways of strengthening the law. We therefore intend to concentrate on the bearing which possible new legal measures may have on the existing array of constraints, and on its points of possible weakness. For this reason we begin with a description of what appear to be the principal constraints today, drawing on the more detailed discussions contained in Volumes I and II of this study.

I. *Constraints on initiating CBW, and the incentives to do so*

The constraints and incentives during World War II

By the end of World War II the stockages of chemical weapons maintained by the belligerents greatly exceeded the total quantity used during World War I. Had they been employed, they might have had a profound effect on the character of the war. Biological weapons, on the other hand, existed only in insignificant quantities as weapons intended primarily for sabotage operations. R & D programmes were being pressed forward to produce biological weapons more suited to large-scale use in regular operations but, by the end of the war, the weapons had not advanced beyond the prototype stage. For this reason, the following discussion of the constraints and incentives operating during World War II is concerned only with chemical weapons.

A common explanation given for the abstention from CW during the war is that the belligerents were deterred from using their chemical weapons by fear of enemy retaliation in kind. While there is evidence to show that this may have been true on a number of occasions during the war, it cannot have been the sole explanation, for there were other occasions when gas might have been used to military advantage without much likelihood of a damaging response from the enemy.

The military attractions of chemical weapons, such as they were, stemmed from the ability of aerosol or vapour clouds of CW agents to blanket area-targets, causing casualties after inhalation, and from the ability of agents like mustard gas and, later in the war, the nerve gas tabun to produce casualties on contact with people's skin when dispersed as liquid sprays.

The former property might be valuable against massed troop concentrations, for example, or against artillery positions whose precise locations were unknown. The latter property might be used to produce mass casualties among concentrations of enemy troops wearing gas masks; it might also be used to threaten enemy units with high casualty rates if they occupied or passed through areas over which the agents had been sprayed. Ground-contaminants might be useful in restricting the ability of the enemy to manoeuvre, in interdicting his supply lines or in disorganizing his rear. However, with the exception of the tear gases and other irritants, the chemical weapons available to ground forces at the start of World War II all had the disadvantage of a delayed action, and could not produce casualties until at least an hour after use. Agents capable of rapid effects over large areas either had to be used from aircraft (as in the case of hydrogen cyanide), or did not become available in significant quantities until later in the war (as in the case of tabun). There were never any ground-contaminants that could produce casualties quickly by percutaneous absorption.

The greatest incentives to use chemical weapons thus occurred when enemy forces were concentrated and largly immobile, as for example when Allied forces were struggling to establish beachhead positions during the Normandy landings. On a rapidly shifting front chemical weapons were much less attractive, but certain of them might still have been used to some advantage, both in defensive and offensive operations, and particularly in cases where ground-support aircraft were available. But here there were a number of technical and operational limitations. The use of area-effect weapons disseminating toxic clouds would require an abnormally high degree of joint planning for operations along adjacent sectors of a front, particularly in offensive operations, and if persistent agents were used they could seriously impede successive operations along the same sector. The need to observe tight anti-gas discipline would encumber fighting units with protective equipment, thus lowering their combat efficiency; and if there was a likelihood that the enemy would respond with gas, this discipline would have to be especially rigorous. Operational planning would be complicated by the fact that the likely results of chemical operations would not be at all closely predictable, both because of the very marked weather-dependence of the weapons, and because of uncertainties about the level of enemy anti-gas protection. Thus although chemical weapons might have been attractive in some circumstances, their use would have introduced many difficulties.

In view of these difficulties, coupled with the fear of what the enemy might do by way of retaliation, it is perhaps not very remarkable that chemical weapons were kept out of the forward supply depots of some belligerents, and that for other belligerents the forward-area stocks of chemi-

cal weapons were allowed to fall well below prescribed levels. On at least one occasion during the war when serious thought was being given to initiating battlefield CW (in circumstances where there was little reason to fear enemy retaliation in kind), the idea had to be abandoned at least in part because of the logistical difficulties of moving up the necessary weapons.

Some of the drawbacks to chemical operations on the battlefield might have seemed less discouraging if more sophisticated chemical weapons had been available when the war broke out, and if the level of CW training among the belligerent armies had been higher. But no belligerent had paid more than desultory attention to developing chemical weapons until the last few years before the war began and, outside the specialized cadres of chemical troops, CW instruction remained at a low, and mainly defensive, level. The belligerents devoted most of their CW preparations to procuring and deploying anti-gas protective equipments and then, just before the war broke out (at least in the case of Germany, the UK and the USA), to building up stocks of aircraft-deliverable chemical weapons. While the latter might have been used in ground-support operations, their main application was seen to lie in large-scale operations against enemy cities. No belligerent seems to have considered counter-city CW operations as strategically attractive in themselves, so that for the most part these stocks of aerochemical weapons served a purely deterrent function. Artillery and infantry chemical weapons were certainly developed, but at least in the case of the Western Allies and Germany they were not procured on the same scale as were aerochemical weapons.

The relative lack of military interest in the offensive possibilities of chemical weapons may be explained at several different levels.

Many military people found the notion of fighting with poison highly distasteful to their professional codes of behaviour; in some instances there is evidence to show that these feelings were heightened rather than lowered by the use of gas during World War I. Thus motivated, they were reluctant to consider the possible value of chemical weapons to their own forces; and as there were logical reasons why chemical weapons might not be as attractive as their advocates claimed, these tended to be given especial prominence in assessments of CW. It was presumably this sort of attitude, coupled with the political factors described below, that had made it so difficult for the protagonists of chemical weapons within the armed services of many countries to gain acceptance for their ideas, budgetary allocations for their weapons-development programmes, and time in troop-training schedules.

Hostile attitudes towards CW outside the military establishments further

impeded the assimilation of chemical weapons. Public opinion in a number of countries was concertedly opposed to CW, and was undoubtedly an important factor in the various international attempts during the inter-war period to prohibit CW and to abolish chemical weapons. Within such a climate of opinion, the development of negotiating policies for the various disarmament conferences, together with the political problems of allocating public funds to support military CW activities, can scarcely have failed to produce reverberations within military establishments that encouraged further disregard for the protagonists of chemical weapons—at any rate in countries where military activities were at all sensitive to popular opinion. It was in large measure because of these various constraints that in most of the belligerent countries significant stocks of chemical weapons did not accumulate until well after World War II had begun.

The effects of a hostile public opinion, together with the strong aversion to CW expressed by a number of political leaders (for example Roosevelt in the USA and Hitler in Germany), not only retarded national CW preparedness programmes but also made it less likely that initiation of CW would ever be authorized in time of war. If a country began to use chemical weapons, it would inevitably alienate a wide sector of opinion both at home and, more importantly, in neutral, friendly or allied countries abroad. This consideration also served to retard national procurement programmes for chemical weapons, although the counter-argument that in the extremities of war this factor would not be significant, and should not be allowed to become so, found some support, particularly after World War II had begun. It was argued that in the passion of war popular attitudes were likely to change radically, and that although the notion of chemical warfare might be anathema in peacetime, it might be acceptable in wartime. But here there was another factor to take into account: the prohibition of chemical warfare under the international laws of war. This prohibition had arisen mainly because influential military and non-military opinion was strongly against chemical weapons: in this respect the prohibition was the legal expression of many of the factors we have been discussing. However, while even the strongest opinions may change overnight, the law does not, and, although the law may be disregarded, there is a considerable difference between performing a possibly unpopular act and performing an indisputably illegal one. The risk of provoking an adverse reaction by initiating CW would thus arise not merely because people might not like the idea of CW, but also because it would contravene formalized codes of international behaviour, thus calling into question one of the foundations on which much of the conduct of international relations rested. To this extent, the legal prohibition of CW not only symbolized existing constraints but also reinforced them.

In the conduct of a global war, when international relations are in any case in a state of flux, the constraints on illegal behaviour *per se* may often be much weaker than in a minor war. This reasoning has led some commentators to doubt whether the illegality of using chemical weapons contributed significantly to their non-use during World War II. But this is surely to underestimate the significance of the legal prohibition. In that it reflected the reluctance of military and political authorities to assimilate chemical weapons into their arsenals, it served to reinforce the belief that chemical weapons were taboo in some way. The prohibition, particularly as formulated in the 1925 Geneva Protocol, placed chemical (and biological) weapons into a class apart from other weapons, and advertised the fact that they had attracted international rejection and strong moral opprobrium. 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 a decision to initiate CW.

The legal prohibition of CW may thus serve to increase the constraints arising from fear of enemy retaliation by making it more probable that the retaliation will be escalatory, even though a disproportionate response would in fact be illegal. During World War II this likelihood was enhanced by the fact mentioned above that the greater part of the offensive CW capabilities available to the belligerents were best suited to large-scale aircraft-delivered attacks. At least in Germany, the UK and the USA, the plans drawn up against the contingency of enemy initiation of CW—even initiation at a minor tactical level only—specified that massive counter-city gas attacks were to be conducted immediately. The corollary of this, and the constraint inherent in it, was that initiation of CW would not be worthwhile unless it could bring substantial strategic advantage. But the chemical weapons of World War II could provide such an advantage only if used on a massive scale and with elaborate preparations beforehand. While many of the belligerents had, by the end of the war, a substantial stockpile of chemical weapons, few, if any, of them believed that their overall capability in offensive CW was sufficient for first use in a strategic context; and most, if not all, were disinclined to think seriously about doing so. Fear of retaliation may have been the ultimate constraint on initation of CW during World War II, but unpreparedness, caused partly by the legal prohibition, partly by the shadow of possible retaliation against cities and by other deeper factors, was the operational constraint. All these factors interacted on one another, gaining strength from their inter-relatedness.

The constraints and incentives since World War II

These two constraints, unpreparedness and fear of enemy retaliation, are as relevant today as they were in World War II. One way of describing the present-day situation is therefore to discuss each of them in terms of the effects of post-war developments on the various inter-related factors that make up the constraints. This we now do. We have in mind principally those countries which possess, or are capable of possessing, modern CB weapons.

One of the most significant changes since World War II is that biological weapons that can be used with regular weapons delivery systems have become operational, although they do not appear to be stockpiled to any great extent. There are two broad kinds of biological weapon: those which cause disease that is subsequently likely to spread to sectors of the target population that are not infected during an attack; and those based on the so-called "non-transmissible" pathogens, which are not thought capable of initiating a spreading disease. The former type of weapon has apparently been considered useful only against crops and animals; against man its performance has been thought to be too dangerously unpredictable. Most, if not all, of the stockpiled anti-personnel BW agents are therefore non-transmissible pathogens. In this respect they have close similarities with chemical weapons, for the agent payloads disseminated by both classes of weapon can cause casualties only if directly inhaled or ingested. From this point of view the casualty-producing ability of an anthrax weapon, say, differs from that of a nerve-gas weapon only in that a much smaller agent payload is thought necessary to produce a given number of casualties: it can be smaller because the anthrax pathogens, unlike CW agents, reproduce themselves within their host; for nerve gas a full casualty dosage must be applied in the first instance. (Biological agents have to reproduce themselves within their host before causing casualties: this causes the delay—the incubation period—before their effects show up.) Apart from this difference, weapons systems based on toxic agents and on non-transmissible pathogens are very similar.

The unpreparedness constraint of World War II was essentially due to the reluctance of military authorities to accept chemical weapons into their battle-planning, or even to think seriously about doing so. CW preparedness, such as it was, was seen more as a burden imposed by the need to anticipate enemy behaviour, and far less as a means for improving offensive combat potential. However, by the time the war had begun, all the major belligerents had decided that there was value in possessing some sort of offensive CW capability in order to deter the enemy from ini-

tiating CW. The bulk of the responsibility for maintaining a retaliatory readiness was assigned to the air forces for, in contrast to the ground forces, these could conduct chemical operations with the least departure from normal routines. Disinclined to see any overriding merit in chemical operations, most, if not all, of the belligerent armies wished to avoid CW if at all possible; if it had to be fought, its impingement on the conduct of ground operations was to be kept to a minimum. As one commentator has put it, "gas was a weapon too technologically demanding and psychologically disquieting to be assimilated by the military profession".[3]

Today, the strength of the unpreparedness constraint on initiating CBW in time of war must depend in the first instance on the extent to which CB weapons have now become assimilated by the military establishments of the countries concerned—on the extent, in other words, to which the military have become accustomed to the weapons and less inhibited about using them. In this respect there have been two strongly divergent tendencies. Some countries which hitherto had paid a good deal of attention to CB weapons have apparently given up any thought of maintaining a peacetime capability to use even chemical weapons, let alone biological ones.[4] In these cases CB weapons are presumably further from assimilation than they were during World War II. Other countries, on the other hand, continue to maintain stockpiles of the weapons, and for them it seems likely that the weapons are better assimilated than before. These countries seem to be few. We note in Volume II of this study that, so far as can be judged from published sources, only the USA and the USSR possess substantial quantities of the weapons, although other NATO or Warsaw Pact countries might possibly be able to draw upon these stocks in certain circumstances. While South Africa, the UAR and Israel are known to have paid serious attention to CB weapons, there are no firm indications that they have actually acquired them on a militarily significant scale. The published literature does not disclose much about the attitudes of the military authorities in China or India to CW weapons, but again there are indications that neither country has chosen to invest in them, with the exception of irritant-agent weapons.

We argue above that before World War II assimilation was in part retarded by the opposition of wide sections of popular and military opinion

[3] F. J. Brown, *Chemical Warfare: a Study in Restraints* (Princeton, 1968), p. 298.

[4] For example, some time around 1955 the United Kingdom decided to throw away all its existing stocks of chemical weapons, some 25 000 tons in all, and not to manufacture new ones, even though the development work needed for this had been completed. Shortly afterwards, France also was reported to be discarding chemical weapons. Like many other countries, the UK has renounced any intention of possessing biological weapons, and has apparently never possessed them on a militarily significant scale.

to use of the weapons, this being reflected in, and reinforced by, the legal prohibition of CBW. The popular hostility does not seem to have declined since then, rather the opposite in view of present public concern about CBW. In addition, the fact of non-use of chemical weapons during the war serves to support those people who are predisposed to argue that CW is an obsolete and militarily-unrealistic remnant of history. It also supports the notion of a customary law prohibition of CW. Accessions to the Geneva Protocol have multiplied in recent years.

If these were the only factors to be taken into account, there would be no particular reason to suppose that the military have come any closer to assimilating CB weapons. But there are two other factors. The first, perhaps affecting public opinion, is that the imminent possibility of nuclear warfare may have overshadowed the potential horrors of CBW, so that some people may now see CBW as the softer option. If this is the case, CB weapons protagonists have certainly tried to promote it, with their claims that CB weapons provide a means for reducing the inhumanity of war.[5] Outside the context of possible nuclear war, however, people seem to be at least as strongly repelled by the idea of CBW as they ever were.

The second, and much more significant, factor derives from the post-war advances made in CBW technology. For most of World War II the chemical weapons available were well suited only to static conditions, and much less so to the mobile fighting which was characteristic of the war. In addition, the anti-gas defences available could have provided discouragingly good protection against the weapons of the time. Since the war, however, there have been at least three important changes. First, biological weapons have now been developed, which if they were to perform as predicted—and here there is great uncertainty—would seem to be easily capable of overwhelming any BW defences that might be ranged against them. Second, with the development of the nerve gases, which started during the war, the capabilities of chemical weapons have increased greatly: they now seem to be much better suited to mobile ground-warfare conditions, and they make far greater demands on the efficiency of protective equipments and discipline. In the conduct of battlefield operations, there are now likely to be greater incentives to use chemical weapons than there were during World War II. Third, one consequence of the present arms race between the two superpowers is that both of them feel impelled to study, develop and procure weapons of even the most marginal utility.

All this is not to say, though, that the technical and operational limita-

[5] See Appendix 1, p. 124.

tions of the weapons have entirely disappeared. Biological weapons are perhaps the most uncontrollable and unpredictable of all weapons, and the fact that they cannot produce any effect at all until at least a day after use severely limits their range of possible applications; the recent unilateral renunciations of biological weapons are indicative of their limited military value. Meterological and other unpredictabilities still affect chemical weapons, although continuing R & D is reducing them. Anti-gas discipline needs to be still more rigorous than during World War II, and is certainly no less burdensome.

However, if field commanders were compelled to use chemical weapons, they would probably have greater confidence in them than hitherto. The increased military attractions of the weapons, coupled with the widely-felt necessity of presenting an imposing anti-chemical defensive posture in the field, is likely to have promoted assimilation of chemical weapons within the military establishments. All in all therefore, those nations which possess chemical weapons today are likely to be more prepared to use them than were those who possessed them in 1939. The same does not hold true for biological weapons for the reasons given.

As regards the constraint arising from the fear of enemy response to CBW initiation, we suggested earlier that during World War II this existed in part because the enemy would be under strong internal pressure to respond in a manner that went beyond the dictates of his subsequent battlefield predicament. He would have to cope both with whatever tactical or strategic damage he had suffered from the initiation, and with the psychological impact of being attacked with illegal and unorthodox weapons. Given the unlimited warfare prevailing during much of World War II, about the only possible response then was retaliation in kind, probably on a much larger scale, and probably against civilian populations. This probability derived from and contributed to the general tendency to concentrate offensive CW capabilities in aircraft-delivered chemical weapons.

The strength of this constraint today must clearly depend on the nature of the war in which CBW might be initiated. If the war is highly asymmetric, with the potential initiator of CBW in command of the air, for example, or fighting an enemy whose supply services are weak or who is deficient in CB protective equipment, the constraint may not be strong. If, on the other hand, the conflict is a symmetric one, the constraint is most unlikely to be weaker than it was during World War II. If the conflict were between two non-nuclear powers which possessed offensive CB weapons,[6] the possibility of escalatory retaliation in kind against civilian populations might be con-

[6] As noted earlier, we do not know whether any non-nuclear powers in fact possess CB weapons today.

sidered a virtual certainty, as it was during World War II. Between nuclear powers, however, the possibility of counter-city retaliation in kind may not seem likely in the event of battlefield use of CB weapons: if nuclear weapons were not in use already, resort to counter-city CBW would carry a high risk of precipitating their use. This would suggest that the enemy's response to initiation of CBW would be either nuclear or retaliation in kind limited to the battlefield. The strength of the constraint would therefore depend on the potential initiator's willingness to conduct a war in which nuclear weapons came into use, and on his assessments, first, of his enemy's willingness to resort to nuclear weapons and, second, of the chances that his enemy would not feel compelled to retaliate against CBW in an escalatory fashion. It seems unlikely that the potential initiator could have much confidence in his assessments of these two factors. Because of this uncertainty, and because he would presumably not want to get involved in a nuclear exchange, the fear-of-retaliation constraint might well prove to be extremely strong—regardless of his enemy's CBW capabilities.

The main conclusions which may be drawn from these considerations seem to be as follows. In the event of a war between belligerents of approximately equal military strength, CBW seems to be no more likely than it was during World War II. Although the unpreparedness constraint might turn out to be weaker, particularly for those few countries that have continued to maintain offensive CBW capabilities since World War II, the fear-of-retaliation constraint is likely to remain dominant, particularly in a war involving nuclear powers. The latter constraint may not affect a belligerent fighting a much weaker enemy, but in that event, although the incentive to use chemical weapons (but not biological ones) may be strong, the odium attached to the weapons in the public mind is likely to generate compelling political constraints.

II. *Points of weakness in the existing constraints on the use of CB weapons*

We now move on to relate the points developed in the previous section to the probability of future CBW. We will continue to apply the concept of a balance between incentives, on the one hand, and constraints on the other. We have suggested above that the elements which might enter into a calculation on whether to initiate CBW are closely related to one another, and that, quite apart from their varying weight in different parts of the world and in different conflict situations, many of them are susceptible to change as time goes by.

As noted in the previous section, post-World War II advances in CBW

technology have increased the military attractions of the weapons. This process will surely continue as long as offensive CBW R & D work continues, assuming there are no really major changes in the capabilities of CB protective measures. As regards CW, there seem to be two main threats. The first is that the so-called incapacitating agents will be developed to a point where their military attractions rank with those of the nerve gases. The second is the possibility that development work, which although unlikely to upset the overall balance between the offence and the defence in CW, may lead to sufficiently great improvements in the weapons to allow their possessors to believe that, in recurrent situations, they would provide a more economical means of overwhelming the defences ranged against them than would other weapons. This may already be the case with nerve-gas weapons, but the possibility will increase if agents having more potent percutaneous effects than the nerve gases are developed and if disseminating devices for existing agents improve markedly.

As regards BW, there is a substantial possibility that if R & D were to continue it would diminish the meteorological dependence of biological weapons to a point where it was no greater than for chemical weapons; while the long incubation times of infective agents cannot be reduced, a number of scenarios can be envisaged in which this time-lag might not matter, or might even be useful.

Thus it is from offensive CBW R & D programmes, if they were continued, that important increases in the incentives to use CB weapons might derive; we discuss the implications of this further in the following chapters. It must be repeated, though, that developments in defensive CBW technology may be as rapid as those on the offensive side. These considerations are discussed further in Volume II.

The main threat of erosion of existing constraints appears to lie in the increased attention that has been paid to what some people have chosen to call "nonlethal" CB weapons. These are based on toxic or infective agents which have only a low probability of killing or permanently injuring people. There are three main classes; these are described in some detail in Volumes I and II of this study, but a short summary will be useful here.

First, there are the *anti-plant agents*. Some of these have been used on a massive scale in war, notably in Viet-Nam, to defoliate forested areas in order to remove natural cover that may conceal enemy units. The same agents have also been used, again mainly in Viet-Nam, to destroy food crops. The chemical agents of this type—and it is reportedly only chemical anti-plant agents that have so far been used in war—are herbicides commonly used in forestry and agriculture, such as 2,4-D and 2,4,5-T. Their military applications differ from their civilian ones only in the

purposes for which they are used, and the concentrations and dosages at which they are applied. The biological anti-plant agents are plant pathogens which are capable of initiating spreading diseases among crops: those that have been stockpiled include the causative agents of rice blast and stem rust of wheat.

Next, there are the *irritant agents,* also known as *harassing agents.* These are chemicals which can intensely irritate the eyes, nose, throat, lungs and skin, and thus disable people who remain exposed to them. Their effects are transient and in most cases soon pass, provided excessive concentrations are not used. They include the familiar tear gases and such other substances as CS. Some are commonly used by police forces in riot-control and related situations. They have also been used in war, and are still being used in the Viet-Nam War, where their tactical applications rest mainly on their ability to force unmasked enemy troops from protective cover, or to disable them so that they can no longer use their weapons.

Thirdly, there are the *incapacitating agents.* These are intended to cause temporary disablement for much longer periods than irritant agents. There are many ways in which the human body can be disabled. Thus, the chemical incapacitants might induce such effects as paralysis, temporary blindness, mental disorder or recurrent fainting fits. One such agent is the "psychochemical" BZ, which gives rise to a combination of mental and physical disabilities that take a few hours to develop but then last for two days or more. Another is a bacterial toxin—staphylococcal enterotoxin—which can induce prolonged vomiting and diarrhoea a quarter of an hour, or so, after inhalation. The biological incapacitants are the pathogens of highly debilitating, but rarely fatal, diseases; among those that have been stockpiled is the virus causing Venezuelan equine encephalitis, which may incapacitate for a week. Civilian applications of these materials are few. Certain chemical incapacitants are used in dart-guns to immobilize large wild animals for capture or marking; such weapons have occasionally also been used by police forces to arrest criminals.

Incapacitating agents may be classed with the remaining category of anti-personnel CBW agents, the *lethal agents,* in a joint category of *casualty agents.* Like the lethal agents they are intended to produce prolonged disablement to such an extent that enemy troops can no longer perform their duties—which is one definition of a casualty. Lethal agents, for example nerve gases and pathogens of diseases like plague or anthrax, do this by killing or severely injuring.

One important point to note about the different classes of anti-personnel CBW agent is that the distinction between them depends at least as much

on the way in which they are used as on the intrinsic properties of the agents. For example, irritant agents can produce casualties, and both they and incapacitating agents can produce death, if they are used in sufficient quantity.[7] The separation of the agents into categories, although it has importance from an operational point of view, is essentially a process of selecting bands in a continuous spectrum of toxicological or pathological effects. The borderlines are extremely difficult to define in terms of the intrinsic properties of the agent in such a way that potentially attractive CB weapons do not straddle them—although they can, of course, be defined in terms of the operational applications of the agents.

We now review the main points at which the set of contraints against the use of CB weapons seems to be weakening, or where there may be points of incipient erosion, and where the law prohibiting use of CB weapons seems to be particularly vulnerable.

First, there is the current use of tear gases and other irritant agents, and of anti-plant chemicals, and the possible future use of incapacitants. The problem here is to identify the extent to which the use of these agents may weaken the entire array of constraints operating against all forms of CBW. The factors involved here include the risk of escalation within a particular conflict up through the range of available CB weapons; they also include the risk of familiarization whereby experience gained with one type of CB weapon in a conflict reduces the constraints against the use of the weapons in subsequent conflicts. There are also the ambiguities in the concept of "war" to be considered, and the problems of unverified allegations of CBW.

Wartime use of tear gases and other irritant agents

The most important threat to the present array of constraints on CBW lies in the disputed position of irritant agents, particularly tear gases and agents such as CS. This problem has become urgent in recent years for two inter-related reasons. First, some groups have made insistent attempts throughout the 1960s to present these weapons as being outside the concept of CB weapons in the public mind, in law and in the conscience of political and military leaders. These efforts originated in the United States; but in 1970 the British Government, by taking the position that CS is not included within the scope of the Geneva Protocol[8] contributed to the confusion, as have Australia and Portugal, the latter more by its acts than by its statements. Second, these weapons have been used extensively in

[7] They can, of course, also be used in conjunction with conventional lethal weapons in order to produce increased casualties. (See Appendix 1.)

[8] It is shown in detail in Volume III that from a legal point of view this position is not tenable.

the Viet-Nam War—thus weakening many of the psychological, institutional and technical constraints which have been effective in the past. An additional factor is the increasingly widespread and well-publicized use of irritants in domestic police operations. This is considered in the next section.

The problem with the wartime use of irritant agents arises not so much from the direct effects of the use of these weapons but rather from the fact that there are many points of similarity between irritant-agent weapons and casualty-agent weapons. Foremost among these is, of course, that legally they belong in the same category; but in other respects as well—politically, conceptually and materially—there are similarities. Because of this, the constraints inhibiting the use of these two classes of weapon are in some part the same, and if those which inhibit the use of irritant-agent weapons are weakened, those which inhibit the use of casualty-agent weapons will also be weakened to a greater or lesser extent. Thus, increased acceptability of irritant-agent warfare involves a risk that subsequently the other, more threatening, chemical weapons may come into play.

The combat use of irritant agents is in some respects similar (but in other respects dissimilar) to the use of chemical casualty agents. Both categories rely on toxic reactions for their effects, so that the dosage problems in distributing the agents to their victims are comparable, and subject to similar uncertainties. Use of either category requires experience in using anti-gas protective equipment while fighting. Much the same mechanisms are used to disseminate the agents, so that irritant-agent weapons closely resemble casualty-agent weapons in construction, and both can be used with the same weapons delivery systems. In so far as delivery depends on air currents for effective distribution over a target, their employment techniques are similar and subject to similar meteorological unpredictabilities. The efficient use of both categories of agent requires skill in relating weapons employment to target topography, prevailing weather conditions and the proximity of friendly units.

These remarks on the technical and operational similarities between irritant-agent and casualty-agent weapons need, however, to be tempered in two ways: First, most of what the use of irritant agents can teach about the use of other types of CW agent is already known from the use of smoke screens with which most armies are familiar. In terms of delivery systems, meteorological uncertainties and similar factors, smoke-screening agents and those irritant agents that are normally disseminated as smokes are very close to one another.

Second, there are, as noted, also technical and operational differences between the military use of irritant agents and of casualty agents. The differences lie primarily in the different military effects of the weapons. Learn-

ing how to exploit applications of tear gases to the full in tactical situations is not the same as learning to exploit the potentiality of casualty agents; the uncertainties involved in the use of casualty agents are greater and the potential costs of miscalculations more prohibitive, than in the use of irritant agents. The necessary protective measures may differ widely from only the simplest type of mask in the case of CS to elaborate and militarily burdensome protective equipment and decontamination procedures for nerve gases. In moral and political terms there is considerable distance between casualty agents and irritant agents—even when the latter are used in conjunction with other weapons to increase enemy casualties. The point is thus not that there would be no constraints left on the use of casualty agents if those on the use of irritant agents disappeared, but that many of the constraints which now operate on casualty-agent chemical weapons would be weakened, some to a great extent, others less.

The risk that if constraints on the use of irritant agents are lifted those on casualty agents may became weaker makes it urgent to maintain the constraints on the use of irritant agents. Had agents such as tear gases been a distinct kind of weapon from every point of view—and had they not already been prohibited under the Geneva Procotol—it would have been difficult to make a case that they are any more in need of being banned from battlefield use than are so many other weapons.

The political constraints against CBW are largely dependent on the continued strength of the popular hostility to such methods of warfare. This in turn depends on several factors: the extent to which CBW is seen as abhorrent, the extent to which it is seen as abnormal, and the extent to which hostility to CBW can be associated with simple concepts, as for example "gas warfare". The use of irritant agents in war on such a scale as in Viet-Nam, and in a war which so divides the public, may weaken the public-opinion constraint in respect of all three factors. Some forms of CBW, albeit very mild ones, have now been used by the most modern army in the world. Their use has been defended by US publicists and political leaders as a legitimate and "conventional", indeed in certain cases a better, form of warfare. Even though the instinctive horror of "gas warfare" remains, it may become weaker as a general constraint the more the simple concept of the gas cloud and the gas mask, which hitherto symbolized and reinforced it, becomes associated with more ambivalent sentiments. The clear-cut and consensual attitude which previously rejected gas warfare in any form may therefore perhaps be no longer so strong a constraint against all CBW. Undoubtedly, acceptance of the milder forms of CBW has increased in some sectors of public opinion and decreased in others, depending largely on general attitudes to US policies. As a consequence,

ambiguity and disagreement about CBW now characterize public opinion.

The ambiguity which long persisted in US official views about CBW in general[9] may also have affected the attitudes of the public to CB weapons generally. Throughout most of the 1950s and the 1960s the protagonists of CB weapons within the US administration and army strongly opposed the idea that the USA should subscribe to any formal obligations limiting its—presumed—freedom of action in respect of CB weapons. To succeed in this attempt, it was necessary to "sell" these forms of weaponry to the public by presenting them as militarily useful, as morally non-reprehensible and as not prohibited under international law—to the United States at least. This publicity effort is described briefly in Appendix 1. In its wake a number of international lawyers associated with the army published studies of the legal aspects of CBW in which they tried to show that prohibitions of CBW are either nonexistent or not applicable to the United States.[10]

The noncommital statements made by the US administration prior to 1969, and its tendency to present its abstention from CBW as a "policy" rather than as a legal obligation, added to this clouding of the legal issues and to the confusion in the public mind. After the United States had initiated use of irritant and anti-plant agents in Viet-Nam, the issues gained a political character which has not made it easier to keep separate the questions of short-term interests and expediency, and long-term interests and principle, or to distinguish between attitudes towards the use of CS and attitudes to the war as a whole.

These two processes of use and of legitimization—in both a narrow legal sense and in a political sense—have gone hand in hand, and it would probably be wrong to see the use as the consequence of the legitimization, or, conversely, the legitimization as an anticipated rationalization of the use which later took place. The mutual interaction of these factors merely illustrates how the various constraints, just as they gain strength from each other, will also erode together.

But constraints other than those arising from the clarity of the legal position and respect for it and from the public condemnation of CW may also have been weakened by the US use of irritant agents and herbicides in Viet-Nam. These are the constraints which have hitherto impeded the material and psychological assimilation of CB weapons by military establishments.

The use of irritant agents and herbicides in Viet-Nam can scarcely have

[9] This ambiguity was finally resolved in November 1969 when the US President drew a line between "riot control agents" and "defoliants", on the one hand, the use of which was to be considered legitimate, and lethal and incapacitating chemical weapons, on the other, whose first use by US forces was renounced.

[10] The main works in this group, those by Neinast, Kelly, O'Brien and Brungs, are discussed in Volume III.

failed to affect the perspective of the US armed forces on chemical warfare. As a result of these operations the armed forces in general, not merely a limited number of CW specialists, have acquired familiarity, materially and psychologically, with some form of CW. By gaining operational experience with this form of CW, officers have come to conceive of tactical situations in terms, *inter alia,* of the way in which these chemical agents may be utilized, of how they can be of assistance in a variety of situations, and of how they can complement other weapons systems and contribute to their effectiveness. In this way *a priori* reasoning about the advantages and limitations of these weapons has been tested in practice. All this, it should be noted, has been happening in a situation where CW is almost entirely confined to one side in the conflict and where there is no significant risk of retaliation in kind to the armed forces using these weapons. This may well have given the forces using irritant agents a somewhat exaggerated view of their intrinsic usefulness.

As a result of this process, the standing of the CW protagonists and CW specialists within the US armed forces may have increased. Some of their ideas have now become more familiar and are no longer mere ideas but devices and techniques which are seen to work and are better understood in many of their ramifications. It is possible that the entire outlook, experience and institutions of the armed forces have become more adapted, if not to any type of CW then at least to those forms which are actually being practised.[11]

There may also have been a tendency for proliferation to other armies: since 1964 the US Army has given instruction in CW matters to representatives of armies from twenty-three other states, and in this way has presumably transmitted not only skills, but also some of its interest in CW.[12] Moreover, the precedent set by the United States means that the political constraints on future users may be less. Already there are allegations of some sort of CW in Guinea-Bissau and other Portuguese territories in Africa.[13]

In short, once irritant agents are used on a large scale in war, as has happened in Viet-Nam, it is the entire array of constraints against CW—

[11] On the other hand, one should not altogether ignore the possibility that the practice of some forms of CW might in retrospect be found by the military to have been undesirable, taking political and military considerations into account, with the result that there will be reactions against these weapons amongst the military. The possibility of a strong political reaction against CW as practiced in Viet-Nam is further discussed below (page 40).

[12] These programmes involve both use of, and protection against, CBW, and are not confined to irritant agents, herbicides and the like. See, for example, the *Congressional Record* 29 December 1969, pp. E. 10992–96.

[13] See Volume I, Chapter 2.

technical, operational, institutional, legal and, foremost, attitudinal—that may become eroded. Compared with the risk this involves that at a future time less innocuous CW agents will come into use, the possible benefits from using irritant agents in war seem small. Militarily their utility is after all marginal, and their value in "humanizing" warfare is more than dubious.[14]

If one were to establish a formal borderline between irritant agents and casualty agents and to allow the use of the former but not of the latter, then it would hardly be realistic to hope that the borderline would be strong enough to prevent other forms of CW in future wars. An attempt to base the law of war on such a distinction seems almost bound to fail because in a number of respects—material, institutional and conceptual—the two seem sufficiently similar to suggest that constraints cannot be established for casualty agents which will not also constrain the use of irritant agents; and conversely that undoing existing constraints on irritant agents means undoing, or at least weakening, those which presently reduce the risk of casualty agents being used. The law of war cannot be designed to fit any categorization one may come up with; or, if it is so designed, it is not likely to remain inviolate for very long. If the category of prohibited weapons corresponds to material and psychological realities, the law will strengthen existing constraints and sharpen the contours of the prohibited category by introducing moral pressures and sanctions—whether of a material or a moral nature—to supplement other constraints in cases where they are weak. If the law relates to categories which do not have a basis in material and psychological realities, respect for it will have to stand alone as the only safeguard against violation. Experience suggests that under conditions of warfare, respect for the law is not a sufficient constraint on its own.

It must not be assumed, however, that because constraints are presently being eroded there is no way back. While the constraints which stem from material unpreparedness may be broken for years to come once there has been large-scale use of the agents and the equipment, this is not necessarily so for the moral, political and psychological constraints. The immediate effect of using irritant agents in war may be to weaken the belief in the strength of the law, to provide a justification or a pretext for other potential users, and to replace in the public mind the unequivocal condemnation of gas warfare with ambiguous concepts admitting of *ad hoc* exceptions. But when these psychological factors are considered in historical perspective it may well be that, together with the weakening of constraints and because of it, opposite forces develop which seek to strengthen the constraints, and these may ultimately gain the upper hand.

[14] See Appendix 1, p. 124.

That is what happened after World War I. The unpreparedness constraints almost vanished as a result of the massive use of gas, the rapid development of new agents, weapons, protective equipment, military employment doctrines and so forth. The Hague prohibition of poison and poisoned weapons became little more than a paper pledge, useful only for propaganda purposes; public opinion split, with a number of "realists" contending that these weapons, abhorrent though they may be, had come to stay, and other "realists" even arguing that all in all gas warfare might be rather an improvement on other forms of warfare. But despite this it was precisely the collapse of all limitations on CW, the glimpse people had caught of the potential hell of twentieth-century battlefields, which led to a political and moral reaction, a reaction in public opinion and in law, and probably in military perceptions as well. The massive use of chemical weapons during World War I created an awareness in the public mind and an abhorrence far more widespread and far deeper than had previously existed against the use of poison in warfare. These reactions eventually found their formal expression in the Geneva Protocol of 1925. They were not only largely responsible for bringing the Protocol into existence, they were also among the main reasons for its subsequent effectiveness. As we saw in the preceding secton, the array of mutually reinforcing psychological, moral and political constraints which evolved in this way in turn contributed to the material and psychological unpreparedness of most belligerents in the first years of World War II. This contributed substantially to the prevention of CBW in the course of that war and thus to the present image of CBW as an unconventional and unacceptable form of warfare.

This pattern of action and reaction which has characterized past development of the constraints and incentives to use CB weapons may of course apply to future developments. It is by no means inconceivable that the erosion of the constraints on CBW which has taken place in recent years as a result, mainly, of the Viet-Nam War will in time turn out to have been the warning that was needed to further strengthen, broaden and universalize the constraints against all forms of CBW. Indeed there are many signs that this is happening, although the final outcome is by no means certain. CW has become much more prominent in the public mind than it has been for decades and there are increasing efforts to do something about the CBW threat. Neither in the United States nor in Britain (nor, *a fortiori,* in the lesser powers which have followed their lead) is it at all clear what positions the authorities will ultimately take on the question of the admissibility of using irritant agents or herbicides in war. These encouraging signs, and, on the other side, the efforts to separate warfare with irritant agents and herbicides from the concept of CBW and make it normal and

acceptable, are the simultaneous and contradictory consequences of the same events.

Police use of irritant agents and the concept of war

The legal position can be summarized as follows: war, in the meaning of the Geneva Protocol, is to be taken in its material, rather than its formal sense of *declared* war. The Protocol unquestionably applies to any armed conflict between the contracting parties. On the other hand it is equally certain that, *per se,* the Geneva Protocol does not apply to wars not of an international character. However, a customary rule of the law of war is not necessarily limited to inter-state war; to determine its field of application, past practice as well as common conviction must be taken into account. These suggest that the customary rule prohibits the use of CB weapons in all forms of civil war and non-international conflict. In the discussions preceding the 1969 UN resolution, one can, it is true, find a tendency for some states to seek to reserve their position on the permissibility of using irritant agents in domestic conflicts of a warlike character; but it would certainly be wrong to claim that a custom has developed which renders such use legal. In any event there is here an obvious risk of erosion of customary law, for between the extremes of clear-cut military operations and normal police operations there is a considerable range of situations where customary law is ambiguous and where interpretations of it can and do differ. On the other hand, it must be stressed that the legality or otherwise of CBW in internal warfare must not be judged solely on the basis of the customary CBW prohibition, for the strength of the prohibition rests primarily on another and generally admitted legal principle, namely that rules which serve to prohibit the use of specific types of weapons are also applicable in conflicts which are not between states. It might be added that international law can certainly not render illegal the domestic use of chemical agents in police or other operations of a purely domestic kind.

There have been various attempts to meet the difficulty created by the ambiguity of the concept of war. This problem, which is of course common to all laws of war, assumes particular importance because several wars in recent decades have belonged, at least in some of their phases, to the category of ambiguous cases, and because unconventional forms of warfare, so it is commonly believed, might become increasingly frequent in the future.

One attempt to cope with the problem in the specific context of CBW was the twenty-one power resolution of the UN General Assembly adopted in 1969. In it those situations to which the CBW prohibitions apply are referred to as "international armed conflicts". This concept is wider than

that of "war" when the latter is taken in the traditional (and now largely obsolete) legalistic meaning of "declared war", but appears to be narrower than "war" when that word is taken in a material sense. The British draft BW disarmament convention seeks to prohibit the use of biological agents "for hostile purposes".[15] It is not at all clear what situations would in fact be covered by such a formula. In some cases the distinction between hostile and non-hostile purposes is ultimately one of political allegiance; for example, views might differ as to whether a given insurrection is a case of civil war, where purposes are evidently hostile, or a case of maintenance of law and order where in the view, presumably, of the draftsmen they are not. In a context which is not directly related to CBW, a report by the International Committee of the Red Cross on the protection of victims of non-international conflicts uses the expression "armed conflicts in which armed forces are engaged in hostilities".[16] Here the decisive point is the existence of at least two contending "armed forces"—organized units of combatants—and this would define a situation in which no one, whether a member of these armed forces or not, may use CB weapons against any target, combatant or noncombatant. This clearly encompasses all cases of civil war and guerilla war as commonly understood, and excludes situations of riot control and repression of banditry; it is probably as good a formulation as one is likely to find.[17]

The problem, however, is not only to find a definition which is reasonably sharp in all cases likely to occur in practice and to gain general acceptance for it; it is also necessary to differentiate cases where police use of irritant agents, for example, is permitted from cases where all use of CB weapons is prohibited, in such a way that existing material, moral and other constraints will reinforce the law and *vice versa.* It is clear that there can be no fully satisfactory answer to this question because the several constraints do not all apply in the same cases, and therefore place contradictory demands on such a definition. We now consider this in slightly more detail.

To analyse the possible points of erosion of the CBW prohibition which arise from the fact that there must inevitably be a range of situations where it is a matter of dispute whether the use of CB weapons is prohibited, it is convenient to consider three different types of situation, while realizing

[15] This draft disarmament convention is further discussed in Chapter 3 and its text is reproduced in Appendix 6, p. 263.

[16] "Protection of Victims of Non-international Conflicts". Report submitted by the International Committee of the Red Cross. Twenty-first International Conference of the Red Cross, Istanbul, September 1969. (Geneva, May 1969.)

[17] The main difficulty would appear to be the borderline between small-scale guerilla warfare and armed banditry since these are distinguished less in terms of organization and command than by the existence of political aims in the former case and their absence in the latter.

that there are no sharp borderlines between them. The first case is inter-state war proper; the second is a mixed category of civil war, civil war with foreign intervention, colonial wars and their sequels, partisan fighting in occupied territories, etc; the third is again a somewhat ill-defined category of police operations such as riot control, the quelling of local uprisings, etc.

First it should be stressed that in a number of respects there is quite a sharp distinction between strictly police-type use and clear-cut military use of irritant agents (so far the only anti-personnel CBW agents which have this double purpose). All police equipment for irritant-agent use can also be used by the military, but the converse is not the case. Hand grenades are typical police weapons for disseminating CS, whereas long-range weapons such as artillery shells, bombs and rockets, unlikely to be used by police forces, may be attractive for battlefield use of CS. Problems such as follow-up with conventional weapons in order to cause casualties exist only in the military case, while others relating to battlefield planning and similar factors, while they are common to both, assume a rather different character in the two situations. Typically the size of area which needs contaminating, and the concentration of agent which is required, will also differ. (Of course, this is not to deny that in some cases the military use of CS will be quite similar to police use, but, if experience from Viet-Nam is a guide, these cases are the exception rather than the rule.) Legally, the two situations belong to different bodies of law: domestic law and the international law of war. Morally there is a considerable difference between the two sorts of use for a variety of reasons: one is the difference in legal status, another is the difference in character and aims between police actions and military actions, which, in turn, gives police forces and military forces rather different images in the public mind. Of course, there is a great difference between being attacked with CS in the course of a police operation and being attacked with it in war. In the first case the general aim is to prevent fighting or bring it to an immediate end by dispersing people. In the second case the aim is to render people incapable of fighting; and there is also the fear of what comes with or after the CS. Even if the use of CS in war were in principle strictly limited to police-type operations, there would still be cause to fear abuse because the enemy forces are not restrained as police forces are by the fact that they may be called to account by those who have suffered abuse.

The difficulty arises from the fact that, even though these two extreme categories are fairly sharply differentiated by a number of criteria, there is a continuous spectrum of situations between them, and the different criteria do not all divide this spectrum at the same points. The use of irritant agents may be contemplated in a particular situation which, in some respects, may

be similar to a police operation and in others to a military one, and therefore the existing constraints do not always support one another.

In some countries the separation between police and army may create a certain institutional barrier against the diffusion of skills and evaluations gained in using irritant-agent weapons, but in many countries there is no sharp organizational and functional separation between army and police. Armies are sometimes called upon to perform riot-control tasks (for instance the British Army in Northern Ireland today). In other cases special para-military forces constitute a bridge between army and police forces (for instance, the National Guard units in the United States). Militarily-trained personnel may perform police functions or the police may obtain weapons from the military when particular tasks so require, and there may be a considerable overlap between these bodies.

It is also clear that in the case of the use of irritant agents in war, the constraints from material unpreparedness are not very strong and may easily be overcome in cases where there are strong incentives for use. Only in conjunction with moral and psychological constraints do the material constraints gain strength by being perpetuated. However, the situations in which moral, psychological and legal factors are likely to constitute powerful constraints are not always clear-cut and for many borderline cases consensus will be lacking. Moreover they apply with greatest force to situations which cut across those to which the material constraints apply.

As regards the acceptability of CB warfare in the public mind, the main point of distinction does not seem to be between use by the police force and use by the army, but between use for riot control and similar tasks and use in operations where the purpose is military. It seems to be fairly generally accepted that in certain types of situation it is legitimate for military forces to perform certain police functions and in so doing to use the means which the police would have employed.

In the early phases of the current Viet-Nam War it was possible to contend, despite the means employed, that the South Viet-Namese Army was performing policing operations, for the opposition was not unified and lacked coordination. As the conflict escalated, and after the insurgent forces became fully integrated under the leadership of the NLF in the early 1960s, the conflict gradually took on the character of a civil war. Foreign intervention (in the form of fighting units) was a fact by the mid-1960s, but this too had been a gradual process. Thus, in this case the different forms were blended into one another, making any sharp distinction by type-of-conflict impossible. It is also the case that views about the nature of a particular conflict and thus about the legality of using irritant agents will be a function of the observer's general political attitudes to the conflict

issues. Public opinion and governments around the world are therefore likely to be divided in their appreciation of specific cases and this might in turn greatly confuse the moral issues and weaken the moral constraints.

It follows from this that it may hardly be possible—and perhaps not even desirable—to uphold a distinction which would always forbid military forces to use irritant agents while allowing police forces to use them. This fact, that if police forces may use irritants military forces are bound to use them in some cases too, makes it very difficult to institute safeguards which will prevent abuse. This has implications both for disarmament considerations and for the risk of eroding the existing constraints. In addition to the safeguards it would provide against the use of casualty agents, CB disarmament might go a long way towards solving this particular problem. As is pointed out in Chapter 3, a disarmament treaty—if it were to allow the continued possession of light police-type weapons such as CS-filled hand grenades, while prohibiting the production and possession of chemical shells, bombs and such weapons, even when filled with irritant agents—would not prevent genuine police-type uses, but would severely curtail the use of irritant agents for warfare purposes.

The present situation creates a threat to the existing constraints in two different ways. The first is the likelihood that use or abuse of irritant agents in ambiguous cases—and even in cases which indisputably fall outside the scope of the law—will gradually wear down the constraints against their use in situations which are unambiguously war. We have already discussed the extent to which increased acceptance of the use of irritant agents in war and for warlike purposes would be likely to erode the constraints against other forms of CBW.

The second threat is of a different kind and may well be a more serious risk in the immediate future. It arises from the temptations for governments to attempt to impose a restrictive interpretation on the law so as to exclude the wartime use of irritant agents from its prohibitory scope. A government may be able to foresee situations in which the use of irritant agents would be attractive, and in which it might consider such use to be perfectly justified, but where nevertheless a decision to use these weapons could be challenged by other countries, or by political opponents at home, whether out of genuine concern that this may constitute CW or in order to embarrass the government politically. In anticipation of such situations—and whatever its views on the legal merits of the case—that government may feel inclined to declare in advance its adherence to a restrictive interpretation of the law and to try to "sell" that interpretation to the public and to other governments by clouding the legal issues and playing down the attendant risks. For example, when the British Government in February

1970 reversed its previous position and declared that the Geneva Protocol did not apply to CS, it appears to have been motivated by considerations of this kind, and by the simultaneous concerns of the Home Office over possible reactions to use of CS in Northern Ireland and of the Ministry of Defence in anticipation of future operations similar to the intervention in Anguilla.

Another illustration of this concern to keep a free hand in future situations of a possibly ambiguous character is the reluctance, already referred to, of some of the Afro-Asian countries to accept an interpretation of the laws of war which makes them applicable in domestic conflicts of a war-like character. This is the reason why the 1969 UN General Assembly resolution used the words "international armed conflicts", instead of the more comprehensive expression "armed conflicts", to describe the situations in which CBW was thought to be prohibited. Presumably, this reluctance is also indicative of the rapid proliferation of interest in irritant-agent weapons for use in "counter-insurgency" warfare which has taken place in recent years.

Thus many governments may have reasons similar to those of Britain for attempting to define irritant agents (or those particular irritant agents they happen to use) as outside the concept of CBW. Needless to say, erosion on this point could gravely affect the status of these weapons in the public conscience and in law, thus raising all the problems of weakened constraints against other forms of CBW which we consider here. This risk is enhanced by the fact that customary law is particularly vulnerable to such statements by governments and to repeated practice running counter to its provisions; as we noted above, it is in conflicts which are not between states that the attractions of using irritant agents are greatest, and, from a strictly legal point of view, it is not the Protocol but rather customary law which prohibits use of CB weapons in such conflicts.

It is not only the use of irritant-agent weapons in warlike situations which involves a risk of erosion. The repeated and widely publicized use of CS in disturbances such as those in Chicago, in California, in Tokyo, in Belfast or in Paris—all of them unambiguously police or riot-control operations—may familiarize the public with the use of irritant-agent weapons to the point where they come to be seen as acceptable, every-day weapons which might as well be tolerated in war.

The conclusion which emerges is that, taken together, the existence of a number of borderline cases between inter-state war and policing operations and the widespread use of irritant agents in police-type operations provides a possible avenue for erosion of the constraints against CBW. The obvious remedy, but one which does not seem likely to be acceptable, is

to discontinue all police use of irritant agents. Failing this, the disarmament measure described above may, as we have seen, go a long way towards solving the problem. In any case it is essential to keep in mind and constantly to emphasize that while there is ambiguity about the definition of police uses of irritant agents and their use in war, certain uses, such as flushing an area prior to bombing, are unquestionably forms of warfare and unquestionably illegal. There can be no question that while the use of CS by police forces and for policing purposes is legal, this does not exculpate other uses of CS.

Incapacitating agents

CBW agents which cause predominantly nonfatal casualties—the incapacitating agents—represent another potential source of erosion of existing constraints. The danger is less immediate than with the irritant agents. The fact that their use (or at least their first use) is prohibited under international law is not contested; the incentives to use the weapons seem to be slight, given their present limitations; and for the present at any rate, they do not have domestic applications as do irritant agents. As we shall see, however, R & D work could lead to the development of agents which are militarily attractive and if by then the constraints against the use of irritant agents in war had gone, those on incapacitating agents might not be all that strong. This is an important reason to press for CB disarmament now, to include in disarmament a ban on R & D and to oppose the erosion of constraints on the use of irritant agents in war.

The idea behind incapacitating agents is that military commanders may find value in possessing weapons which allow them to inflict high casualty rates on an enemy without danger of killing more than 1 or 2 per cent of the people who became casualties. There are two reasons why such weapons might be thought valuable. The first, and less significant, one is that nonfatal casualties may be more of a burden on enemy resources than fatal ones: they have to be evacuated, given medical aid, and looked after until they recover. Thus there may not only be immediate tactical advantage from an incapacitating-agent attack by virtue of the high casualty rates sometimes possible with CB weapons (against an unprotected enemy), but it may also provide longer-term advantages by disrupting enemy logistical arrangements with a sudden flood of hospital cases. Secondly, and perhaps much more important, an incapacitating CBW option might allow more ambitious military operations to be conducted within areas heavily populated with noncombatants. There might be situations in which it was impossible to engage the enemy without killing large numbers of civilians; in that event the choice would be either to go ahead and incur whatever costs there might be in

killing civilians, or to forego engaging the enemy. A typical scenario here is the use of incapacitating agents to blanket an enemy-occupied but otherwise friendly island prior to amphibious or airborne invasion. Here a biological incapacitant might be chosen; it could be disseminated a few days before the invasion so that the latter coincided with the end of the incubation period of the disease. Chemical incapacitants, whose effects appear more rapidly after dissemination, might be preferred in smaller-scale operations.

As regards the present level of development of incapacitating agents, it appears that the chemical ones, which in many respects are fundamentally inadequate, have fewer military attractions than the biological ones. It certainly seems to be the case that incapacitating agents have formed a higher proportion of anti-personnel BW agent stockpiles than of CW agent ones. Indeed, if there are any military attractions at all in possessing anti-personnel biological weapons, they would seem to apply almost exclusively to the incapacitating-agent weapons. This is not so for chemical weapons; in the first place, their casualty-producing ability can fulfill a rather wider range of military requirements, and, in the second place, lethal chemicals—particularly the nerve gases—are thought to be much more efficient casualty agents than existing incapacitating chemicals. From this point of view, incapacitating CW agents are militarily less attractive than the nerve gases because they take longer to produce casualties, because the severity of the casualties they produce is less predictable (especially in the case of the psychochemicals), and because they are not so effective percutaneously (which means they are easier to protect against). With a few possible exceptions, they are also more expensive and, in that their effective casualty dosages are higher, they require a greater weight of weapons for effect.

In contrast to irritant agents, the constraints at present affecting use of incapacitating agents have much the same strength as those affecting the use of lethal agents. All CW casualty agents, whether lethal or incapacitating, are closely related from a military standpoint. There are no great differences in the types of equipment needed to use lethal and incapacitating agents, although follow-up operations may of course be rather different in the two cases. Neither are there important differences in the level of protection needed against them (assuming, that is, that percutaneous chemical incapacitants are available, or soon will be). They are subject to identical meteorological unpredictabilities and comparable physiological ones. Both classes produce their effects by toxic mechanisms that interfere profoundly with the workings of the human body. The law makes no distinction between lethal and incapacitating biological methods of warfare, and while some jurists have claimed that irritant agents are not included in the category of pro-

hibited chemical weapons, few have claimed the same for incapacitating chemicals. If they did, their claims would certainly be unsupportable, as we have shown in Volume III of this study.

It follows that, if for some reason the constraints against use of incapacitating agents gave way, there would be a grave risk that the constraints against use of lethal agents would give way too. At the present time it appears that the constraints against using incapacitating agents so outweigh the incentives that there is no immediate danger that they will give way; but, as noted above, the military incentives to use them might well increase if research and development continue. One factor that is relevant here is the high incidence of wars of counter-insurgency and intervention: if weapons development in the field of CBW is not stopped, this may lead weapons designers and procurement authorities to pay increasing attention to weapons that can improve military capabilities in noncombatant-populated combat zones. This in turn may lead to increased interest in incapacitating weapons, and to further support for development programmes aimed at reducing their present technical and operational limitations.

In the absence of further disarmament measures it is thus possible that in future conflict situations the tension between the incentives to use incapacitating weapons and the constraints against doing so will increase. In such an eventuality, the existing array of constraints may rapidly disintegrate. One such weakness may be found in the different psychological inhibitions about CBW. A case has sometimes been made that because incapacitating CBW agents have only a low probability of actually killing people, it would be foolish, perhaps even morally wrong, not to use them in situations where civilians might otherwise get killed. If presented strongly enough, this line of argument—the limitations of which are discussed in Appendix 1—could lead people to start questioning what is in many cases an almost instinctive rejection of CBW. Once this begins to happen, many of the other constraints which stem from this deep psychological reaction might also weaken. The assimilation of CB weapons by military establishments might accelerate, given that some of the weapons might by then have substantial military attractions. The legal prohibition of incapacitating CBW might be called into question (just as has happened over irritant agents) both as regards its propriety and even, in its application to chemical incapacitants, as regards its very existence. The following quotation from an address given recently by a US Army general illustrates one of the lines of argument that has been used to secure greater acceptance of incapacitating CBW:

> ... The incapacitating agents were not available for consideration when the Geneva Protocol of 1925 was formulated.
>
> These incapacitating chemical weapons would be a marked asset to US forces

in military situations where it is necessary to gain control of an area in which both civilians and insurgents are co-mingled or where civilian and enemy military troops are inter-mingled. This would be particularly true on peace-keeping missions in underdeveloped nations where insurgency is a problem and where the US is asked to assist in maintaining stability of a state.[18]

Under such influences, more and more people in those countries conducting the "peace-keeping missions" might become persuaded that incapacitating CBW is a legitimate and acceptable method of fighting.

It is relevant to note that some of the advantages that have been claimed for the use of the irritant agent CS in the Viet-Nam War could also be applied to chemical incapacitating agents. This suggests one of the pathways whereby incentives to use certain types of incapacitating agent might increase. Thus, CS weapons have been described as beneficial because they permit engagement of enemy troops intermingled with noncombatants. Situations have occurred in which US forces prior to attack have saturated a target containing combatants and noncombatants and then moved in so quickly that the enemy forces were still too overcome by the CS to offer significant resistance. The need for the attacking troops to use their normal weapons was thereby reduced, thus allowing the mission to be accomplished with less danger to the lives of noncombatants. Situations such as these may not have been common, but they suggest the attractions of a weapon that can combine military effectiveness with a decreased risk of incurring the costs that are liable from killing noncombatants. CS suffers, however, from what in some situations would be a drawback, namely that the incapacitation produced by its irritant effects is short-lived, unless massive and impractical dosages are used. Because the incapacitation is unlikely to last for more than a very few minutes, it can be exploited only in tactical situations where troops can be sent in to engage the enemy immediately after the CS has been disseminated. It is therefore only exploitable in very minor engagements, or where the user of CS is capable of very rapid manoeuvre. If the incapacitation were longer-lasting, it might be exploited in larger-scale operations, and would make fewer demands on the user's powers of mobility. This is the type of consideration which suggests the incentives that might arise to use such agents as BZ or staphylococcal enterotoxin.

If such agents did in fact come into use, the consequent effect on the

[18] "Chemical and Biological Warfare." Briefing by Brigader General J. A. Hebbeler, 4 March 1969, at request of Congressman Richard McCarthy. (Reproduced in the *Congressional Record*, 1 April 1969, pp. H.2424–H.2426.)

The General's somewhat disingenuous comment on the Geneva Protocol was neither strictly correct, nor relevant to the scope of the Protocol, as we explain in Volume III of this study. Nonetheless, it was a pregnant statement about the law, if not a particularly explicit one, and may well have impressed some of its audience.

constraints against using other types of CB casualty agent are obvious enough. If the period of incapacitation were indeed an important operational factor, then other agents with different incapacitation times might also prove attractive. The longest periods of incapacitation are those produced by biological agents, so that the initiation of incapacitating CW might in turn generate pressure to use biological weapons. Likewise, because chemical agents proved valuable by producing (nonfatal) casualties in intermingled situations, field commanders might be led to consider their possible applications in non-intermingled situations. Here there would be less requirement to keep down the numbers of fatal casualties and interest might grow in using chemicals to obtain still higher casualty rates whatever the mortality rate. In such a situation to change from using weapons charged with incapacitating agent to ones charged with nerve gas, say, might not require great changes in the conduct of operations or the level of anti-gas discipline.

In the absence of CB disarmament, the extent of the risk of erosion of constraints which the incapacitating agents give rise to is in large part determined by the future of the prohibition of irritant agents in war. If the use of irritant-agent weapons in war were now to cease altogether and be unanimously condemned, then the threat from the incapacitating-agent weapons would probably not be very great. But if the use of irritant agents in war were to continue, and gained acceptance in the public mind, then it would be likely that the incapacitating agents would constitute the next point of disintegration of the constraints on CBW in general. Indeed, if irritant-agent weapons gained acceptance as a means of warfare the remaining moral and legal prohibitions would be seen in a new perspective. Conceptually the construction would be that they applied to CB weapons, not because of the toxic effects of these weapons on organisms, but because of the excessive suffering they cause if used. And once this change of perspective has occurred, the inclusion of incapacitating agents under a prohibition from which irritant agents are excluded would, to many, appear wholly unreasonable, for every argument—good or bad—that can be made on behalf of the "humane" character of certain uses of irritant agents would be equally applicable to some of the possible uses of incapacitating agents. Thus a prohibition which includes one but not the other would have to rely for its strength either on purely material constraints which, unless supplemented by moral ones, can only delay, not prevent, the weapons coming into use, or else on essentially formalistic criteria—such as making a difference between those agents which are only used in armed conflicts and those which are also used in domestic situations—which constitute weak barriers because they do not correspond to morally significant categories.

In short, what this means is that if it became accepted that exceptions

to the CBW prohibition can be made for certain agents because some of their uses may be thought of as relatively humane, then the prohibition would become so filled with gaps that it would be very difficult indeed to preserve its remnants from complete disappearance. The specific danger inherent in incapacitating agents is that they may bridge the gap between irritant agents and lethal agents. They are similar to irritant agents in that for some people their use may seem justifiable on "humanitarian" grounds; but from a technical, operational and functional point of view they are much more similar to lethal agents. While their use may therefore appear a logical, and even a desirable, improvement on the use of irritant agents, it would also impose a grave risk of inducing reliance on all forms of anti-personnel CB weapon.

Anti-plant agents

At first sight, the use of CBW agents to damage or destroy plants does not seem particularly close to the use of anti-personnel CB weapons. From a military and operational standpoint, there are obvious differences between employing herbicides and employing nerve gas, as there are from the standpoint of public opinion. But there are two questions to ask. First, may there not be a danger that increased acceptance of the use of anti-plant agents in war will both increase the acceptability of damaging an enemy by damaging his environment, and increase the efficiency and scale on which such ecological warfare may be conducted? Scorched-earth policies have long been a feature of war; but anti-plant CBW agents provide a means for putting these into practice in a vastly more economical and destructive manner than hitherto. At one extreme, ecological warfare may involve nothing more than local destruction of forest and of a year's harvest; but at the other extreme it may initiate a chain reaction of irreversible environmental changes over great areas, and may thus profoundly affect the way of life, perhaps even the survival, of whole populations.

The second question to consider is whether, in the absence of other constraints, the use of chemical herbicides might not expand into the use of biological anti-plant agents, and thence conceivably to a diminished unacceptability of the use of anti-personnel biological weapons.[19] This is of

[19] There is of course also the possibility that anti-plant CW might escalate into anti-personnel CW, although technical and military factors do not seem likely to encourage such a development to any great extent. The risk arises not so much from the material and conceptual similarity herbicides may have to other CB weapons, but rather from their legal subsumption under one category, and the possibly ambiguous status of herbicides under the law.

Because it may not make much military sense to respond to anti-plant or irritant agent usage with CB casualty agents, the risk may be more theoretical than actual.

course a risk that would be greatly diminished by BW disarmament or by a caucus of unilateral renunciations of biological weapons following the examples of the United States and other countries.

The legal position as regards anti-plant agents has been described in Volume III of this study; the main points are these. From the point of view of the nature of the weapons—chemical or biological—both the Geneva Protocol and the customary rule can be construed as ambiguous. The Protocol prohibits "bacteriological methods of warfare" which clearly encompasses all use of biological anti-plant agents for war purposes. As regards chemical agents there is no reason to doubt that the draftsmen intended the scope to be similarly comprehensive, and the large majority of parties to the Protocol adhere to this interpretation, as witnessed by the 80-3 vote in favour of the 1969 UN General Assembly resolution which declared as contrary to international law the use of all chemical and biological weapons "which might be employed because of their direct toxic effect on man, animals or plants". Thirty-six states abstained, and as one observer puts it, "examination of the statements of the abstaining states suggests that if the competence of the United Nations to interpret the Protocol had not been an issue and/or if a positive vote on the resolution would not have implied desertion of a major ally, support for the broader interpretation would have been nearly universal."[20] On the other hand, it is true that chemical herbicides were not discussed in 1925 (though biological anti-crop agents were referred to in the negotiations and were considered to be comprised under the Protocol's prohibition) because those that today have military attractions were not known at the time. More importantly, it can be claimed with some justification that *some* of the uses to which herbicides have been

However, the legal and moral constraints and the pressure exerted by public opinion have been weaker in relation to use of chemical herbicides—or for certain of their usages—than for any other type of CBW. At the same time the majority of nations hold that these weapons are prohibited, and this divergence of opinion about the acceptability of herbicide warfare means on the one hand that there is a possibility, not necessarily only a theoretical one, that these weapons will be used, and on the other, that their use in war, particularly where retaliation with herbicides is not practicable for the enemy, might lead to reprisals with other types of CBW. If such reprisals are not out of proportion with the initial offence they would not be illegal, because from the point of view of reprisals CB weapons form a whole, as is described in Volume III of this study. Moral and other psychological constraints may therefore be inoperative in this case, and once first-use of CB weapons other than herbicides had occurred, all constraints against further use would be diminished. Whether CB weapons then came into general use would depend on little else than their military utility.

To the extent that the status of irritant-agent weapons under the law of war is also thought to be ambiguous, the same possibility of escalation by reprisals and counter-reprisals of course applies in that case also. However, irritant-agent weapons appear to be useful primarily in situations where the enemy has no means of reprisal.

[20] David E. Brown, "The Use of Herbicides in War: A Political/Military Analysis", in *The Control of Chemical and Biological Weapons* (Carnegie Endowment for International Peace, 1971), p. 57.

put in war, notably defoliation to increase visibility, is no more chemical warfare than is the use of smoke screens which, by general consensus, are not considered to fall under the prohibition of the Protocol. In both cases, it may be claimed, the effect sought is not physiological but optical.

The position under the customary rule is similar, although for somewhat different reasons: the evidence is that the prohibition applies to herbicides but the contrary view cannot be conclusively disproved on legal grounds alone. The 1969 resolution again provides substantial evidence on the beliefs of states, but the practical possibility of using these weapons in war is such a recent development that it can be claimed that a practice of non-use has not developed and, indeed, that US use in Viet-Nam under the belief that this is permissible constitutes evidence against the assumption of such a practice.

Thus, while according to the views of a large majority of states both custom and convention prohibit the use of herbicides in war, a view denying these prohibitions cannot be strictly disproved. The matter is further complicated by the existence of other rules of the law of war concerning, not the nature of the weapon, but the nature of the target against which it is used. Whether jungle or plantations, the destruction of vegetation which hampers military operations is permitted under the law of war (disregarding, of course, any specific prohibition relating to the means used for this purpose). The destruction of crops which serve as war munitions and of economic crops which are being exported is also permitted, and, as pointed out in Volume III, their destruction in the growing stage is presumably permitted under the same conditions. Food crops and industrial crops may not, however, be destroyed for the purpose of starving or otherwise harming the enemy population. As an exception to this it is permissible to destroy food crops intended solely for consumption by the enemy armed forces. Finally, there is the wholly exceptional case when a retreating army, under the pressure of military necessity, may employ a "scorched earth" policy.

As regards the US use of herbicides in Viet-Nam one would therefore reach the following conclusion: the crop-destruction programme may or may not be illegal from the point of view of the means employed (in the opinion of a majority of states it *is* illegal), but it is certainly inadmissible under the laws of war in so far as it affects noncombatants. The extent to which this has been the case is considered in Volume I, Chapter 2, and in Volume II. The jungle defoliation programme may or may not be illegal because of the means employed (again, the majority view is that it *is* illegal), but had it been conducted with means other than CB weapons (by fire or mechanical means) no legal objections could have been raised. This assumes, of course, that the current programme is not significantly harmful in other ways (eco-

logical or physiological). If it is harmful, as increasingly compelling evidence suggests,[21] then one might also begin to argue that this programme falls under the prohibition of weapons of a nature to cause superfluous injury, that is, injury out of proportion with its military utility.[22]

Returning to our initial problem, we can now locate one possible point of erosion of the constraints on CBW, one which is suggested, albeit on a relatively modest scale, by events in Viet-Nam. The question is this: assuming that the use of chemical herbicides for operations such as jungle clearing to increase visibility became a generally accepted means of warfare, what are then the prospects of holding the line as regards large-scale anti-plant-agent attacks on industrial crops or on the food supplies of the civilian population?

As regards the passage from the destruction of jungle vegetation to the destruction of food crops it is immediately clear that there are no material or organizational constraints at all. Identical equipment, techniques, training and logistics, chemical agents, and so forth are involved in both cases. The only material difference is that the destruction of cultivated crops generally requires lesser dosages than does the effective defoliation of wild vegetation. Depending on circumstances, the remaining psychological and moral constraints may have considerable force or they may not. The same applies to the constraint arising from the risk of retaliation in kind since in many cases it would not exist. Other constraints, of course, are present as well: international sanctions, whether moral or material, and, evidently, the adverse effect on the allegiance of affected civilians. This latter consideration alone would presumably rule out the possibility of full-scale crop destruction in so-called counter-insurgency warfare, but in situations of intense and protracted conflict between states, particularly where the belligerents are not equally vulnerable, civilian reactions may not be such an important consideration. Thinking of several of the theatres of World War II, it is difficult to claim that large-scale food destruction by herbicides would have been inconceivable, had the means been available. Indeed, as the war in the Pacific was ending, a shipload of anti-plant agents for use against Japanese rice crops was on its way from the USA to forward US bases.

Thus it is clear that material constraints against environmental warfare may have been completely eroded in the course of the Viet-Nam War. Nevertheless, it should not be concluded that the use of herbicides in Viet-Nam has been altogether detrimental from the point of view of constraints against future use, for a strong case can be made that other constraints, those constituted by public opinion and, possibly, the law as well, may in the long

[21] See Volumes I and II.
[22] See Volume III.

term have been strengthened, rather than weakened. With the war in Viet-Nam, public opinion, to put it crudely, may well have received an overdose of herbicides, so that what happened after World War I could happen again: the public outcry against these first manifestations of a new means of warfare might be so strong that new safeguards, legal or otherwise, may come into being and that in future situations where anti-plant-agent warfare might be considered, the political costs will seem prohibitive in comparison with military gains.

The military use of herbicides in Viet-Nam began around 1962 and attracted little attention and less outcry. Herbicides were used at first on a small scale which to the uninformed may have appeared similar to civilian uses. They were used to clear vegetation around bases and along lines of communication. There probably have been similar cases in previous wars.[23] In Viet-Nam much clearing of this kind was done by mechanical means, a practice which, of course, is unobjectionable from the point of view of the law of war. In any case, it is natural that public opinion should take little exception to certain uses of herbicides which may have been thought of less as methods of warfare than as aids in building roads and bases. Moreover, the first uses—at least in so far as the public was informed—were of a defensive kind, and, even though from a legal point of view that is immaterial, from a moral point of view it may have made these operations seem less reprehensible.

A number of factors acted in concert to create the widespread condemnation which ensued. First, of course, was the vast expansion of the programme to a level where several million gallons of herbicides were being spread over the country each year; second was the fact that after 1965 the public began to conceive of herbicides as used in Viet-Nam as a weapon in the full sense, a means of warfare—a perspective which previously had been confined in the main to military commentators.[24] This change in perspective was prompted by greater emphasis on uses such as defoliation of enemy "infiltration routes" and enemy-occupied zones to facilitate offensive action, and, most important perhaps, the food-destruction programme. It was becoming clear that these were not mere extrapolations of civilian uses, but that a new dimension had been added to warfare with its specific attendant risks of damaging the economy of the country, of upsetting ecological

[23] See Volume I, Chapter 2, note 27.

[24] Thus in 1963, Lieutenant-Colonel Fair of the US Army wrote: "A new weapon has been added to the fight against guerillas. This weapon removes the leaves from the vegetation that the VC use to hide their presence. The resulting improvement in visibility should permit the more effective application of the superior combat power of the [Viet-Namese Army]." (S.D. Fair, "No Place to Hide", *Army*, September 1963.)

balances and of starving enemy troops, enemy sympathizers or just civilians in general.

The protest movement against the war was developing at the same time and, inevitably, the two issues of the war in general and herbicide use in particular became intermingled. In the United Nations this growing opposition gave rise to the Hungarian draft resolution of 1966, but already then the conviction had developed that this was a means of warfare proscribed under the Geneva Protocol. Hostility towards herbicide warfare was further fuelled by the growing concern about environmental problems in general. Very recently, and probably in response to these two factors, the US Government has ordered the phase-out of herbicide agents in Viet-Nam.

Thus, prior to 1960 and in the early 1960s, a case could have been made that herbicide use in war did not impinge much on the public conscience and when it did was not condemned as a flagrant violation of international law. But today that is no longer so. The condemnation of the large-scale use that has occurred has been so strong and its identification as CW so widespread that it is difficult to imagine that large-scale herbicide warfare and CBW prohibitions could co-exist in the long run. If after the war in Viet-Nam is over one of them has to go, it could well be the former, not the latter. On the other hand, a trend towards lower inhibitions and the proliferation of use may be seen in recent reports of the use of anti-crop chemicals by Portugese forces in Angola; in this case at least, the military incentives still seem to be stronger than the non-military constraints.

The other possibility to discuss is the risk that anti-plant agents might constitute a possible avenue for diminishing the unacceptability of certain forms of biological warfare. When the target in anti-plant operations is a single plant species, biological agents have considerable advantages over chemical herbicides. Contagious plant diseases, specific to one species, would be much cheaper and much easier to use. In contrast to chemical crop-destruction agents, they can be disseminated without complete control of the airspace and, possibly, they may even be disseminated covertly. Such agents have been developed for BW purposes.[25]

In a situation, therefore, where a government chose to destroy, say, war munitions crops or export crops (it should be recalled that this is neither more nor less illegal than is jungle defoliation) there might be strong military pressures, and perhaps civilian pressures as well, for using biological agents instead of chemical weapons to economize on procurement, aircraft and pilots. It is not difficult to see how the case might be argued. Biological agents would destroy only the target plant, and one of the arguments in

[25] Notably the agents causing rice blast and stem rust of wheat.

favour of CS usage in Viet-Nam could be used almost word for word: Would it not be more "humanitarian" to use biological agents instead of chemical agents in cases where the target crop is mingled with food crops intended for civilian consumption? Would it not be unreasonable to contend that in those cases the law prohibited the use of biological weapons which only destroy the target crop, but not the use of chemical weapons which, inevitably, and however carefully applied, would destroy some of the food crops as well?

Again, in this case the main danger arises in inter-state wars, not in counter-insurgency warfare where the resulting antagonism of noncombatants would in most cases be unacceptable. It may be noted that many poorer nations are so heavily dependent on one or a few crops that they would be exceedingly vulnerable to this kind of warfare.

Unverified allegations of CBW

Past allegations of the use of CB weapons in war are described in Volume I of this study. They consist of a few unambiguous and relatively well-documented cases and of a large number of allegations where evidence about the truth of the alleged events is either non-existent or inconclusive and where the occurrence, if there was one, was of relatively minor military importance. In a few cases investigations took place, but on an *ad hoc* basis, and sometimes under auspices of debated impartiality. It is therefore reasonable to consider the value of having a permanent and internationally accepted body or machinery with the purpose of investigating allegations which may be made in the future. In this section we consider the effect such investigation machinery might be excepted to have on the occurrence of allegations of CBW and on the implications of such allegations for the strength of the various constraints against further CBW. Some of the problems involved in setting up a formal machinery for verifying allegations are discussed in Appendix 4, which also includes case studies of the alleged BW incidents in China and North Korea in 1952, and the alleged CW incidents in the Yemen during 1963–67.

The existence of an investigation machinery may help to constrain or stop a potential or actual transgressor, by adding the risk that he will suffer political damage through exposure or through having to refuse admission to an investigating body. It would be one more element to be weighed in the political balance when decisions were taken about starting use, increasing it, reducing it or stopping it. This is particularly so in remote or largely unreported conflicts where the belligerents may otherwise hope that the use of CB weapons would go unreported or that it

would be so little reported that they could deny its use sufficiently effectively to avoid excessive damage to their reputations. In a more open conflict the belligerents may acknowledge the use of CB weapons but claim, falsely, that the use of some of these weapons, or their use in some instances, is not illegal. In this case as well, the existence of an investigation machinery should have a constraining effect on potential use.

In highly asymmetric conflicts where a modern army confronts guerillas or local armies in some relatively small and little-developed country—i.e., in cases of "downhill" use—the technically more advanced belligerent might in some cases dominate the effective transmission of information to the outside world. In such cases—and they are precisely the cases where, generally speaking, CBW appears to offer the greatest attractions—an internationally recognized investigation machinery might prove important, partly because of its ability to establish the facts but also because of its ability to disseminate its findings to a wide audience. On the other hand, if the position of the advanced power in the area is so strong that it dominates the supply of news to the outside world, it may also be in a position to bar entry of an investigating team, claiming that there is no *prima facie* case for investigation; but this may of course produce suspicion.

Since public opinion is sensitive about CBW and hostile to it, allegations that a country has used CB weapons can have a substantial propaganda value. For the same reason, false CBW allegations are likely to have a detrimental effect on the international climate and to produce vehement recrimination. The awareness that CBW allegations would normally be investigated and that the results would be given wide publicity might discourage parties in conflict from making false CBW allegations. It is also possible that false allegations may be the result of genuine mistakes, aided by the ease with which hostile myths and rumours gain currency in time of war. These may also be highly damaging if they remain uninvestigated.

If the existence of an investigation machinery reduced the incidence of CBW, this would of course contribute to maintaining any constraints there might be from material unpreparedness. In fact, this effect may be more important than is immediately apparent, for one cannot exclude the possibility that some of the many minor cases of CBW allegations have been well founded and were in fact cases of field-testing of the weapons. Many cases of alleged use have been on such a small scale that it is difficult to see that they could have served any other purpose unless, as is entirely possible, the allegations were all fabrications or mistakes.

Nor would it seem unreasonable for a state wishing to test a new weapon in the field to conduct a small experiment in some remote and unreported conflict area.

The impact of allegations of CBW and of their formal investigation on the strength of legal, moral and political constraints depends on a number of factors: the extent to which the allegation would be believed in the absence of investigation, whether the allegation is confirmed by the investigation, the strength and universality of international condemnations, the reactions of the accused party, and so forth.

When an allegation is shown upon investigation to have been untrue, the result will be to damage the reputation of the accusor and the effect will probably be to strengthen the belief in the law and in the force of the moral and other constraints. When an apparently dubious and disbelieved CBW allegation which is denied by the alleged perpetrators is found, upon investigation, to be true, this finding might be expected to increase the political constraints on future use by the same or other belligerents. But this is done at a cost, because at the same time the law has been shown to be weaker and more vulnerable than originally thought. How much or how little depends, among other factors, on the strength of international condemnations and on the reactions of the accused government. Finally, in the case of an allegation which receives general credence and which is confirmed by subsequent investigation, the investigation itself might appear to have been of relatively minor importance. All will depend on the political context and on the effect the investigation has on the publicity given to the case. As a rule, the investigation should help to create a strong international reaction of indignation and condemnation. On the other hand, one cannot exclude the possibility that, in some cases at least, the fact that there is an on-going investigation may serve as a pretext to governments to avoid taking a position on the issue.

The use of CB weapons may in some cases tend to increase the acceptability of CBW in future, particularly when the use has been militarily successful or appears to have been less abhorrent in its immediate effects than had been anticipated; on the other hand, the use may call forth so strong condemnatory reactions that the legal, moral and political constraints against future use are thereby strengthened.

These two opposing factors are also present as contradictory tendencies in the development of customary law. The customary law prohibition of CBW arises from a long practice of non-use and a universal or quasi-universal belief by states that such practice amounts to an obligation. Allegations of CBW, if true, (or if believed), will be seen as exceptions

to the practice and—particularly if they are numerous and only cause weak reactions—as such weaken not only the belief in the strength of the law but, in the case of customary law, the strength of the law itself. Yet at the same time allegations that the law has been violated constitute an opportunity for all states—the originator of the allegations, the accused state and third parties—to reaffirm their belief in the existence and imperative character of the law. If the accused party chooses to admit the fact and to deny its illegality the first effect is to weaken the law (at least in so far as it derives from a custom), to create some confusion about its scope, and, possibly, to confirm and strengthen the belief in a narrower version of the prohibition.

Summing up, it seems clear that a machinery for verifying allegations of use would help to reduce the frequencey of use of CB weapons and of propagandistic allegations of CBW. In addition to its obvious intrinsic benefits, this would also strengthen the material and, at least in certain respects, the moral and political constraints. On the other hand, the occurrence of allegations of CBW does not only have detrimental effects. They call forth reactions which serve as a demonstration of the strength of the law and of its firm foundations in the public conscience and as a measure of the likely political costs to other would-be violators.

III. *Possible measures to strengthen the prohibition of use*

The general theme in the preceding discussion has been that the law of war prohibiting the use of CB weapons cannot stand alone but needs the support of other constraints if it is to be effective. These constraints, however, do not have the same force throughout the range of possible CBW agents and throughout the range of uses to which CB weapons may be put. As regards the use of nerve gases—and in so far as the present situation is concerned—the constraints appear to be much more forceful than the incentives; as regards the use of irritant agents by police forces, the opposite is the case. The question therefore arises as to how a prohibition might best be devised to exploit maximally the existing non-legal constraints and how some of the constraints might be further increased by other measures.

Put in such broad terms, the problem, evidently, would largely be an academic one. Prohibitions are now in force which proscribe certain uses of CB weapons; other uses are so common and so deeply ingrained in the routines of police corps and riot squads that a policy reversal would probably be impossible, even if it were deemed desirable. It is only on those relatively few points where the law is ambiguous (the use of her-

bicides in war and certain intermediate cases between use in "war" and use in domestic police operations) or where it is strongly contested by significant powers (use of irritant agents in war) that the question of the relative desirability and effectiveness of prohibitions of different scopes is at all a matter of practical importance.

In deciding whether, in particular cases, it is preferable to opt for a broader or a narrower interpretation, there are two main considerations to take into account. In the case of anti-plant agents it is largely the intrinsic desirability of prohibiting them which counts, because they include agents of a potentially extremely destructive kind. With the irritant agents it is mainly considerations about the effectiveness of the CBW prohibition as a whole which leads one to the conclusion that the prohibition of these agents must be preserved. It cannot generally be taken for granted that the wider the scope of the prohibition, the more effective it will be. In fact, one is faced with the following dilemma: If, on the one hand, the law is given a scope which is less comprehensive than the set of weapons and situations to which the existing material and psychological constraints relate, these constraints might be eroded through the practice of those forms of CBW which, in this hypothesis, would be permitted. If, for example, the use of tear gas in war were declared legitimate, the moral revulsion against "gas warfare" as a single, clear-cut category would become undermined, and instead more complex concepts would have to be relied upon as substitute constraints to prevent, say, nerve gases from coming into use. The opposite side of the dilemma is that, if the law is given a scope which exceeds the range of weapons and situations to which existing non-legal constraints refer, the law is more likely to be violated and so brought into disrepute. An attempt to make the prohibition so comprehensive as to encompass police use as well as wartime use of CB weapons would have involved a risk of this kind.

As we have seen, the general constraints which now contribute to reducing the threat of CBW in general might become considerably weakened by the use in war of irritant and anti-plant agents. Therefore, there is an urgent need to reverse any trend towards greater acceptance of the use of these agents in warfare. This would require swift action towards discontinuing their use in Viet-Nam and towards universal agreement on that interpretation of the Geneva Protocol and of the customary law prohibition of CBW which is normally accepted, namely, that these prohibitions apply to all chemical and biological agents used in war against man, animals or plants because of their toxic effects or infectivity, however temporary and mild.

Various ways have been suggested to attain a universal agreement on the interpretation of the law.

A UN General Assembly resolution. This approach was adopted in 1969 when the UN General Assembly passed resolution 2603 A. In it the General Assembly declared that the Protocol—and also the customary rule—prohibited the use in "international armed conflicts" of any chemical substances "which might be employed because of their toxic effects on man, animals or plants". Eighty states, a large majority of UN members, voted for this resolution, and only the United States, Australia and Portugal voted against it. Nevertheless the importance of the resolution as an interpretive statement was diminished by the fact that thirty-six states abstained from voting. The abstaining states consisted of all NATO members which had not voted against the resolution, a number of Latin American countries and most Asian allies of the United States, plus a few other countries the most important of which were Israel and South Africa. Most of the abstaining states took no position on the substance of the issue but based their stand on procedural difficulties, in particular as regards the competence of the UN General Assembly to interpret international documents through resolutions. (This is more fully discussed in Volume III.) This resolution, which was of great importance in a number of respects, succeeded in demonstrating the strength of support for an extensive interpretation of the law, but it could not achieve a uniform interpretation, and there is little hope that new resolutions could do so because, whatever their position on the substance of the matter, some states will undoubtedly continue to deny the validity of the method.

A new or supplementary protocol. It has occasionally been suggested that the Geneva Protocol is awkwardly worded and technically obsolete and that it might be preferable to draw up an entirely new instrument, similar to it but more explicit as to what is prohibited. Alternatively it has been suggested to draw up a protocol to the Geneva Protocol which would clear up the alleged ambiguities as regards irritant agents and herbicides and to which, it might be hoped, all parties to the Geneva Protocol would also accede. Such an approach would not be helpful, for from a legal point of view—and also from the point of view of the public's understanding of the issues—this could only mean that the binding character of the Protocol is in doubt and that states now parties to it are not necessarily bound in respect of irritant agents and herbicides. Instead of strengthening the law, the effect might be to raise doubts about its scope (as understood by the majority of states). In practice, such proposals are unlikely to gain much support because the large majority of states firmly oppose any restrictive interpretation of the Protocol or any contention

that it could be so interpreted, and only three states have expressed an opinion in favour of a restrictive interpretation.[26]

Advisory opinion of the International Court of Justice. If so requested by a two-thirds majority of the UN General Assembly, by the Security Council or by any one of the specialized agencies, the International Court of Justice may submit an opinion as to the correct interpretation of treaties such as the Geneva Protocol. In view of the strength of legal arguments favouring an extensive interpretation, there is little doubt that if the International Court were to pronounce in favour of one position it would be the extensive one. As far as irritant agents are concerned this is virtually certain. The requesting body is not bound to accept the advice of the Court, and, in view of the attitude prevailing among a majority of UN member states, it is very unlikely that a pronouncement favouring a restrictive interpretation would be accepted by the General Assembly. At any rate, such a pronouncement would be exceedingly unlikely. Nevertheless it is not at all certain that a request for an advisory opinion could receive the necessary two-thirds majority vote by the General Assembly for such a request might also carry the implication that the General Assembly considers the scope of the prohibition to be uncertain.

Because the United States is a dominant military power in the world, the key to further progress in making the prohibition of all chemical warfare universal ultimately lies in US willingness to forego further use in war of irritant agents and herbicides and to revise its present interpretation of the law. The position of Britain, the only other power of some significance which has adopted a restrictive interpretation (and this after a long period when it upheld the usual extensive interpretation of the Protocol), is important too. Other countries can do little by way of formal international measures to make them change their position. One can only impress upon these two governments the paramount importance of their positions regarding these relatively peripheral forms of CW for the long-term viability of the ban on CBW as a whole, the rather limited short-term military benefits they might derive from the wartime use of irritant agents and/or herbicides, and the strength of public opinion and legal evidence on the matter.

Another way to confirm and strengthen the law would be to dispose of those clauses in the reservations which most of the major powers made upon ratification of, or accession to, the Protocol, which limit the scope of the prohibition contained in the Protocol to a simple no-first-use de-

[26] The USA, UK and Australia. Portugal is not known to have made any explicit statements. Canadian statements have been ambiguous.

claration. According to the general rules governing such treaties all parties to the Protocol, whether or not they have made a reservation to this effect, are entitled to exercise the right of reprisals in kind in the event of being attacked with CB weapons. Reprisals, however, must not be out of proportion to the initial offence, and during and after the conduct of reprisals the treaty retains its full force. With this exception the Protocol is a true prohibition of use. According to the reservations, however, the Protocol shall *cease to be binding* on the reserving state if it is violated by an enemy state. For those states which have made such a reservation it must therefore be assumed that once the Protocol has been violated the aggrieved party is relieved of all obligations under the Protocol for the entire duration of hostilities. In this way the Protocol is reduced to a no-first-use declaration, which is a much weaker form of prohibition since under it any form of CBW would be permitted in a conflict once CBW was initiated.

This reservation must today be considered as obsolete and void since the customary rule, which this reservation cannot abrogate, remains in force throughout the conflict and prohibits any use of CB weapons, except in the case of reprisals in kind which are proportionate to the initial violation.[27] There is, therefore, a case for individual reserving states to renounce these clauses formally. This would confirm the strength and binding character of the customary prohibition and lift any doubts there might otherwise have been that the prohibitions do not only cover first use. Even if CB weapons were to be used by one side in a future war, the prohibition of the Protocol would still retain its full binding character, and general retaliation with CB weapons would remain prohibited. The importance of a renunciation of these reservation clauses lies in the fact that the customary prohibition might conceivably be more readily eroded in the future than may the conventional prohibition. Also it might be easier for a state acting in bad faith to dispute the meaning of the customary rule than that of the conventional one. These, indeed, are the usual reasons for seeking to codify customs in the form of treaties.

It may be noted that as regards the BW prohibition a custom appears to be developing by which even the right of reprisals in kind would be denied to states which are subjected to BW attack. Reprisals with chemical weapons would, however, remain legitimate. This emergent custom, which is still in its early formatives stages, is evidenced by the growing belief that BW in any form and under any circumstances is absolutely prohibited. It has found expression in the unilateral declarations of some states to

[27] See Volume III.

the effect that they consider the BW prohibition in the Protocol to be absolute;[28] other states have unilaterally renounced present and future possession of biological weapons. It may be noted that these two measures logically imply one another, for whereas today the possession of chemical weapons for warfare can only legitimately serve a function of deterrence against CBW attack, the possession of biological weapons cannot legitimately be justified on any grounds if their use for reprisals in kind is not permitted. At this point, therefore, prohibitions of use merge with disarmament obligations, as unilateral renunciations of use merge with unilateral renunciations of possession. If the growth of this customary prohibition of *any* use of BW continues, disarmament will be greatly facilitated. This is vividly shown by the unilateral US renunciation of BW in November 1969, and the US decision to destroy its biological weapons stockpiles. This may have meant the destruction of the only existing stockpiles of biological weapons.[29]

Over the years there has been a slow but recently accelerating increase in the number of states which have ratified or acceded to the Geneva Protocol. This increasing universality of the conventional prohibition has been an important factor in creating and consolidating the customary rule prohibiting CBW and it is a major reason why the customary rule must probably be assumed to have as wide a scope (in terms of agents) as the conventional prohibition.[30] The customary prohibition is now firmly established and because of this the use of chemical and biological methods of warfare is outlawed, even to those states which are not parties to the Protocol. But it would be false to conclude from this that the Protocol is on the way to becoming redundant, for when customs and conventions having the same object are considered in a wider historical perspective it becomes clear that they supplement and reinforce one another, that they develop together but in such a way that now one, now the other, takes the lead, and that in this process neither can be readily dispensed with. One major form which the development of the conventional rule, the Geneva Protocol, has taken is this trend towards universality, and it is important that this trend should continue. This is all the more so since, as we noted, rules codified in treaties such as the Geneva Protocol may be, in the long term, more resistant towards a gradual erosion of their provisions than are customary rules.

[28] Views to this effect were already being expressed in the League discussions in the 1920s and 1930s. See Volume IV.
[29] See Volume II.
[30] This identity of scope was implicitly affirmed in the 1969 UN resolution already referred to. For a further discussion see Volume III.

The United States is now the only major power which has not ratified the Geneva Protocol. Virtually all the states of Europe are parties to it. Among the countries of Asia, Africa and Latin America, less than half of the states are explicitly parties to the Protocol, and several of the most important states in Asia and Africa are not parties. Only one of the smaller Central American republics has acceded to the Protocol.

In the case of most African and a number of Asian countries which are not *formally* parties to the Protocol, there is some doubt whether they are nevertheless bound by its provisions. The question is whether former colonies or protectorates which, upon gaining independence, have made a general declaration of substitution to the rights and obligations of the former colonial power are *ipso facto* parties to the Protocol. Practice is not firmly established in this field, so automatic continuance cannot be affirmed as a general rule. Nevertheless, some of the former colonies and protectorates have apparently acted on the assumption of automatic continuance. To affirm their position in regard to the Protocol it should not be necessary for states which have made a general declaration of continuance to accede formally to the Protocol, but their position would be clarified if they were to notify the French Government, depositary of the instruments of ratification and accession, that they consider themselves bound by the Protocol.

The procedures for ratification of the Protocol by the United States are now in motion: the decision to seek ratification was announced in November 1969. The Protocol was forwarded to the US Senate for advice and consent to ratification in August 1970. Senate hearings took place in the spring of 1971.

This means that, following the Japanese ratification in May 1970, the Protocol may soon become universal as far as the major military powers are concerned. In terms of direct constraints on the future use of CB weapons in war it is, of course, this which matters most, since none of the lesser powers which are not parties to the Protocol are likely to have anything approaching a militarily significant CBW capability for a number of years. In so far as the immediate future is concerned, the importance of further ratifications and accessions will, therefore, lie primarily in the consolidation of the law as a rule of universal application regardless of possible contrary wishes of individual states, and in the constraining effect ratification may have on the future acquisition by these states of a CBW capability.

Despite the fact that it would constitute a considerable step towards universal acceptance of the Geneva Protocol, the proposed ratification by the United States also raises certain problems because of the narrow

interpretation which the US administration hitherto has attempted to give to that document. It will be useful to consider this in some detail.

President Nixon, on forwarding the Protocol to the Senate, recommended that US ratification should be accompanied by a reservation: "That the said protocol shall cease to be binding on the Government of the United States with respect to the use in war of asphyxiating, poisonous or other gases, and of all analogous liquids, materials or devices, in regard to an enemy state if such state or any of its allies fails to respect the prohibitions laid down in the protocol." This reservation contains two main provisions. The first stipulates that in case of CB warfare all allies of the enemy will be held to be co-responsible and further, that the USA will be free to conduct reprisals on behalf of its allies. (This is a reservation which most of the major powers have made upon ratification. The mechanism and its implications are elaborated upon in Volume III of this study.) The second provision stipulates that, as regards chemical warfare, the United States will consider itself relieved of all obligations under the CW prohibition of the Protocol for the entire duration of hostilities in case of enemy initiation of CBW. (Many other countries have made this reservation too, but with respect to both CW and BW.) As noted earlier (page 65), this provision is either devoid of practical consequences because of the existence of the customary rule, or else it is an indirect expression of an interpretation of the customary rule as a mere no-first-use obligation, an interpretation which is legally unjustifiable today (but which was not unjustifiable when the other major powers submitted their reservations).

Another important point is the question of the interpretation which the United States may put on the definition of those chemical weapons the use of which is prohibited under the Protocol. On this matter a procedure other than that of a formal reservation is being considered in the USA. When the President forwarded the Protocol to the Senate, he included a State Department report which said that in the "understanding" of the United States "the Protocol ... does not prohibit the use in war of riot-control agents and chemical herbicides".[31] Such an interpretation by a leading military power would constitute a step towards eroding the conventional rule embodied in the Protocol and might induce other countries to follow this example and interpret that document in a restrictive sense, thus perpetuating and aggravating the present disagreement over

[31] For the full texts of all these documents, see the *New York Times* of 20 August 1970. Indirectly, the President endorses this interpretation by affirming in his letter of transmittal that the United States has always observed the principles and objectives of the Protocol: in other words the current US use in Viet-Nam is not thought to be in violation of the Protocol.

the legal status of irritant and anti-plant agents in warfare. If this interpretation passes unscathed through the Senate—which is by no means certain—the question therefore arises whether other states, individually or collectively, can impose their broader interpretation on the United States or make the United States postpone ratification of the Protocol unless it endorses the normal interpretation of that treaty.

The case that in the long term the strength of the law might gain from a postponement of the ratification of the United States has been made in the following terms.[32]

1. The Geneva Protocol, despite the contrary views of the UK and Australia, prohibits the use in war of all agents used because of their direct toxic effects on man, and there is a strong case for maintaining that it also prohibits the use of anti-plant agents in war. Indeed, the contrary view is not supported by any positive evidence and has not been put forward by any state party to the Protocol. An important reason why the law is fairly clear on these points is precisely that the United States is not a party to it and, according to the rules governing the interpretation of treaties, the views and actions of the United States are therefore not relevant for the legal interpretation of that document. US ratification under the conditions now contemplated would thus increase the ambiguity of the Protocol, if, indeed, it did not create ambiguity where previously there was none.

2. A US ratification under these conditions would not create any new material limitations on the actions of the United States for two reasons. First, the United States has explicitly acknowledged the existence and binding character of a customary rule analogous to its own restrictive interpretation of the Geneva Protocol. Second, the effect of the formal reservations with which the US administration proposes to accompany its ratification is to make the prohibition of BW absolute in so far as the United States is concerned and to subscribe only to a CW prohibition of first use (and only as regards lethal and incapacitating agents). But the Presidential decisions in the autumn of 1969 and the spring of 1970 to renounce completely the use, possession and production of biological weapons and toxins, and to extend the US renunciation of the first use of lethal chemical weapons to incapacitating weapons as well, achieved precisely the same thing—albeit not in an internationally binding form. As a result, ratification of the Protocol on the terms envisaged by the administration would change the CBW "policies" of the USA into formal

[32] See, for example, the *Proceedings of the Conference on Chemical and Biological Warfare*, sponsored by the American Academy of Arts and Sciences and the Salk Institute, 25 July 1969 (Boston, 1969).

obligations—and this is, of course, in itself important—but would not change the substance of the commitments already undertaken by the US Government.

3. It does not appear to be altogether inconceivable that if US ratification were deferred until the war in Viet-Nam is over or until the use of chemical weapons in that war has ceased, it might then be possible to obtain ratification of the Protocol without any restriction on "riot-control" agents or herbicides. One indication that the United States might subsequently become willing to change its policy on irritant agents and herbicides is provided by the fact that the US Department of Defense has been instructed not to use tear gas or defoliants without Presidential permission after the Viet-Nam War ends. Another is that the administration has decided to phase out the Viet-Nam defoliation programme.

So, present US ratification of the Protocol on the terms envisaged would increase considerably the ambiguities of the prohibition and only reinforce, not extend, the limitations on the weapons which the United States can use in war. In particular, the present moment seems not to be very suitable for achieving a US ratification of the Protocol which covers irritant agents and herbicides.

Against these considerations one must weigh the fact, already mentioned, that a ratification of the Geneva Protocol would give the present US commitments on CB weapons the form of an internationally binding multilateral treaty obligation. There are also three other factors which tell in favour of immediate US ratification, even if this is to be on the terms proposed by the present administration:

1. There is the risk that if ratification is deferred it may never take place, which, of course, would seriously reduce the importance of the Protocol in the long run. The likelihood of this is impossible to ascertain. Nor—if that is the choice one is facing—is it at all easy to judge whether in the long run it would be preferable to have the Protocol truncated in respect of irritant agents and herbicides, but to have it ratified by all states.

2. A US ratification of the Protocol may create a more favourable environment for further international measures in the field of CB disarmament, particularly with regard to US-Soviet relations. This view may seem to be confirmed by the fact that both before and during the current Viet-Nam War there has been a tendency for the CB disarmament debate to centre around the question of the US failure to ratify the Protocol. Yet there is reason to believe that this has to some extent been a proxy issue, although a convenient one to exploit for propaganda purposes. After all, no better proof of the seriousness of US intentions in the field of

CB disarmament could be given than its unilateral renunciation of possession of biological weapons and toxins. The basic cause of the vulnerability of the US position in current international debates on CBW probably has more to do with its use of irritant agents and herbicides in Viet-Nam than with its failure to ratify the Protocol. If so, ratification of the Protocol on the understanding that these forms of warfare may continue in Viet-Nam may not improve the atmosphere, but simply shift the target of the attacks. In any case, the factors here are so difficult to judge that it is impossible to form a firm opinion.

3. A US ratification of the Protocol may prompt other states, Latin American countries in particular, to follow suit. We have already stressed the importance of further accessions to the Protocol.

If the United States ratifies the Protocol without revising its "understanding" of the scope of the prohibition, the possibility remains open for those states which consider the interpretation given by the USA to be incorrect to bring a case against the United States before the International Court of Justice. This would fall under the provisions for rulings on contentious cases which means that the case can be brought before the Court by any party to the Geneva Protocol which is also a party to the optional clause on compulsory jurisdiction of the Court Statutes. Being itself a party to that clause the United States would find it difficult to refuse to appear in a suit brought by such a party.

When a state upon ratification of the Protocol files a formal reservation, this means that it explicitly modifies the terms of that treaty in so far as its own obligations are concerned. Other parties to the Protocol are then free to accept or to reject treaty relations on so limited a basis. By dealing with the question of irritant agents and herbicides, not in the form of a reservation to the Protocol, but in the form of an "understanding" expressed in a letter from the President to the Senate, the US administration has avoided what would have been an obvious implication of a proposal to the Senate to ratify the Protocol with a formal reservation about irritant agents and herbicides, namely, the recognition that it is giving an interpretation to the text of the Geneva Protocol which differs from the normal one. This makes it more difficult for other states to refuse treaty relations with the United States if they feel so inclined, but it makes the US position vulnerable in another way: unless there is a formal reservation, the Protocol cannot have a prohibitory scope for the United States which differs from that which it has for other states. This means that if the United States ratifies the Protocol without a reservation (in respect of irritant agents and herbicides) but simply with the "understanding" currently envisaged by the administration, and if it continues

to use irritant agents and herbicides in war after ratification, then it is not protected from legal prosecution on the charge of violating the Protocol. A Presidential statement that such and such weapons are not prohibited under the Protocol does not render their use by the United States legal.

This is not to say that such a Presidential statement is without legal bearing, only that its bearing is very limited. It may make it more credible that the United States has been acting in good faith when using these weapons in war. It may perhaps exonerate individual commanders of penal responsibility for their acts on the grounds that the illegal character of such use may not have been absolutely flagrant. It may induce other countries to follow suit and interpret the Protocol in a similar way and this in turn may affect the scope of the treaty. But apart from this, such a Presidential statement is only one piece of evidence—and not the most weighty—among all those which must be taken into account in determining what is the authentic interpretation of the Protocol (or whether there is any interpretation which can be called authentic) and in judging whether such use as may occur in the future is legal or whether it constitutes a violation of the laws of war.

Hence the legal protection which such a Presidential understanding provides for the United States and its citizens in case herbicide and irritant-agent warfare continue after ratification is very limited. On the other hand, if it is allowed to remain unchallenged by the other parties to the Protocol the US "understanding" may contribute towards eroding the scope of the Protocol. This would be more likely if those states which did not take a stand on the 1969 twenty-one power resolution of the United Nations General Assembly, and whose views about the scope of the Protocol's prohibition are not otherwise known, were to refrain from protesting against the narrowness of the US interpretation of it. Their inaction might conceivably in the future be construed as acquiescence—not, of course, as acquiescence in a restrictive interpretation, but acquiescence in the view that the Protocol admits of several different interpretations.[33]

[33] The US Senate Committee on Foreign Relations held hearings on the Geneva Protocol in the spring of 1971. As a result of testimony received, many in the Committee, while strongly supporting the objectives of the Protocol, were reluctant to proceed further toward its ratification, fearing that the administration's restrictive interpretation of the Protocol in respect of tear gas and herbicides would undermine its effectiveness. In a letter to the President dated 15 April 1971, the chairman Senator J. W. Fulbright expressed the view of "many Members" that "it would be in the interest of the United States to ratify the Protocol without restrictive understandings, or, if that is not possible at this time, to postpone further action on the Protocol until it is". As a preliminary to further consideration the Committee there-

The present situation as regards the CBW prohibitions is one of considerable flux. Three sets of events in recent years (all of them closely inter-related) stand out as particularly important: first there is the war in Viet-Nam and the practice there on a large scale of two of the milder forms of chemical warfare; second, the present US administration has taken several important decisions—foremost among which is the unilateral renunciation of biological weapons—which aim to reduce the future threat from some of the most destructive and pernicious agents within the spectrum of CBW agents; third, there is in international circles (particularly in the UN General Assembly and in the Conference of the Committee on Disarmament) a remarkable upsurge of concern with the CBW threat and of efforts to deal with it.

What we have seen in this chapter is that the first of these events, the Viet-Nam War, if it establishes a pattern for the future may well undo what the other efforts seek to achieve. It may do so by gradually eroding the material, moral and other constraints from which the law, ultimately, gains its strength. On the other hand there is also the opposite and more hopeful possibility, which this incipient erosion itself has stimulated, that the current reaction of the public and of governments against CBW will stop the erosion and even reinforce the constraints on CBW, as happened after World War I.

fore requested that the administration reconsider its position as regards tear gas and herbicides. (See the *Congressional Record-Senate*, 8 June 1971, p. S 8486.)

Chapter 2. The case for CB disarmament

In the previous chapter we described some of the points of weakness in the legal prohibition of CBW and in the various other constraints and inhibitions against using CB weapons. We speculated on the possible consequences of these, and discussed a number of formal measures that might be taken to strengthen them. This discussion was limited to courses of action within the framework of the existing international laws of war. In this chapter we move on towards more radical possibilities, namely those of disarmament. Even though it is illegal to use CB weapons in war, and even though political and other factors may weigh heavily against resort to at least the more fearsome of them, the possibility nonetheless remains that the weapons will be used simply because they are there.

While this alone constitutes a powerful case for pressing for CB disarmament, there are still stronger pressures. In the narrow context of preventing CB warfare, CB disarmament is a logical step. But in the wider context of decreasing international mistrust, of increasing the collective and individual security of nations, and of reducing the attractions and likelihood of war, international disarmament may be seen as an end in itself. Here the most comprehensive disarmament is the ideal, but the negotiation of more limited measures may provide a means for sustaining and encouraging effort to reach this ideal. The attainment of CB disarmament could both eliminate the grisly threat of CBW and stimulate more basic attempts to improve the lot of man.

But partial measures are open to criticism, rightly or wrongly, both on general grounds and on specific grounds. While they may serve to stimulate more comprehensive agreements, they may also delay them; we touch on this question in relation to CB disarmament in the next chapter. In addition, to outlaw possession of some weapons but not others, whose acquisition may proceed unchecked, may raise special problems: while a partial disarmament measure will remove some of the weapons with which a war might be fought, it may do little to reduce the likelihood of war itself. For this reason objections to partial disarmament based on military considerations are common. Thus it is often argued that if a war has to be fought, it should be conducted in the most efficient manner possible: no limitations should be placed on the means employed if they would impede the speedy

conclusion of the war. An early advocate of this argument in relation to CB weapons was Captain A. H. Mahan, in 1899; in explaining why the US delegation would not subscribe to the Hague Gas-Projectile Declaration[1] he said:

> I represent a people that is animated by a lively desire to make warfare humane but which may nevertheless find itself forced to wage war; therefore it is a question of not depriving itself through hastily adopted resolutions of means which it could later avail itself with good results.[2]

The other main objection to a partial disarmament measure confined to CB weapons is that, besides eliminating what might be an important contribution to national security, it might also prevent the use of weapons that could decrease the brutality and inhumanity of war. This argument rests on the view that CB weapons are in some way less inhumane than other weapons.

We begin this chapter by discussing these objections further. We then move on to describe the arguments in favour of CB disarmament.

I. *Objections to CB disarmament*

The objection which Captain Mahan expressed in 1899 to a ban on chemical projectiles has recurred many times since then in connection with attempts to negotiate other treaty constraints on CBW or to increase accessions to existing treaties.[3] As an argument against CB disarmament, its scope is, of course, extremely narrow. It concentrates on the possible weakening effect such disarmament might have on the overall military strength of one nation, and pays no attention to the wider benefits that might accrue to the security of that nation—or the community of nations as a whole—if CB disarmament took place on a multilateral basis. For this reason the argument has widest currency in those countries that conceive of national security primarily in terms of national military strength.

Given the comparative insignificance of CB weapons within the arsenals of those countries that possess them—and so far as we know it is only the

[1] To outlaw use of "projectiles the sole object of which is the diffusion of asphyxiating and deleterious gases". The Declaration is discussed in Volumes III and IV of this study.

[2] W. D. Puleston, *Mahan* (London, 1939), p. 204.

[3] See, for example, the testimony given before the US Congressional appropriations committees by personnel of the US Army Chemical Corps, and its successors, throughout the 1960s. General Creasy, recently retired as head of the Chemical Corps, put forward the argument in its most basic form in 1959: "I would hate to see us enter into any agreement with anybody so that if we are going to fight we are going to do it with our hands tied behind our backs." (*Chemical, Biological, and Radiological Warfare Agents,* Hearings before the Committee on Science and Astronautics, US House of Representatives, 86th Congress, 1st session, June 1959, page 17.)

superpowers that maintain militarily-significant CBW capabilities—arguments for and against CB disarmament based on national security principles often seem unduly high-flown. Such arguments are in any case based on a pair of assumptions whose validity varies greatly from country to country. The first assumption is that national security resides mainly in military might. The second is that a CBW option is relevant to those military capabilities that are believed important for national security. We discuss the extent to which these assumptions are valid for different categories of country in the next chapter.

Whether attitudes towards CB disarmament are expressed in the language of national security or not, they ultimately depend on the importance of a CBW capability in the military posture of the country in question. The more a country relies on CB weapons for its deterrent or combat effectiveness, the more compensating benefits it will need to be assured of before agreeing to CB disarmament. Outside the context of more general disarmament, this particular question of costs and benefits will hinge on the military value of CB weapons compared with other weapons that might serve the same function.

In Volume II of this study, we discuss the military attractions and liabilities of CB weapons in some detail, and in the previous chapter we explored the various factors that might influence a decision to use, or refrain from using, CB weapons in time of war. One point which emerges from this, and which is fundamental to considerations of the military value of CB weapons, is that the incentives to initiate CBW are likely to be strongly constrained by political, military, legal and psychological factors in all but highly asymmetric conflicts. It might therefore be supposed that the only countries to see positive value in possessing CB weapons would be those that envisage the contingency of a war against an enemy whose powers of retaliation are considered weak—too weak to constrain initiation of CBW—and whose deficiencies in CB protective equipments may enhance the incentives to initiate CBW. It is significant that the only major confirmed instances of CBW since World War I have all occurred in asymmetric conflicts of this type—the use of chemical casualty and irritant agents by Italy in Ethiopia, and by Japan in China, and the use of irritant and anti-plant chemicals by the USA and its allies in Viet-Nam. Nowadays, though, it seems likely that public attitudes have become so firmly opposed to CBW that the political liabilities of using CB weapons in such "downhill" conflicts provide an almost overwhelming constraint. The fact that CB casualty agents have not been employed in Viet-Nam, so far as is known, might be explained at least as much by their political unacceptability as by an absence of military incentives.

It is at this particular political constraint that the humanity argument for CB weapons has mainly been directed during the past decade. Many people must find it exceedingly paradoxical that CB weapons, which are widely regarded as mass-casualty weapons of a peculiarly loathsome kind, should be claimed to be relatively humane. But while these claims are not supportable—as we show in Appendix 1—their spuriousness is least obvious in the case of the so-called "nonlethal" CB weapons; and from a military point of view these may well be the most attractive of all CB weapons in downhill conflicts, particularly so-called counter-insurgency situations. Diligent public-relations campaigning with the humanity argument might therefore remove the final constraints on the use of at least one class of CB casualty agent (the incapacitating agents) in downhill conflict situations. This was indeed one feature of the US Army Chemical Corps' public relations drive in the late 1950s. The head of the Chemical Corps was remarkably explicit about this before a Congressional committee:

> We are attempting to completely separate these [incapacitating] agents from the lethal agents so that any castigation normally given to toxic agents will not be associated with these agents, since these do not maim or kill. As a result we hope to have a weapon which will give the commander much freer reign [*sic*] in its use as compared to toxic agents. It is my hope that through the use of incapacitating agents the free world will have a relatively cheap and rapid means of both fighting and deterring limited war which has come to the forefront in the international political scene in the last several years.[4]

At the present time, however, all major powers, including the USA and the USSR, are publicly committed to CBW policies which exclude the first use of CB casualty agents, including incapacitants. The downhill attractions of CB weapons therefore seem to be ruled out for these countries even if they might wish to exploit them. The attractions will presumably persist, however, as a source of pressure for reversals of national no-first-use policies, and perhaps also as a focus of military discontent with CB disarmament negotiations.

The rationale for possessing CB weapons even when their first use is not permitted is that they may deter an enemy from initiating CBW, or may be used to nullify any advantage he might gain should this deterrence fail. On these terms, the value of the weapons does not seem to be great, at least to those countries known to possess them, and certainly does not constitute a strong case against CB disarmament. In the first place, no country seems likely to initiate CBW against an enemy of approximately equal military strength. In the second place, a multilateral CB disarma-

[4] General M. Stubbs, *ibid.*, p. 32.

ment treaty would surely be at least as effective a precaution against this particular threat as deterrence in kind. In the eyes of an enemy disinclined to take public CBW policy declarations at face value, his antagonist's arsenal of CB weapons might appear intended for first use just as much as for deterrence. There would then be the usual action-reaction effect at work in which the deterrents sustained not only the threat they were intended to deter, but also the mistrust warranting their existence. The principal objection to multilateral disarmament as a remedy for this is that a party to the agreement might continue to maintain secret stocks of the weapons. In the next chapter we discuss such cheating; it neither appears particularly plausible, nor, if it did occur, would the risks inherent in it seem likely to outweigh the benefits of CB disarmament.

II. *The dangers of CB weapons*

The case for CB disarmament remains essentially the same as it was when international negotiations for it began. For chemical weapons it was expressed as follows by the General Board of the US Navy in 1921:

> Gas warfare has a peculiar quality different from any method heretofore employed, in that, though directed toward a particular target, its destructive effect is not limited to that target, but passes beyond control of the belligerent agent and may involve a sacrifice of innocent lives over a wide area. On account of this peculiarity the use of gas . . . is objectionable, because not only the combatant is killed, a perfectly legitimate target, but many noncombatants may also be victims, and these innocent persons may deliberately be made the objects of gas attack by unscrupulous belligerents.[5]

The Board was replying to questions submitted to it in connection with the negotiating policy that the US delegation should adopt at the Washington Conference of 1921–22. The delegation received further advice from an Advisory Committee on Land Armaments, chaired by General J. J. Pershing:

> Chemical warfare should be abolished among nations as abhorrent to civilization. It is a cruel, unfair, and improper use of science. It is fraught with the gravest danger to noncombatants and demoralizes the better instincts of humanity.[5]

As for biological warfare, a special committee on CBW set up by the General Commission of the League of Nations Disarmament Conference

[5] *Congressional Record* (Senate) 9 December 1926, pp. 142–43.

concluded in 1932 that it was "so particularly odious that it revolted the conscience of humanity more than any other form of warfare".[6] All in all, CBW was considered to be a uniquely repugnant and despicable method of fighting, and, because CB weapons were considered excessively cruel and uncontrollable in their effects, their continued possession and development by nations was regarded as both dangerous to mankind and utterly immoral.

Today, the deep-rooted aversion towards CB weapons persists, but the destructiveness of the weapons has increased enormously. Chemical weapons are now hundreds of times more potent,[7] while biological weapons are no longer a future horror, but have been stockpiled in large numbers.

There are thus two distinct elements in the case for CB disarmament. The first lies in the apparent ability of CB weapons to destroy living creatures over vast areas, and in the belief that any activity involving them is totally evil, degrading the better instincts of humanity. This we describe further in the concluding section of this chapter. The second lies in the fact that the effects of the weapons are only poorly predictable in many situations, particularly when directed against large targets, and may be uncontrollable. The overall destruction which they might cause could far exceed both expectation and the military utility for which they might be valued. The extent to which they could magnify the consequences of an ill-considered or irresponsible military act is thus too enormous to be tolerated.

The central factor here is unpredictability—the uncertainties about what might happen to the environment in general, and to people in particular, if CB weapons were used on a large scale in war. While the present level of knowledge about the short-term effects of CB weapons may be thought adequate to plan for their possible wartime exploitation, the ignorance about their long-term consequences—which could be enormously more damaging—is very great. The uncertainties fall into two broad categories. The first concerns the subsequent conduct of a war in which CBW is initiated, and of future wars. The second concerns the damage that CB weapons may cause beyond the immediate combat zones—beyond them, that is, either in space or in time.

[6] League of Nations, *Series of League of Nations Publications* 1932, IX, 46.

[7] Relative potency can be measured in different ways. In March 1958, the Chief of the US Army Chemical Corps said: "Actually the improvement in chemicals since World War I is moderately stated a thousandfold in effectiveness, whether you are talking about lethality or talking about casualty production as distinguished from lethality." (*Department of Defense Appropriations for 1959: Department of the Army*, Hearings before a subcommittee of the Committee on Appropriations, US House of Representatives, 85th Congress, 2nd session, Washington: Government Printing Office, 1958, p. 300.)

Escalation and habituation

As regards the first of these categories, the dangers are those of escalation and habituation. Use of CB weapons could escalate a war not only because of the way in which each belligerent might react to its implications, but also because of the inherently escalatory character of the weapons themselves. The former hinges on the fact that at the present time CBW is not a generally acceptable method of fighting, and that its initiation is illegal. The latter arises from the relatively uncontrollable character of CB weapons as compared with other weapons.

A belligerent who resorts to unorthodox and illegal methods of fighting may provoke his enemy into taking violent countermeasures. His action may also be interpreted as a sign that he believes he can no longer achieve his objectives with the means previously employed, but is nonetheless sufficiently compelled by his war aims to pursue them with more drastic means: this also will suggest that drastic countermeasures are needed. There may therefore be a risk that the war will expand beyond whatever limits within which it was being fought. There may, in other words, be escalation. Thus, if nerve gas, for example, were suddenly introduced into a conventional war in Europe, resort to nuclear weapons might soon follow. We have discussed this risk in more detail in Chapter 1.

Even if a belligerent's use of CB weapons is so restrained that his enemy does not need to consider an unprecedentedly violent response, and if the pressure for such a response is resisted, the fact remains that the constraints on using CB weapons will have given way. Once this has happened, it will become likely that the weapons will be used in every situation where this might be militarily advantageous.

CB weapons have certain attractions in tactical operations, and they may initially be used for this reason; but they also have attractions outside the immediate battlefield. They may be attractive not only against forward enemy positions, but also against his rear—to interdict supply lines, to disorganize support facilities, and so on. Indeed, their attractions in the latter roles may far exceed those in the former, so that once they have been used against forward positions they are that much more likely to be used against rear positions. Under conditions of modern warfare, it will be hard to say where the enemy's rear stops: even the most remote command post, transportation network or industrial installation may be considered part of the enemy's rear, and therefore a suitable target for attack. Many other types of weapon can, of course, be used to engage an enemy's rear as well as his forward position; but the difference between high explosive weapons, say, and CB weapons is that the effects of the former can be confined much more precisely to

their intended target. Thus, an air strike with conventional weapons against a military installation on the edge of a town is less likely to kill the town-dwellers than one with CB weapons. Because of their relatively uncontrollable character, CB weapons used against the enemy's rear would greatly increase the risk of blurring the distinction between operations against military targets and those against civilian ones. Some types of CB weapon are potential mass-killers of civilian populations.

What this suggests is that once CB weapons have got onto a battlefield, their character is such that the future course of the war will become far less predictable. The extent to which the commanders of both sides can plan ahead may therefore become smaller: they may have considerably less control over the conduct of future operations, and may be forced into acts of war whose violence far exceeds any conceivable military necessity. Furthermore, if CB weapons are used frequently in a conflict, their general acceptability may be increased, and their use in future conflicts may become more probable.

In addition to the fact that introduction of CB weapons into a war may, by forcing escalation, lead to an inestimably greater loss of life than was anticipated, there is also the uncertain possibility that even if there is no escalation, very great damage will occur outside the immediate combat zones. The possible extra-battlefield consequences of using CB weapons are considered in some detail in Volume II of this study; it will be useful to summarize the main points here. They fall into two groups: the uncertainties that CBW agents can be confined to their intended target areas; and the possibilities that CBW agents will continue to produce harmful effects long after the conflict has ceased.

Uncontrollability

Quite apart from the possibility that CB weapons, like any other, may miss their targets, they may cause unintentional damage in areas outside the combat zone following natural transport of the CBW agents away from the target area. Here the prevailing weather conditions will be of primary significance. Other factors include the possibility that involatile CW agents may enter surface or ground water, thus creating a risk that either they or their breakdown products will produce damaging effects in distant areas, and the possibility that people, animals, birds or insects infected during a BW attack may propagate the disease after moving away from the target area, whether they succumb to it or not. The latter possibility is discussed further below; it may also be noted that this means of spreading disease might

conceivably be the aim of a BW attack, perhaps of a clandestine one, rather than an unintended side-effect.

The meteorological unpredictabilities, which in an extreme situation might amount to a risk that the user of CB weapons will suffer more damage from them than his enemy, arise from the fact that, for greatest area-effectiveness, CBW agents must be made airborne in such a form that the air currents prevailing over the target area can be exploited to the full. But the effects produced by the airborne agents can be predicted, and therefore controlled, only in so far as the meteorological situation can be predicted. This prediction requires a foreknowledge of such parameters as wind velocity, temperature gradient, and the way in which these vary over the target area. Accurate meteorological data of this type will generally be difficult to acquire and, if acquired, their reliability will decrease the larger the intended target area. Furthermore, the state of applied meteorology is such that, even if the relevant meteorological intelligence is acquired, there is not yet a completely adequate theoretical base for using it to predict the precise field behaviour of air contaminants. The larger the target area, the greater may be the divergence between the predicted and the actual field behaviour of CBW agents. This form of unpredictability may work both ways, of course; the agents may fail to reach all the areas they were expected to, or they may spread great distances beyond them.

These meteorological uncertainties will be greater for biological weapons than for chemical weapons. The effectiveness of biological weapons depends on a much wider range of climatic variables including, for example, relative humidity, the intensity of ultraviolet irradiation and the prevailing concentration of certain air pollutants. The fact that biological weapons are likely to be used against larger targets than chemical weapons will magnify the relative consequences of poorly-predicted field behaviour. The margin of probable error between actual and predicted performance will thus be greater for biological weapons, embracing a more extreme disparity in possible damage. This greater uncertainty will be compounded by the fact that quite apart from meteorological difficulties, the nature of BW agents is such that it is very much harder to define the limits of an area placed at hazard by an infective aerosol than by a toxic one.[8] Further-

[8] Estimates of the effective dosages of CW agents are inherently likely to be more reliable than estimates for BW agents. CW agents require predictions about the interaction of an inanimate poison and one living species (man); BW agents involve two living species. This consideration governs the reliability not only of estimates of the dosage of agent having a specified probability of effect, but also of estimates of the difference between the dosage having a negligible effect and the dosage having a virtually certain effect. Furthermore, for a nerve gas it may be said with some confidence that this difference would be well within a single order of magnitude; for biological agents, on the other hand, the difference would be very much greater, at

more, we are speaking here only of the hazards to living organisms arising from direct exposure to the microbes disseminated. As we shall see later, this hazard may be greatly increased by the uncertain extent to which the microbes may subsequently breed and multiply in the environment, and change their characteristics in the process.

Long-term damage

In that CBW agents may cause both short-term and long-term damage to living organisms, they may continue to produce harmful effects after the conflict in which they are used has ceased. Some CBW agents are likely to cause more long-term damage than others. At the present level of knowledge about the effects produced by toxic or infective materials, the long-term ones are far less well understood, and therefore far less predictable, than the short-term ones. Weapons designers will concentrate on the short-term effects; the chronic damage that CBW agents may cause will generally be seen as a side-effect, and not as a property open to military exploitation—at least not until the relevant scientific knowledge has greatly increased. Because the long-term effects lack military possibilities, they may be ignored by military planners. Because they may be unknown and are largely unpredictable, they may be assumed to be insignificant. Yet it is quite conceivable that the overall damage that they may cause could far exceed the short-term damage that is seen as militarily significant, particularly when considered in conjunction with the fact that it may prove impossible to confine CBW agents to the immediate target areas.

The chronic effects of chemical weapons

The possible long-term consequences of CW fall into two categories. First there are the direct long-term toxic effects that CW agents may provoke in man. Then there are the indirect effects that may arise following chemical damage to the environment that man inhabits. Only a small proportion of the effects in either category have been adequately investigated, either in general terms as regards underlying toxic mechanisms, or in more specific terms as regards the propensity of existing CW agents to induce long-term damage. The rapidly expanding study of environmental pollutants is continually revealing unforeseen consequences of man's increasing dependence on synthetic chemicals. Hitherto unsuspected connections are being found between pollutants and certain diseases earlier regarded as spontaneous.

some point between a factor of a hundred and a factor of a hundred thousand or more. The dosage of agent received from a CB aerosol cloud declines gradually from its centre.

Certain ecosystems central to man's well-being have been discovered to be highly sensitive to trace quantities of synthetic chemicals. For the most part these studies concern substances other than CW agents, but, in that the latter are specifically designed to affect living organisms, albeit acutely, there is a likelihood that they or their residues may cause at least as much chronic damage as other chemicals earlier regarded as harmless. This is not to say that the likelihood is necessarily a strong one, but rather that its strength is largely unknown. What limited information there is about the chronic effects of CW agents shows that it certainly ought not to be ignored.

As regards long-term damage in man, the grimmer possibilities include carcinogenesis (the growth of cancers), teratogenesis (the induction of birth-deformities and other birth defects), mutagenesis (the induction of mutations in growing cells, with the attendant possibilities of inherited defects in future generations), as well as the many other possibilities of long-lasting or permanent disability arising from toxic damage to components of the body. Some CW agents are known to have caused these types of effect in man; certain aspects of the chronic toxicity of other CW agents have been examined in laboratory animals. But not all possible CW agents have been screened for all possible toxic effects—far from it. Illustrations of the cause for concern are these: Mustard gas is well known to be a potent mutagen, although no one yet seems to have studied the progeny of mustard-gas casualties in this regard. There is strong evidence to suggest that mustard gas was responsible for an abnormally high incidence of lung cancer both among British and US World War I gas casualties, and among Japanese World War II CW agent factory workers. Nitrogen mustard has shown teratogenicity in chick embryos. Organophosphorus compounds related to the nerve gases are capable of producing long-term nervous disorders, while certain of the nerve gases themselves have been implicated in cases of chronic muscular paralysis and psychiatric disorder among people believed to have been exposed to small dosages of them (although this is not yet conclusively established). Several organosphosphorus compounds have displayed teratogenicity in laboratory animals, and there is some evidence to suggest that some of these compounds have been responsible for cases of human birth deformity. The widely used tear gas CN has shown co-carcinogenicity in mice. The possibility that CS, by virtue of its alkylating properties, is a mutagen cannot yet be dismissed. The anti-plant chemical 2,4,5-T was withdrawn from military use in Viet-Nam (after some 25 000 tons had been sprayed over the countryside) after it had been shown to be teratogenic in mice and rats, and following rumours that it had caused birth deformities in Viet-Nam.

Even less can be said with any confidence about the broader ecological consequences of CW. The experience of World War I may provide some

reassurance here, for despite the dissemination of 10 000–20 000 tons of persistent CW agents over the battlefield (plus around 100 000 tons of non-persistent ones), there appears to have been little long-term damage to the soil. Whether the same would hold true for present-day CW agents is not known. Neither can it yet be predicted how the South Viet-Namese countryside will react in the long run to the military use of anti-plant chemicals there: by the end of 1969, around 11 per cent of the surface of the country had received something like 78 000 tons of herbicides (from about 90 000 tons of agent), about 95 per cent of this in a space of four years.[9]

The chronic effects of biological weapons

As regards BW, the possibilities of long-term damage are enormously more threatening than for CW. BW agents are living organisms that may be capable of establishing themselves wherever wind or weapons take them. If their new environment does not kill them off, they may multiply rapidly, thus setting up new foci of disease to plague local inhabitants far into the future. Having established themselves, they may spread into neighbouring areas, either under meteorological influences—as in the 1967–68 epizootic of foot-and-mouth disease in Britain—or by way of insect, bird, animal or human carriers. If circumstances especially favour them, their spread may be explosively rapid, and vast areas may be struck with pestilence. While there are powerful checks and balances that may prevent this from happening—as is apparent from the fact that the ancient Black Deaths and the influenza and cholera pandemics of the present century are exceptional rather than normal—the retarding factors are only imperfectly understood.[10]

What is clear is that the self-propagation of disease requires the coin-

[9] This corresponds to a mean annual dosage (kilograms per hectare of treated area) at least six times greater than that employed for forestry and agricultural purposes in Sweden—a country whose domestic use of chemical herbicides is among the most intensive in the world. Volume I contains details of the use of CW agents in the Viet-Nam War.

[10] Commenting on the 1968–69 influenza pandemic, a recent WHO publication has this passage: "Pandemics of influenza occur when a shift in the composition of the influenza virus results in a new strain with unusual infecting capacity. Advances in virology have enabled research workers to examine closely the strains isolated since 1944, including the current [1968–69] Hong Kong strain. Although the occurrence of certain changes in the protein coat of the virus has been established, the factors responsible for infectivity and rapidity and universality of spread remain unidentified. Thus it is not known why the 1918 pandemic (which resulted in the death of about twenty million people) or previous and subsequent pandemics occurred. Equally, it is still impossible to anticipate the change that will give rise to the next natural pandemic." (*Health Aspects of Chemical and Biological Weapons,* Report of a WHO Group of Consultants (Geneva, 1970) p. 68.)

cidence of such a large number of different promoting factors that the probability of their coincidence is small. But what precisely these factors are, and how essential they may be, is very largely unknown. A military planner contemplating a small biological attack is thus faced with an extreme uncertainty: will his attack have side-effects no more serious than those a forester at present believes he is risking when spraying his pine plantations with polyhedrosis virus to eliminate sawfly, say, or will it institute the spread of disease over a whole continent, as did the myxomatosis inoculation of a few rabbits in France in 1952? His technical experts may be able to attach a weighting to some of the factors likely to promote one or other of these eventualities, but they cannot be certain either that their relative weightings are correct or that they have considered the whole range of relevant factors. Epidemiology is still in its descriptive, empirical stage; it will be a long time before it becomes an adequately predictive science. Confidence in the overall outcome of a BW attack is therefore the prerogative only of the ignorant. The following considerations taken from Volume II illustrate this.

1. Recent statements by certain officials in the USA—the only country to acknowledge that it has conducted an active development programme for biological weapons (which it has now renounced)—indicate that they do not regard the pathogens of man-to-man transmissible diseases as attractive candidate BW agents. But the notion that the use of BW agents that are not man-to-man transmissible would carry no risk of producing a self-propagating contagion is false. Non-transmissible pathogens can maintain themselves and multiply within insect or animal populations, and their hosts or other living creatures coming into contact with them may act as vectors for the diseases they cause in man. Under some circumstances a disease might spread as rapidly among a human population through intermediary vectors as through direct man-to-man transmission. The great yellow-fever epidemics of the past were sustained by mosquito vectors that transmitted the virus from reservoirs in monkey populations and from infected men. And even if the buildup of such pathogens within local animal reservoirs does not lead to epidemic outbreaks of disease, the disease may nonetheless remain endemic in the area for years to come. Thus to be certain that a pathogen which is not normally transmissible from man to man will not in fact cause an epidemic requires an intimate knowledge of the possible host-vector cycles for the pathogen within the target area. There may be many host-vector combinations that can sustain a particular disease; and it seems unlikely that sufficiently detailed information about the local insect and animal population could be obtained for many potential BW target areas. There is, of course, also the pos-

sibility that BW technologists may develop weapons that are actually intended to initiate self-propagating diseases, or indeed that they have done so already. It may be noted that, although US biological weapons designers did not apparently do this in their anti-personnel weapons, they did so in their anti-crop ones; nothing is known about other countries.

2. It is to be expected that someone planning a BW attack would select a pathogen against which the target population had little or no natural immunity. With the possible exception of clandestine attacks, a BW target is thus more likely to be attacked with an exotic disease than with an endemic one. This will both add to the uncertainties about its possible persistence in natural reservoirs in the target area, and, if the disease then becomes endemic, may also add enormously and unnecessarily to the post-war recovery problems of the country attacked.

3. There is a definite possibility that a BW agent that established itself within a target ecosystem would, by a process of breeding and evolution, re-emerge, perhaps with increased virulence, to cause disease of unforeseen characteristics. This has happened with natural diseases. The process may not only be one of mutations within the particular strain concerned, but may also involve cross-hybridization within an animal host between the BW agent and certain of the local microflora, pathogenic or non-pathogenic. Under certain circumstances for example, epizome-mediated antibiotic-resistance factors (which may have been deliberately bred into a BW agent) might be transferred to local pathogens whose diseases normally respond to antibiotic treatment. There are many possibilities, and none of them are at all well understood.

4. Even if a disease spread for BW purposes does not become endemic in the target area, it may bring about ecological changes leading to environmental damage or unforeseen public health hazards. This arises from the possibility that BW agents may so deplete populations of susceptible species of wild life in an area that they can no longer survive. This might create an empty niche in the local ecosystem, thereby seriously disturbing its equilibrium. Thus, a new species of fauna might move in to fill the niche, one that carried a disease that was harmful to man, acquired either naturally or as a result of BW attack. The consequence of this could be the establishment of a new natural focus of the disease. Not only biological weapons may cause this phenomenon; chemical weapons might provoke it also (and so might the massive use of conventional weapons), as seems to have been demonstrated by the herbicide programme in the Viet-Nam War—for example in those instances where bamboo has invaded defoliated areas. The latter is an example of the niche being filled by another species with harmful consequences for the future rural economy.

5. Certain types of BW agent may be capable of persisting in a target area independently of local wildlife. These include the various sporulating bacteria and fungi. For at least two biological weapons proving grounds where anthrax spores have been disseminated, it has been stated that the ground will remain hazardous to animal life indefinitely.

The significance of possibilities 1–5 and the other chronic effects of CB weapons discussed earlier is not only that they are conceivable, but that their likelihood is substantially unpredictable. Through the laborious efforts of national and international public health services great areas of the world have been freed from disease, and barriers erected against its future encroachment. But the effectiveness of these measures, and their ability to withstand new onslaughts, are by no means assured. The consequences of a biological war could nullify the painful work of decades, could expose present and future generations of people to fearful diseases, and perhaps even, through the emergence of some unimaginable new plague, threaten the very existence of mankind. Given the present level of knowledge, the chances of these things happening if biological weapons were used cannot be stated, however much the designers of the weapons may have tried to control them. Much the same applies, on a smaller and more restricted scale, to chemical weapons. Even if the side-effects could be predicted, it is by no means certain that they would adequately enter into the calculations of those who supervise military operations, for in the extremities of war the immediate effects of a weapon are bound to be more closely considered than any long-term consequences, particularly ones that are at all uncertain or ill-defined.

Further study and development work might possibly reduce some of the present unpredictabilities of CB weapons, and therefore permit a closer control over their possible side-effects. But there are two limitations to this. First, the degree of controllability of CB weapons cannot be entirely ascertained until they have been used: they may indeed prove to be fully controllable, but they may also turn out to be disastrously erratic. Second, the fact that sophisticated and controllable CB weapons had become available would not necessarily mean that all the participants in a biological war would refrain from using their cruder, and presumably cheaper, predecessors. It is also possible that increases in the predictability of CB weapons might promote exaggerated belief in their controllability, and thus encourage their use.

In conclusion, then, an important argument in favour of CB disarmament is that there is a possibility that, if CB weapons were used, they might cause far more extensive and long-lasting damage than their users expected; that this damage might far exceed any for which there could possibly be a military justification; and that because of all this, reason and the most ele-

mentary sense of responsibility dictate that these weapons should not be used, and that nothing should be permitted that may increase the chances that they will be used.

III. *The case for CB disarmament*

Opponents of CB disarmament have claimed that CB weapons offer possibilities for a relatively benign and humane use of force. Because CB weapons may increase the opportunities, so it is claimed, for humanitarian behaviour in time of war, their possession should not be outlawed. As we argue in Appendix 1, while certain types of CB weapon might occasionally be used to secure certain types of military objective with less destruction of life and limb than other weapons, the same CB weapons can also be used to increase the violence of war, and the number of situations in which armed force can be applied. In addition, reliance upon them may increase the likelihood that other categories of CB weapon will sooner or later come into use, weapons so repulsive in their effects that no humanitarian case in favour of them can possibly be tenable. We have also shown that in some situations the effects of these weapons are intrinsically so poorly predictable that the destruction which they might cause could be enormous compared with that which they were intended to cause. In the face of these dangers, the claims for the humaneness of CB weapons pale into irrelevance.

CB weapons are potential implements of mass destruction. Thousands or tens of thousands may die after a single CBW attack, combatants and noncombatants alike, killed without discrimination. In acquiring these weapons, those who possess them may not have had mass-destruction applications in mind, but there is a danger that, because the weapons lend themselves to this function, they may in an extreme situation be used to perform it.

The principal feature distinguishing CB weapons from other weapons is their unique ability to damage life without damaging anything else. To exploit this feature, as CB weapons designers presumably must, is to set in motion a whole chain of activities whose ultimate purpose is to harm or destroy life in the most specific and efficient manner possible. This aim will direct the work of chemists, microbiologists, and many other people, all of whom will devote their expertise, and develop their sciences and skills, to this basic objective. The refinement of CB weapons draws upon several different technologies and scientific disciplines, some of which would otherwise play little part in military R and D activities; all of them will become imbued, to a greater or lesser extent, with this alien influence. To many people working in these fields, this is a matter of grave concern.

The ramifications of CBW, and the threat which CBW imposes, can only get worse unless positive preventive measures are taken, so long as the present international competition in arms continues. There is inevitably a pressure to develop more and more efficient weapons in all classes of armaments that are not outlawed. Work on weaponry stimulates improvements in defences, and these in turn stimulate improvements in the weapons. Mistrust between countries is reflected in competition between their respective weapons designers; although one side may see few military attractions in possessing or developing CB weapons for its own use, it may believe that the other side finds them attractive, and may therefore feel compelled to anticipate possible enemy developments. These are the basic mechanisms of an arms race.

Not only may continued CBW R & D lead to weapons of still greater destructiveness, but it may also increase the chances that the weapons will be used. At the present time, CB weapons have a number of serious technical limitations which further development work may eventually remove. The weapons might then gain considerably in military attractiveness. And even if there were no major technical improvements in the weapons, the mere fact that military scientists were working on them would serve to promote belief that the weapons were not in fact so useless or unacceptable as the long history of non-use of the more potent CB weapons might otherwise suggest. Continued R & D may thus increase the incentives to use CB weapons in time of war, and weaken the constraints on doing so.

Continued R & D, alongside continued possession of CB weapons, may also encourage their proliferation around the world. Observing that CBW R & D continues in some countries, other countries may start to question their reasons for not acquiring CB weapons. Some may be led to believe, for instance, that the national security rationale with which the nuclear powers have surrounded their nuclear weapons could be applied to CB weapons and their own security. Such weapons are much cheaper to produce than nuclear weapons, and although their acquisition would require very considerable technical expertise and know-how, this is rapidly diffusing out of the CBW programmes of the superpowers. Once this process of proliferation begins, the way is set for arms races in different parts of the world. By destabilizing international relations, this may increase the risk of war, and with CB weapons in increasing numbers of arsenals, the likelihood of CBW breaking out may also increase.

Quite apart from other considerations, the fact that CB weapons have not yet proliferated, and the risk that they will do so, is good reason for pressing for immediate CB disarmament, including the cessation of offensive CBW R & D. There are other factors which favour immediate action.

Public concern about CB weapons has been mounting rapidly over the past five years in many parts of the world; and scientists working in a number of the disciplines relevant to CB weapons development, notably the microbiologists, are taking steps to impede further encroachment of CBW-related goals and values into their fields of research. These factors exert political pressure in favour of CB disarmament, and this should be exploited before the tide of opinion recedes. Beyond these considerations lies the fact that CB weapons are particularly suitable for the negotiation of partial disarmament measures. Because the weapons are only marginally important for the security of those countries that possess them, if indeed they are important at all, their possessors can raise few serious objections to abandoning them. The successful conclusion of another partial disarmament agreement would be an end in itself.

Chapter 3. CB disarmament

I. *Introduction*

Disarmament has usually been pursued on the grounds that to reduce or get rid of arms in the hands of nations and to create or strengthen international machinery for keeping the peace is the way to increase the security of nations. At present little more than lip service is paid to this view. The policies actually followed by the dominant powers seem to rest, implicitly or explicitly, on the view that their security is best achieved through military strength, and that disarmament should consist of getting rid of only those weapons or policies whose abandonment or limitation will not detract from the pursuit of security through strength. There are obvious grounds for questioning whether this approach should be called disarmament. But this is not the place to debate these wider issues.

In this chapter we shall first consider how CB disarmament would impinge upon the security of different nations in a world in which other arms were kept. We shall then show that the negotiating positions on CB disarmament now being taken in Geneva bear little relationship to the security interests of the participating nations. They more closely reflect general political postures which have been developed during the cold war and in earlier disarmament negotiations. These general postures have been brought to the subject of CBW, where they have been clothed in the language of these weapons.

We shall then examine the scope of CB disarmament proposals, old and new; we shall look at the main recurrent themes, and at the question of verification and enforcement.

The concluding section looks at the case for and against a disarmament treaty dealing with biological weapons only if a disarmament agreement dealing with chemical and biological weapons together cannot be reached.

II. *National security and CB weapons*

It has been shown in earlier chapters of this volume (and, more fully, in other volumes) that CB weapons, while capable of causing great destruction in some circumstances, are of limited military value, and are subject to

unusual political and psychological objections; they appear not to be possessed by many countries nor to have been used on a significant scale more than three or four times since World War I—and then only "downhill", i.e., against a defenceless enemy who is incapable of retaliation in kind.

These considerations would suggest that CB disarmament might not meet much opposition and might get a good deal of support on narrow national security grounds. But it is useful to explore the question further, trying to see how different kinds of countries will see their national security interest in relation to the possession or abolition of CB weapons.

It is quite easy to envisage conditions where CB weapons may look attractive for a particular operation—especially if it is assumed that there are no defences and no risk of retaliation in kind. Descriptions of the use of CBW in operations like this, for example, to take a bridge, to deny territory by contaminating it, or to attack a concentration of troops, are common in military manuals on CBW and also in books by CBW experts. But for a country to decide whether it wishes to possess CB weapons or renounce them, its government will have to look not only at the tactical attractions of those weapons, but also at wider political considerations and the long-term implications of the decision. The military and political considerations are not fully separable. Moving from the platoon or company level, where narrow, short-term considerations will be uppermost, to the top of the military hierarchy where generals advise ministers, political considerations will blend into military ones. At the tactical level, the unit commander might see military advantages in the possession and use of chemical and biological weapons for a particular operation, defensive or offensive. His divisional or army commander might see countervailing disadvantages to his own side: if the area was contaminated, future operations might be hampered, or the gain expected from the initial use might be nullified by the risk of enemy retaliation, whether in kind or with some other weapon, on the same front. And at the top military level (i.e., chiefs of staff) it might be held that to breach the constraints on the use of CB weapons would be to invite the use of these weapons on other fronts, against cities and in future wars, all contingencies that might be considered disadvantageous. Finally, the politicians might hold that the security of the nation would best be served by trying to prevent possession of CB weapons and that only such a posture is consistent with the political and moral sentiments of the nation and the stance of its government at home and abroad.

In practice, arguments concerning possession of CB weapons will not be conducted with advocacy of a CBW capability being started at the low level and then filtered at higher levels of the military and political machine.

Rather, specialists in CBW will deploy arguments that necessarily start from propositions about the efficacy of CBW in the field and these will be critically examined by reference to wider considerations.

In the following discussion we shall look at the military and political attractions of CBW under different conditions. For this purpose, we shall divide countries into rough categories.

One criterion is possession of the scientific and industrial capability to produce CB weapons. Production of modern single-purpose agents, i.e., the nerve gases and biological agents for which there is no civilian use, requires highly specialized scientific and technological skills and equipment; many years may be required to build up a capability—unless know-how is obtained from a possessor. The dual-purpose agents (such as hydrogen cyanide, phosgene and other agents that are widely used for civilian purposes, as well as for military purposes) and the cruder CBW agents can be produced much more easily, though a moderate industrial and scientific base is required.

The second criterion is the general military strength of the country relative to possible enemies. This is relevant because it determines in large measure whether the possession or non-possession of a CBW capability will be likely to tip the balance of strength importantly. But general military strength is not an easy concept to define. It will be influenced by the level of general economic development of a country, as well as by its size and its degree of militarization. Wealth may not be decisive. As is evident from Viet-Nam, modern weapons massively used may not be very effective in overcoming popular resistance by people who are simply armed.

For simplicity, we shall divide countries into three categories: at one end are the nuclear powers. The possession of nuclear weapons is their main characteristic, but all of them also have armies equipped with CB defences and all are industrially capable of producing CB weapons. At the other extreme are weak countries without the industrial capability to produce modern CB agents and weapons, without adequate means of delivery and without CB defences. Many underdeveloped countries are in this category. In between there is a range of middle powers which, in varying combinations and degrees, have the industrial capability to produce CB weapons, the means of delivery and defence against CBW attack. This group of countries ranges from, say, Sweden—which is rich in all three attributes to, say, India —which possesses a substantial air force, a chemical industry of some size, but probably weak defences for its army and none for its people.

It should be noted here that there are some types of conflict short of war in which CB weapons (other than irritant agents) might conceivably be used. Small groups intent on acts of destruction might resort to CB weapons,

crude biological weapons perhaps, which can be applied in a variety of ways in acts of sabotage and assassination. Or CB weapons other than irritant agents might conceivably be used by authorities intent on stamping out such people.

Whether this sort of behaviour is likely to occur is a debatable point. In any event, the possibility of such behaviour would be diminished by CB disarmament, which would make it impossible for people to obtain CB weapons by diversion from military supplies and would help to constrain use of these weapons by the authorities too. As for amateur production and diversion of toxic chemicals and biological agents from legitimate civil uses, the cure lies in proper domestic regulation of use; the problem is no different in kind from that of regulating the use of poisons and other dangerous substances with which man has lived for a long time. What matters is that these regulations should be effective.

Another special case is the possible insidious use of BW agents to destroy crops by spreading plant diseases during a cold war. It is known that biological anti-crop agents were prepared in the United States, the one country to have a BW programme about which there is much information. Disarmament will not increase the risk of action of this kind; by eliminating BW programmes, it may reduce it.

If we leave behind these special cases—aberrant behaviour and insidious crop infection—we are left with war in all its varieties. This includes guerilla warfare once there is a degree of separation between areas held or dominated by guerillas and those held or dominated by government forces. It includes civil war. It includes colonial wars and those where for any other reasons there is international intervention, and it includes direct international war.

We shall consider the military attractions of CBW for use and for deterrence together, since one is essentially the expectation of the other. The military aspects of CBW are considered at length in Volume II.

Nuclear powers and CB weapons

Use of CB weapons against another nuclear power. If nuclear war broke out, restraints on normal (wartime) behaviour would be shattered and this would raise the likelihood of use of CB weapons, but if nuclear weapons were being used, CB weapons would scarcely be decisive.

Outside the context of nuclear war, a nuclear power might consider using CB weapons offensively in the hope that these weapons would give it superiority and yet not provoke nuclear retaliation. This implies that the aggressor finds his enemy so lacking in nuclear weapons or, perhaps more probably, in resolution to use nuclear weapons, that he is ready to risk

challenging his enemy's nuclear deterrent for the sake of some possible gain. It has been argued that if chemical disarmament were inadequately verified, one side might be tempted to cheat and to use chemical weapons in order to try a challenge of this kind, hoping to gain an advantage because his enemy would be forced to encumber himself with anti-gas defensive equipment and to take precautionary measures to a greater extent than the attacker who would know where CW was going to be used. This has been put forward as an argument for the possession of CB weapons in order to deter use of CBW—or for no chemical disarmament without careful verification.

There is not, however, agreement among authorities on this issue. Arguments tend to be chosen to fit the political needs of the moment and the strategic interests of the country concerned. Thus in arguing at Geneva that the difficulty of verifying Soviet compliance with a chemical disarmament treaty was the obstacle to chemical disarmement, Mr Leonard, the delegate of the United States, which possesses nerve gases, said:

> But the one-sided possession of nerve agents could offer unacceptable advantages to the Power possessing them. And, let me emphasize, such a situation would inevitably increase the temptation to use nerve agents in any conflict. Thus, chemical warfare could become more, rather than less, likely—a result hardly in keeping with the objectives of this Committee. We have heard it suggested that the United States, as well as some other major Powers, need not fear this consquence because we could always, so to speak, even the score with nuclear weapons. That argument is one which, in full candour, we are surprised to hear from any member of this Committee. It seems to us that anyone who suggests retaliating with nuclear weapons in the event of a chemical attack is abrogating his responsibility to find meaningful arms control solutions to the problems of chemical weapons.[1]

A short time afterwards, the British Minister of Defence, Mr Healey, defending Britain's non-possession of nerve gas, said:

> N.A.T.O. as a whole has chemical weapons available to it because the United States maintains an offensive chemical capability. However, I believe that both the former and the present Government in Britain were right not to stockpile offensive chemical weapons in the United Kingdom. . . . It is almost inconceivable that enemy forces would use chemical weapons against N.A.T.O. forces except in circumstances of a mass invasion—in which event more terrible weapons would surely come into play.[2]

The last sentence of Mr Healey's statement dismisses the premise on which Mr Leonard's proposition is based.

Another proposition is that a nuclear power, faced by a conventional

[1] Disarmament Committee document, CCD/PV. 466, 21 April 1970, p. 23.
[2] *Hansard* (Commons) 801: 389, 6 May 1970.

attack which it could not contain by conventional means, might use CB weapons defensively in order to achieve a pause, rather than resort quickly to nuclear weapons. This was suggested by Liddell Hart as policy for NATO,[3] but the suggestion was never, as far as is known, adopted. The trouble is that such a policy, if it becomes known publicly, may give the impression that the side adopting it is afraid to use nuclear weapons. NATO has long had the doctrine that it would be ready to resort to nuclear weapons to stop a conventional attack. To announce the intention to resort to CB weapons as an intermediate step might weaken that posture. It may be for this reason that the Liddell Hart policy appears not to have been adopted by NATO, and why the need to preserve the possibility of using this policy has not been mentioned as a ground for opposing disarmament in the recent disarmament debates, even though other aspects of strategy in Europe have been brought up.

Both these scenarios rotate around a dilemma that is fundamental to all nuclear deterrence: by acquiring additional non-nuclear weapons, and thus additional steps in the "escalation ladder", a country may avoid the need to resort to nuclear weapons at once, but, in doing so, it may reduce or increase the effectiveness of its nuclear deterrent, depending on how the enemy looks at it. Deterrence is subjective. The enemy may be more frightened by the knowledge that you have nothing but nuclear weapons than he is by the prospect that you have lots of lesser weapons you could use first, or *vice versa.*

Another proposition is that CB weapons might be maintained by the superpowers for use against Chinese troops if they were to cross their frontiers in either direction in Asia. This argument has been made publicly by advocates of CB weapons in the United States and Western military experts seem to have been claiming recently that it has been adopted in the USSR.[4] It is also noticeable that the Socialist countries' draft chemical/biological disarmament treaty, unlike any previous arms limitation agreement or proposal, provided that the treaty should enter into force only when it had been ratified by all five permanent members of the UN Security Council.[5] This provision looks as if it must have been aimed at ensuring Chinese participation.

Altogether the military arguments for possession of CB weapons by the nuclear powers in their confrontation with one another seem of a second order. This is essentially because these nations have so many other weapons,

[3] B. H. Liddell Hart, *Deterrence or Defence: A Fresh Look at the West's Military Position* (London, 1960).
[4] See, for example, *The Times,* 3 March 1971, p. 7.
[5] This clause was not included in the Socialist countries' draft treaty for biological disarmament, which was tabled later. See the Postscript to Volume IV.

nuclear and conventional, deployed against each other that their CB weapons appear to be largely superfluous. The position would change if, as a result of nuclear parity, saturation or other military or political developments, nuclear weapons came to be regarded as unusable. These nations would then effectively cease to be nuclear powers; on this classification, they would join the middle powers.

Use of CB weapons against lesser countries. Since the big powers can mobilize only limited forces against any one lesser power without neglecting other areas, and since those forces may not always be well suited to overcoming the type of opposition put up by that lesser country, a military temptation to use CB weapons is not difficult to visualize. The three or four main instances of CBW since 1918 have been against weak victims, but the reaction to the use of CB weapons in three of these instances—the use of gas in Ethiopia, the use of irritant agents and anti-plant agents in Viet-Nam and the alleged CW in the Yemen—indicate how strong the political opposition to this kind of usage can be.[6] These are cases of "downhill" use of CB weapons, i.e., use by a strong country against an enemy who is both without defences and incapable of retaliation. Precisely because of the inequality between the two sides, the military temptation to use CBW is strong and so is the popular outrage against any such usage.

Middle countries and CB weapons

This is the group of countries which, by definition, possess in varying degrees the capacity to produce CB weapons, delivery systems and defences. In it are those countries which might most plausibly entertain the idea of acquiring CB weapons in order to deter war and to deter use of CB weapons by their enemies.

Use of CB weapons against nuclear powers ("uphill"). Middle powers which did not enjoy the protection of a superpower, or had little confidence in it, might see military advantages in possessing CB weapons in order to raise the cost of attack to the enemy (i.e., to help deter the enemy from invasion) and in order to prevent the enemy from feeling tempted to use CB weapons in the hopes of achieving military superiority through one-sided use along the lines indicated above (i.e., to deter use of CB weapons). To achieve either form of deterrence, the possession of CB weapons must be

[6] The exceptional case was Japanese use of CW in China: reports of the use of gas there in 1937–38 produced little reaction in the West and at the League of Nations, perhaps because China is remote from Europe and because people were then preoccupied with European developments.

made public, or, at least, a convincing hint of possession must be conveyed to the potential enemy.

Presumably the reason why countries of this kind, for example Sweden, have not developed CBW capabilities (other than defences) is that, as with possible nuclear capabilities, broad political-cum-strategic considerations have overridden any narrower military arguments that may have been put forward. Exposed countries outside the main military blocs are likely to be very conscious of their vulnerability to military threats from big countries and may feel that to preserve the laws limiting the possible range of weapons used, as well as other elements of international law, is the best way to preserve their independence and to foster peace.

Use of CB weapons against an equal. A middle power might think of CB weapons for overwhelming an opponent in a surprise attack and, as defensive weapons, for use if other defences fail. Both these uses benefit from surprise, the achievement of which will be made easier if the weapons are produced and held in secret.

The attractions of using CB weapons will be influenced, however, by whether the enemy is believed to have an offensive capability with which he could retaliate, or defences which might reduce the effectiveness of an attack, or both. As a rule, knowledge of the enemy's capabilities is likely to be imperfect because of the practice of surrounding CBW programmes with secrecy. Thus, in the absence of disarmament, the typical situation between middle powers will probably be that one country knows the other has some kind of defensive CBW programme but does not know how far this extends into offensive work or into contingency plans to produce an offensive capability quickly; and *vice versa.*

Considerations of this kind about the offensive and defensive value of CB weapons to middle powers are likely to lead to the view that, as between equals, one-sided possession of CB weapons, if the possessor knows he is the only one with such weapons, could be dangerous to the non-possessor; and the experience of World War II may be cited as evidence of mutual CB deterrence through possession of the weapons. This means that, from a purely military point of view, there may in this case be an argument for possessing some CBW capability, perhaps only a modest one, in order to deter use of CB weapons by the other side; and that there may reasonably be concern that compliance with a CB disarmament agreement should be tightly verified. Both arguments may be mitigated if the non-possessor can rely on the support of a nuclear power or other powers to come to its defence, or if the non-possessor has strong conventional means of defence and retaliation at its command: the typical modern use of CB weapons has been against countries with little or no air force and no CB defences. Even so,

middle countries of this kind, for example Israel and the UAR, might show some concern if there were a prospect of one-sided possession of CB weapons, before or after disarmament.

Use of CB weapons against an inferior ("downhill"). The military attractions of using CB weapons increase if a country cannot achieve its objectives with other weapons. By definition, the opponent is inferior in his ability to produce a CBW capability and to retaliate. The military attraction will be the greater if the opponent is defenceless too. A CBW attack may provoke aid to him and is likely to provoke a political outcry. But it has happened in the past that a country has ignored considerations of this kind, and it could happen again.

Weak countries and CB weapons

If they were ever to contemplate the use of CB weapons for other than police action, the authorities in weak countries, which by definition lack defences as well as the ability to produce anything but primitive CB weapons, would be likely to contemplate CBW only in extreme circumstances: against guerillas when they were geographically separated and once an internal struggle had become savage; against neighbouring countries in a desperate attempt to defeat them, to stave off defeat or to conduct a scorched-earth policy. The possibility that at some future date a weak country (no one can say which) might want CB weapons for these purposes is unlikely to tell against CB disarmament now. Advanced countries will scarcely want to keep CBW capabilities in order to be able to supply unknown countries at a future date. They stand ready to assist guerilla and counter-guerilla forces with weapons in general. They might in this context foresee a need in their aid kits for irritant agents which, in the forms suitable for police use, are likely to be traded quite freely anyway. But they are scarcely likely to think it advisable to prepare full lethal CB weapons armouries for this purpose alone. As for the possibility that a weak country might try to prepare its own primitive CBW capability, few governments are likely now or at any given point in time to envisage that they will run into the kind of situation indicated above. Moreover, a politician or a military adviser in a weak country will have to weigh against the possible attractions of possessing and using CB weapons—and they seem small—all the other scenarios in which CBW might be used against his country by medium powers or strong powers, directly or in support of their local allies. With CB weapons, as with all weapons, disarmament will be most attractive to the weak and defenceless.

"Poor man's deterrent"

The idea has been voiced that CBW might become a "poor man's deterrent" in the future. The emphasis has usually been on BW. It has been suggested that when knowledge of microbiology has advanced and spread, weak as well as middle countries could possess biological weapons and that by asquiring them they could improve their "strategic" position vis-à-vis the nuclear powers. This argument, which was sometimes put forward by advocates of biological disarmament in the United States with the aim of showing that the continued development of biological weapons was not in US military interests, has been criticized on technical grounds: the capability of the poor countries to launch a BW attack might be limited by lack of the best means of delivery; the delay and uncertainty associated with the use of biological weapons makes any threat to use them an act which is more likely to provoke attack (for purposes of pre-emption) than to deter it. But the more significant point here is that the "poor man's deterrent" proposition has never, to our knowledge, been voiced by a "poor man" and, so long as that is so, it is not an obstacle to CB disarmament. Weak countries, perhaps understandably, seem on the whole to be more interested in getting rid of weapons of mass destruction than in contemplating their possible acquisition of such weapons at some uncertain date. They probably feel, consciously or unconsciously, that CB weapons are no answer to all the influences, economic, political and military, that the strong powers can exercise over them.

III. *National security and CB disarmament*

In the light of this analysis, one would expect that the nuclear powers, notably the Soviet Union and the United States, would see no strong military need for CB weapons and that any need they did see would be in possible conflicts with third countries, not in their mutual confrontation. Secondly, one would expect that some middle powers might see some military attractions in CB weapons and risks in CB disarmament if it were not balanced or if their security were not guaranteed by stronger powers. Thus they might see some national security problems, though not necessarily insuperable ones, in CB disarmament. One would expect that the weak countries would see only advantages in CB disarmament.

In fact, the national positions now taken towards CB disarmament do not fit the pattern indicated by these security interests. The non-nuclear coun-

tries—that is, the middle and weak countries in the classification above—seem nearly unanimous in their support for CB disarmament. Progress towards full CB disarmament is held up by a deadlock between the United States and the Soviet Union about chemical weapons. The United States takes the position that chemical disarmament is impossible now because no one has adequately explored the problem of verifying it; by cheating and launching an attack with nerve gas in Europe, the Soviet Union might achieve a military advantage so significant as to be unacceptable. However the United States supports the British draft biological disarmament treaty. On its side, the Soviet Union has complained that the US posture is motivated by politics, not by the technical considerations put forward by the USA, and for a year and a half supported a draft treaty for CB disarmament that was broad in scope and relied importantly on mutual trust. For verification the draft provided for a complaints procedure through the UN political machinery and otherwise left regular verification to national authorities. In March 1971, however, the Socialist countries in the CCD tabled a new draft that provided only for biological disarmament. We do not discuss this reversal of Soviet negotiating policy here; the immediate point is that the present negotiating positions do not fit in with the "national security" interests discussed above. There appear to be several reasons for this.

To start with, there is the "adding-up effect". Those big nations which believe they have interests and commitments in many parts of the world which they must defend or support will have military plans—and military aid plans—for a large and varied array of contingencies. In a number of these an argument may be made for the use of CB weapons of one kind or another. None of these arguments in its particular scenario may be at all strong, yet the combination of a large number of weak arguments may make a case, or help to make a case, which appears sufficiently strong to persuade the top military and political leaders to decide in favour of the continued possession (or acquisition) of a CBW capability. Going down the scale, weaker and smaller countries will tend to be concerned only with immediate local threats to their security. These are likely to be few. Often they will have only one contingency—or none—in mind.

By the same token, big powers which possess, or could acquire, large military forces are open to the temptation to see advantage in the rule of force in the world exercised without limitations imposed through disarmament or international law; weaker countries, just because they do not possess military strength, are more likely to see advantages in disarmament and the rule of law.

In the United States the actual use of irritant agents in Viet-Nam and,

probably, an interest in keeping open the possibility of using these, and possibly other comparable CW agents, in future anti-guerilla wars must have carried weight in an appraisal of current military interests in CBW. Apart from that, there must have been a political desire to avoid the embarrassment of engaging in negotiation of a chemical disarmament treaty at a time when the armed forces are using some types of chemical weapon in Viet-Nam.

Then there are institutional pressures. In any country which possesses a CBW capability the institutions responsible for maintaining and developing that capability are almost sure to argue against its abolition. Institutional pressures of this kind are inevitable in all walks of life and in all societies. In the case of a CBW capability, the pressures may be rather less strong than in some parts of the war industry. Chemists, biologists, chemical engineers and other people employed in a CBW programme possess skills that are usually in demand. In the case of BW programmes, the laboratories, field testing facilities and so on with which they work are among the best for study of environmental microbiology and related subjects. If funds were provided, such facilities could readily be adapted to work on peaceful problems of applied microbiology, of which there are many in both the rich and less developed countries. But whether or not the economic conditions are favourable to redeployment of men and facilities, the leaders and members of any institution or organization that faces the threat of abolition are likely to oppose abolition until it occurs, because change involves risks and uncertainty, and because it is difficult for individuals or groups to admit that what they have been doing is best stopped. And in any society there may be some ardent militarists who will oppose the abandonment of any weapon in such extreme terms that others, wishing to keep the programme going for reasons that are less extreme and less explicit, will be able to feel moderate and inconspicuous.

A further explanation of the present bargaining positions over CBW is that the countries engaged in the disarmament debate have carried over to the CBW debate postures which they developed in the course of post-war disarmament debates devoted to other subjects—nuclear weapons, general and complete disarmament and partial disarmament measures. These debates have been dominated by the two superpowers. The Soviet Union has tended to make a sweeping and radical proposal, usually with slender provision for verification, while the United States has made a narrow proposal with strong provision for verification. Verification has then become the point of dispute between the two countries. Often it has probably been a proxy issue doing service for the real political obstacles to disarmament.

All these factors appear to have produced the present situation where the

two superpowers are deadlocked over verification of a CB disarmament treaty despite the fact that the possession of chemical or biological weapons appears not to be of great concern to either of them in their confrontation with one another.

Thus the present CB disarmament debate is a highly political affair. It can be understood only against the background of the postures and thinking of the two superpowers and the routines and habits of debate that have developed as disarmament has been discussed over the years in the polarized and somewhat unrepresentative committee in Geneva—unrepresentative in that two of the most important countries in the world, China and France, are absent.

The position of the United States also needs to be seen in political terms. Because it has been using chemical agents in Viet-Nam, because it has had some well-publicized accidents with chemical weapons and because it has been visibly active in the field of CBW, it has been the main focus of criticism abroad and also, owing to its open and vigorous way of debating such matters, the country where domestic criticism has been the most vocal and acute. The wave of criticism of CBW in the United States coincided with, and was indeed one element in, a general wave of anti-militarism provoked mainly by the Viet-Nam War.

It was against this background that CB disarmament was taken up in Geneva and that President Nixon ordered the review of US policy which led to the unilaterial renunciation of biological weapons and toxins, a pledge of no-first-use of lethal and incapacitating chemical weapons, and the decision to seek ratification of the Geneva Protocol—that is, to a compromise between full CB disarmament and no CB disarmament. It is not surprising that there was a compromise: the political and institutional forces making for compromise are always strong in most governments; and at that time the use of irritant agents and defoliants in Viet-Nam must have militated rather decisively against chemical disarmament. Nor is it surprising that the grounds put forward in public for this compromise concerned the problems of verification in the confrontation with the Soviet Union, the other main party to the disarmament debate. To argue with reference to the utility of CB weapons against middle or weak countries would be an indefensible position to assume politically, and one that may scarcely be considered in internal deliberations. The present disarmament debate and the main arms race are an essentially bi-polar affair and the arguments tend to be perceived and presented that way.

Table 3.1. Possible contents of a CB disarmament treaty

Activity to be stopped	1. R& D, production, testing, international trade, possession training, use 2. All the above, for defensive purposes
Species to which ban applies	Biologicals (± toxins), chemicals (± toxins, ± defoliants and ± tear gases), incendiaries
Objects to which ban applies	Agents, appliances (weapons and specialized delivery systems), production facilities, storage facilities, transport facilities, training facilities
Quantitative extent of ban	Complete, or in excess of permitted ceilings (e.g., quantities needed for industrial or police use)
Geographical coverage	Complete, advanced and heavily armed countries only, less advanced and unarmed countries only (i.e., a non-proliferation treaty), regional
Environmental coverage	Complete, marginal (outer space, Antarctica, ocean floor)
Instrument	Formal undertaking, informal agreement, unilateral actions
Verification	Formal international agreements for continuous surveillance or for investigation of allegations with or without veto, agreement on national measures
Enforcement	Obligation on all participating nations: to apply sanctions to violators, to provide general military support to victims, to undertake reprisals in kind or otherwise, to help victim to undertake reprisals, to help victim with CB defences, to establish a standing international service or information system on CB defence, to arouse public opinion. (The UN Charter covers some of this ground.)

IV. *Problems of CB disarmament*

Alternative proposals for CB disarmament

The possible elements in a disarmament treaty or policy can be defined in terms of the variables set out in table 3.1. The list is derived from the summary of past proposals given in Volume IV, and from knowledge of disarmament proposals in other fields.

The basic elements in treaties for disarmament in general, and CB weapons in particular, were thoroughly explored before World War II. The range of possible actions may be modified by scientific progress, for example the development in recent decades of biological weapons and of new techniques of verification. Or more refined methods may be used to specify the agents to be outlawed, for example degrees of toxicity. But most new proposals put forward are half-measures—to tackle biological weapons only, instead of biological and chemical weapons together, or to omit defoliants or irritant agents from the scope of the agreement. If the problem is disintegrated and partial measures are considered, then the number of possible measures increases: the less comprehensive the measures considered, the greater the number of alternatives and hence the greater the scope for debate.

In all these respects CB disarmament is no different from disarmament applied to any other weapons. The listing of variables in table 3.1 can be applied to any weapon. If all types of weapons and activities were included

in such a list, one would arrive at a specification of general and complete disarmament.

In fact any disarmament agreement must contain a central core of provisions, namely, that development, production and stockpiling of the weapons in question is prohibited or limited. Beyond that, any number of questions relating to the scope of the policy may arise. There are three main questions that arise with CBW—though they are not unique to CBW: the extent of the prohibition for different products; the treatment of marginal activities, notably research, and defensive preparations; and verification that these prohibited activities are not being pursued.

Extent of the prohibition

The aim in disarmament is to stop the actual or potential possession of weapons, and specialized inputs that go into them, without stopping the possession of peaceful products. Absolute prohibition of possession is possible only where the weapon or input has no civilian use—or if the civil use is sacrificed for the sake of disarmament.

With CB armaments this raises a number of problems. Some chemical *weapons* and filled apparatus in final form—tear-gas grenades and crop-spraying systems in aircraft filled with herbicide—are used also for civil purposes, i.e., for police and for agricultural and forestry purposes. Some chemical *agents* that can be used in weapons, for example, phosgene and hydrogen cyanide, are also used on a large scale as industrial inputs. Thus there are "dual purpose" chemical products, capable of being put to both military and civil use, at two stages: the final filled *weapon* (or spray apparatus) and the chemical *agent* put into the weapon. The production and possession of both of these can be only limited, not prohibited, if civil use of them is to be unimpaired, i.e., if the police and farmers and foresters are still to have them.

On the other hand, the nerve gases, which at the present time seem to be militarily the most attractive of all CW agents, are not used for civil purposes. Nor are BW agents, except in militarily-insignificant quantities for vaccine production and laboratory use. These agents, and weapons filled with them, can be called "single purpose" products, i.e., for military use only. The production and possession of these can be prohibited subject to minor exceptions.

Then there are unfilled weapons and apparatus for the dissemination of CB agents. These may often differ little from weapons used for other purposes (for example, smoke munitions) or from equipments used for both civil and other military purposes (such as aircraft spray systems used for

Table 3.2. Coverage of proposals for chemical and biological disarmament

	Single-purpose agents			Dual-purpose agents		
	Biologicals ~~~~		Chemicals →			
	Infectious	Toxins	Nerve gases, etc.	Phosgene	Tear gas	Herbicide
Agents						
Research						
Development						
Testing and evaluation						
Production						
Possession of stocks						
Import/export						
Unfilled weapons						
Research						
Development						
Testing and evaluation						
Production						
Possession of stocks						
Import/export						
Filled weapons						
Filling						
Possession of stocks						
Import/export						

agricultural spraying or for laying military smoke screens). The area of overlap may increase if the use of micro-organisms in agriculture, forestry and other civil areas continues to expand. Hence, if police and civil uses are not to be affected, it is possible to ban only those unfilled weapons which are developed specifically for CW or BW usage or to limit production of CW or BW agents to amounts needed for civil use. The significance of such a ban is rather unclear.

It is useful to see how the British draft biological disarmament treaty and the Socialist countries' original draft treaty for CB disarmement approached these problems.[7] This can best be seen by reference to table 3.2, which shows the possible areas which might be covered by a treaty. The British draft treaty deals with the two left hand columns only—biologicals including toxins—but it is not easy to show how many of the activities specified on the left are prohibited. The Socialist countries' draft treaty went right across the table from left to right but again there is difficulty in seeing precisely what activities were to be prohibited. The problems are as follows.

[7] The arguments for and against a biological only treaty if a chemical and biological treaty cannot be agreed are discussed later, pages 120–123. The full texts of the draft treaties are reproduced in Appendix 6.

The British treaty, dealing with biological weapons only, takes agents as its starting point. The parties would undertake "not to produce or otherwise acquire, or assist in or permit the production or acquisition of (i) microbial or other biological agents or toxins of types and in quantities that have no justification for prophylactic or other peaceful purposes; (ii) ancillary equipment or vectors the purpose of which is to facilitate the use of such agents or toxins for hostile purposes". Research aimed at production of these forbidden products is outlawed too; and existing stocks of them are to be destroyed.

The commitment not to acquire or assist others in the acquisition or production of the forbidden products seems to imply that foreign trade is forbidden; and the outlawing of possession and production of agents and of ancillary equipment and vectors seems clearly to mean that filled weapons are outlawed. The uncertainties about the range of coverage occur around research, development and testing, particularly in the light of the British decision to continue defensive research. The treaty outlaws research *aimed at production* of the forbidden products, but it nowhere refers to development or testing, and the meaning of research and production is ambiguous, since it is not possible to do defensive research as it is now practised without production on some scale. A quantitative limit appears to be implied but not stated.

The Socialist countries' draft treaty which dealt with all chemical and biological weapons, focussed on weapons. The original draft provided that each party would undertake "not to develop, produce, stockpile or otherwise acquire chemical and bacteriological (biological) weapons". Stocks of these weapons were to be destroyed. There was no reference to agents.

One of the objections made by the United States to the Socialist countries' draft treaty was that it did not define a "weapon". Did it mean only filled weapons, so that unlimited stockpiling of mustard gas and nerve gas was permitted? How did it deal with dual-purpose agents, such as chlorine and phosgene? And if tear gas was not to be outlawed for police use, how was it to be handled?

After these criticisms were voiced, the Socialist countries amended their text by adding, after the word "weapons", the words "or equipment or vectors specially designed for the use of chemical and bacteriological (biological) weapons as means of warfare". These words have rather ambiguous meanings in English. The word "vector" appears to have been used to convey what in the Russian text was rendered "means of delivery". "Vector" with this wide meaning occurs in French, but usually in English the word "vector" in the context of CBW means an organism which transmits a pathogen. It was presumably in this latter sense that "vector" was used in the

British draft treaty along with "equipment" meaning those bits of equipment that are specific to the delivery of biological agents, e.g., special containers, but not the aircraft carrying them or other weapons. It looks as if these parts of the Socialist countries' draft treaty, which were added as amendments, may have been inspired by the British draft treaty but may not have been adequately adapted to a chemical plus biological treaty or quite correctly translated between English and Russian.

The Socialist countries' draft treaty could have been modified by retaining the focus on weapons, prohibiting completely the production and possession of all those that are single-purpose, and merely excluding from the prohibition tear-gas munitions of types used in police actions and herbicide spray systems.

It can be argued that if this were done it would be enough. National governments should be relied upon to stop preparations for the manufacture of weapons which are outlawed. Or a blanket provision might have been included to the effect that governments should ensure that all such preparations of agents and other inputs not required for civil use were stopped.

The alternative approach to a comprehensive treaty is to apply a more complex set of prohibitions. Thus, in the case of single-purpose items, production of agents as well as weapons can be prohibited, subject to very minor caveats, as in the British draft on BW. In the case of important dual-purpose items, a more complex system could be applied, whereby production of any agent or weapon (such as tear-gas grenades) that was dual-purpose was permitted, up to the limits of civil needs, these perhaps being reported each year. Distinctions of this kind are not new. Thus a system of reporting on production of limited quantities of tear gas for police use was proposed by the United Kingdom and, in slightly modified form, by the United States in 1933, and was also proposed by Yugoslavia in 1970. Recently in Geneva, Sweden made a distinction concerning items to which an "unconditional prohibition" might be applied. It was indicated that the unconditional ban (on single-purpose items) might come first, the conditional ban (on dual-purpose items) following later, since it might be more difficult to work out.

It is important to note that a distinction made on this basis, separating single-purpose from dual-purpose items, places biologicals, the nerve gases and certain other CW agents in the first category; it places phosgene, hydrogen cyanide, tear gas, herbicides and other such chemicals in the second category. There is no justification here for the distinction now being made in the disarmament debate between biologicals (including toxins) on the one hand and chemicals on the other.

Indeed any attempt to draw a distinction between biological and chemical

agents raises problems. These concern toxins.[8] The United Nations group of experts classified them as chemicals. The British draft BW treaty includes them with biological agents; so eventually did President Nixon's renunciation of biological weapons. These problems of definition arise only if CW and BW are treated separately.

In considering what is the best form of CB disarmament treaty it is important to consider how such a treaty would fit together with the existing prohibitions on the use of CB weapons (Chapter 1, above). The irritant agents are the principal problem. The prohibition of their use in war rests on the distinction between what is a war and what is not. There are likely always to be borderline cases about which people disagree, and there are likely to be cases where a conflict starts as something clearly less than war, say, riots, and ends up as a civil war or international war, with the consequent risk that irritant agents which were—and would remain—legitimate within domestic jurisdiction for riot control would be carried over into battle. In order to minimize the likelihood and extent of such misuses of irritant agents,

[8] Toxins have one fundamental difference from micro-organisms, and one fundamental similarity with chemical poisons, in that they are inanimate substances that are not capable of reproducing themselves. They therefore act much more quickly than the microbial pathogens, for there is no incubation time involved (although with many of them, pharmocodynamics rather than breeding-rates impose a latency period). Their main similarity with microbial agents is that some of them are the products of bacteria, and therefore require almost identical manufacturing facilities; this is clearly a highly important consideration in the context of verification. But equally there are other toxins which are not the products of bacteria, and some of them, and maybe eventually some of the bacterial toxins as well, may be accessible to purely chemical synthesis. In the words of the working paper on toxins provided for the CCD by the US delegation "toxins are poisonous substances produced by biological organisms, including microbes, animals and plants" (CCD/286, 28 April 1970). This is a very wide range of substances. At one end are the bacterial toxins such as botulinal toxin and staphylococcal enterotoxin, both of which have been stockpiled as CBW agents, which at present can only be produced microbiologically. In between there are the snake poisons, insect venoms, plant alkaloids, and so on, some of which can be synthesized, and some of which, for example curare and ricin, have been used or considered for use in warfare. At the other end are materials like the fluoracetates which are invariably manufactured by chemical process when they are needed, although they are also produced by biological organisms. (Potassium fluoracetate is the toxic principle of *Dicephalatum cymosum*, a well-known plant hazard to South African cattle; some fluoracetates have been considered as potential water-contaminants for CW purposes.) These latter materials provide a graphic illustration of the difficulty of classifying toxins; another example of this type of toxin is hydrogen cyanide, a standard CW agent of both world wars and very widely used industrially, which occurs in some four hundred varieties of plant, in certain animals, and is synthesized by at least one bacterium (*Bacillus pyocyaneus*). Even if toxins are defined to include only protein agents in order to exclude hydrogen cyanide and the like (see the definition of "toxin" in *Webster's Seventh New Collegiate Dictionary*, 1969 edition), there are still difficulties. Nonproteinaceous toxins include such materals as tetrodotoxin, batrachotoxin and saxitoxin, which, apart from the botulinal and tetanal toxins, are among the most poisonous substances known to man; and one of them, saxitoxin (which has been stockpiled as a CBW agent), is accessible by applying microbiological culture techniques to algae that are capable of producing it.

a disarmament treaty should aim to limit the production of irritant agents to what is needed for riot-control purposes and no more. As is indicated above, the limitation on production could be applied with respect to quantities (reported periodically, and perhaps agreed in advance too) or it could be applied with respect to specific types of irritant-agent weapons only, permitting production only of small, hand-thrown grenades and any other short-range instruments usable in riot control and forbidding altogether production of free-fall bombs, shells or other weapons which are plainly suited to use in war and not in riots. Both types of limitation—quantitative and qualitative—on the production of irritant-agent weapons could be combined, and so could comparable constraints on the quantity and types of agents that are allowed to be produced. In what detail such limitations should be specified is a tricky issue. Detailed descriptions in terms of today's weapons may become outdated by technical advance and are therefore unsatisfactory, unless a review procedure is established to keep up-to-date a list of permitted items and to survey quantities. General descriptions are probably more satisfactory, though they may suffer from elasticity when politicians and lawyers attack their interpretation.

The important point, however, is that the various constraints should interlock and so reinforce one another. For this purpose, a qualitative limitation on the permitted types of non-controlled weapons and agents looks like a promising step. It might be simpler to negotiate and enforce than a quantitative limit.

Defensive preparations

Among advanced countries, where there has been a history of CBW preparations, there may be reluctance to abandon or outlaw defensive measures at the same time as offensive CBW capabilities are abolished. It is likely to be argued that if, as is always the case, one cannot be completely sure that disarmament will be observed, then it is wise to maintain, or at least to be permitted to maintain, defensive preparations.

Yet the maintenance of defensive preparations, while caused in this way by mistrust, will also tend to generate mistrust. In the first place, defensive preparations, for example training in how to fight in anti-gas equipment, is a large part of training in the offensive use of CBW. Secondly, defensive research is usually considered to require the production of small quantities of CBW agents, single-purpose as well as dual-purpose, and it is likely to include the search for possible new agents, the testing of them to see if they look potent operationally, and so on. Defensive research is then indistinguishable from offensive research, including some phases of development,

i.e., it comprises not just a search for possible agents but also the more intensive study of their toxicity and of other properties that make them suitable as CBW agents.[9]

Moreover, if defensive research is maintained on a national basis on these lines and is surrounded by complete or partial secrecy, there seems to be a considerable probability that suspicion will be aroused in other countries. The researchers will concentrate their work on the most dangerous new potential agents or weapons, seeking to find answers to them. Yet it is work on those agents that will arouse most suspicion.

In an ideal world the best would be to abolish defensive preparations. That requires a favourable political climate—and may help to reinforce a favourable climate. Such conditions might obtain in parts of the less-developed world, which do not yet possess CBW capabilities, if the risk that more advanced countries might introduce or use CB weapons, including irritant agents and defoliants, in these areas was removed. That indeed is another reason for preserving the comprehensive interpretation of the prohibition of use. But among advanced countries, and so long as there is hostility and suspicion, lack of defences may be reckoned to increase the incentives to cheat and attack.

An alternative solution is to make defensive work open and to internationalize it as much as possible. This might be achieved by establishing an international information system and by internationalizing work, having more exchanges between laboratories in the relevant fields and using existing or specially created international organizations to help with advice or in mobilizing defensive aid. In the case of BW defensive research, the international epidemiological work of the WHO is directly relevant and indeed suitable (with some development) to the task.

Research and development

Related to this is the question whether, and in what way, CBW research can be outlawed. It is often asserted that "research cannot be outlawed" since it is part of science, usually regarded as a sacrosanct activity. But to say this is to beg the question. It is the systematic search for new CBW agents, or the exploration of their qualities and their development after they have been found accidentally, that needs to be stopped, not the peaceful pursuit of scientific research even though such activities will give rise accidentally to discoveries that could be of military interest.

[9] For definitions of research, development and other phases in a programme, see Appendix 2.

In fact, there is no reason why CBW research, as defined above, should not be outlawed. Effectively no one does this kind of work, unless a government not only sanctions it but commissions people to do it, and scientists would stop this sort of research if the government ceased to do that. The law would be a formal expression of the common disinterest in, and distaste for, the work, as well as a commitment between governments. Scientists would not find their peaceful work in any way inhibited; and it is not likely that many scientists would be led unwittingly to undertake forbidden work unless the political and economic climate was one in which they had a strong desire to deceive themselves and conform to the wishes of the authorities.

The danger in letting research and development go on is that it may yield new and more attractive weapons, so increasing the incentives to acquire and use a CBW capability. Moreover if research and development is allowed, there is likely to be competition between nations—a research and development race. This is bound to be a threat to a disarmament treaty and to the array of constraints surrounding CBW. It is a welcome feature of the British and Socialist countries' draft treaties that they both appear to ban, or at least to limit, offensive research and development. If it came into force, either treaty would be an advance on the disarmament treaties in force so far. Research and development in arms appears never yet to have been curtailed in a disarmament treaty.

The need for verification

In the present (and pre-war) CB disarmament negotiations, as well as in recent disarmament negotiations concerning other types of weapons, one of the main issues of dispute has been verification, that is, the problem of assuring that a disarmament agreement is being observed. As noted earlier, the question of verification often appears to have been a proxy issue doing service for the underlying political differences. This probably has happened not so much because people have consciously decided to use verification falsely as an issue—though that probably does happen—as because it is the issue through which mistrust and fear of the other side is most easily expressed in negotiation and in public political statements.

It is best to start from the assumption that nations will not usually make agreements unless they intend to observe them and to ask whether and where cheating might occur, that is, what, if anything, must be guarded against. It is a mistake to approach the problem the other way round, assuming, implicitly if not explicitly, that nations will usually make agreements and cheat, and that honesty will be the exception. That is unrealistic. If mistrust is as bad as that, there is not likely to be a treaty anyway.

It is then necessary to consider what, if anything, the parties to an agreement would gain or lose from cheating, in military terms and, more broadly, in political terms, and secondly, it is necessary to ask what degree of verification can be achieved through existing channels of information and what more could be achieved if special means were developed unilaterally or by negotiation.

In this last context, a good deal depends on the political conditions that prevail between the pair or group of countries considering an agreement. If CB disarmament were part of a major reconciliation in which more general disarmament was taking place, then a major change in the atmosphere and opening up of communication between the rival blocs and rival countries might be postulated. At present, this is scarcely so as regards any part of the world where countries might agree to CB disarmament. Hence one must not assume that the climate, general or local, will improve and one must consider what flows of information are available now and what specific changes might be negotiated or made otherwise in this one field.

The problems of verifying chemical and biological disarmament differ in some degree. Because development and maybe even production of biological agents is more likely to be conducted largely within the scientific community than in the industrial community, there is a good chance of knowing from open literature and from communication between scientists where a BW programme might take place, who might work on it and, possibly, whether a programme is being undertaken at any given time. In this respect the position, however, is changing as industrial production of biological products is developed for new uses. A "biological industry" already exists on a significant scale producing pharmaceutical products. It is now expanding into the production of biological control agents (micro-organisms that are produced in order to destroy insects and pests, for example, plant parasites, locusts or rats).

But verification of biological disarmament is no longer an issue. When the United States renounced biological weapons, it did so without making its action conditional on reciprocity or verification. It apparently reached this policy after weighing its national security interests as regards biological weapons. The British draft treaty on biological disarmament, as noted later, makes only modest provision for verification and so does the Socialist countries' draft treaty. It is therefore possible to concentrate on verification of a chemical disarmament treaty.

The analysis of military aspects of CB weapons given earlier suggests the following conclusions as regards the military arguments for verification of a chemical disarmament treaty:

1. The nuclear powers need not worry much about verification. It is true

that reciprocity and verification might become more important if there was a move towards general disarmament or nuclear disarmament, such that the level of weapons other than chemical weapons was reduced to the point where the possession of chemical weapons alone would make a significant difference to the balance of military strength. At that stage it might be necessary to seek reassurance that the other side had genuinely got rid of its CW capability. Thus one might think in terms of quite informal and unilateral acts to get rid of CBW capabilities now, followed by more formal reciprocal arrangements and possibly by formal provisions for verification if general disarmament or nuclear disarmament negotiations began to gather momentum.

It may be wrong, however, to think that elaborate formal measures would be needed then. If détente, the recognition of the futility of the arms race, and the achievement of mutual trust had reached the point where substantial disarmament was possible in the nuclear field, then it is quite likely that open communications and the free flow of information between the different nations involved would have reached the point where formal provision for verification became a fairly easy matter, entailing a rather slight and unexciting addition to a well-developed system of exchanges of information and people.

2. On our analysis, some middle countries might, on military grounds, feel some concern about verification of a chemical disarmament agreement. One cannot rule out the possibility that one-sided possession of chemical weapons in a confrontation between middle countries (which by definition are capable of producing CB weapons from their own resources) could be thought to yield a military advantage—though this does not mean to say that such an advantage would actually exist: there are wider considerations to take into account, including the extent to which the potential victims could rely upon international support and aid, defensive or offensive, whether provided by a stronger ally on a bilateral basis or through the United Nations or some other machinery on a wider basis, and, secondly, the general and long-term benefits of avoiding a CB arms race.[10]

3. Weak countries (which by definition are incapable of producing their own CW or BW capabilities) are not likely to reckon that their military position will be damaged by chemical or biological disarmament on account of imperfect verification. They might prefer a well-verified treaty, but a

[10] If adopted, the military proposition that a middle power by acquiring a CBW capability could help to deter nuclear powers would not mean that the middle power was concerned about verification, only that it opposed disarmament. But there is no evidence that any middle power has adopted this policy—and some evidence of the policy would be needed if it were to deter anyone.

poorly-verified one will be better for them than none. So long as the treaty has a positive effect in reducing possession of these weapons among the more powerful countries, the position of the weak will be improved.

The degree of hostility which will enter into people's calculations when they contemplate the need for verification will be almost inseparable from their general assessment of the political climate. It is scarcely a separate variable. One can identify particular areas where hostility is high—the conflict between Israel and its neighbours in the Middle East and, in Africa, the conflict between South Africa and its black neighbours—but one cannot do much more.

Techniques of verification

The question of what can be achieved by different techniques of verification is analysed in Appendix 2. The object of the analysis is to show what kinds of information can be achieved with different degrees of intrusion. It deals primarily with biological weapons and the nerve gases, these being the most potent CBW agents. As regards dual-purpose chemical agents, for example, phosgene, chlorine, tear gases and herbicides, the task of verification would be either to enforce a qualitative ban on filled weapons of the forbidden types or to enforce a quantitative limitation on supplies of the agents, so as to ensure that supplies in excess of civilian requirements were not produced and diverted to military usage. Techniques of the latter kind are already in use for fissile material that can be used in making nuclear weapons and, in a different context, for narcotics. To a large degree, reliance is placed on national reporting. In the case of fissile material the IAEA operates a system of intrusive on-site inspection. Under the Non-Proliferation Treaty it will be applied on an obligatory basis to non-nuclear countries.

It is clear—indeed it is a truism—that if the political will and openness existed, techniques could be devised which would produce a high level of verification. The real question is whether the potential parties to a disarmament agreement are ready to open up significantly and whether, if they did, anyone would bother much with formal standing provision for verification and would not feel that openness in itself created a sufficient basis for trust.

As regards existing flows of information, the degree of openness varies according to the type of society—though all societies tend to be open as regards scientific literature.[11] Otherwise the degree of openness tends broadly to be related to the degree of friendliness between governments.

Altogether the need for formal verification machinery seems relatively slight in the case of CBW. Moreover, as is noted below with reference to

[11] See Appendix 2, page 145.

complaints procedures, it can be argued that verification procedures may create distrust or that they will allay it. There are respectable authorities for both opinions.

Complaints procedures

If formal provision is made for verification of a CB disarmament agreement, two main approaches are possible. A permanent international inspectorate can be established to collect and analyse information. One such system, the WEU system, exists for CB and other types of weapons, but it operates only within the military alliance in Western Europe.[12] Alternatively, reliance may be placed on a complaints procedure under which countries may bring forward information that they have gathered themselves and ask that further investigations or action be taken. Both the British and Socialist countries' draft treaties on biological disarmament provide for complaints procedures, though in slightly differing forms.

If an international inspectorate is established, it means that those countries which subscribe to the system agree in advance that inspectors should, within limits provided for in the agreement, be permitted to enter their country and do their job. With a complaints procedure, reliance must be placed on other channels of information—open literature, communication between scientists or other types of experts, reconnaissance satellites, secret intelligence, and so on. In proposals of this kind, it is usually provided that an accused country should cooperate in the investigation of a complaint made against it. The problem is to decide what constitutes a *prima facie* case sufficiently strong to justify investigation of this kind. A similar problem will arise if there is an international inspectorate. If the inspectorate finds suspicious evidence it will have at some stage to report to a superior body—for example an inspectorate board created for this purpose or the UN Security Council or General Assembly—and that body will have to decide if the evidence justifies further investigation, or action of some other kind. This may not be easy, since that body, made up of representatives of different nations, is likely to include the accused or some of his friends and some of his enemies. With an inspectorate there should be better evidence on which to base a decision than there would be if purely national means of information were relied upon in the first instance, and in that respect an inspectorate may constitute a stronger deterrent to cheating than would a complaints procedure. But with either system one eventually comes up against the possible unwillingness of the accused, abetted by his friends, to permit further

[12] See Appendix 3 for details.

inspection. And obstruction can be critical, even if it is only temporary, since speed is often essential if evidence is not to vanish.

The way in which the accuser and accused may influence one another in this context is not altogether simple. Any country which refuses to allow a complaint to be investigated is likely to arouse or aggravate suspicion against itself. If a completely unfounded accusation is made against it, the accused may decide to invite people in to see that the accusation is false and to demonstrate its virtue, rather than to resist the accusation and argue that a *prima facie* case has not been established. Moreover, knowledge that the accused country may behave in this way may help to deter people from putting forward frivolous accusations. But these are patterns of behaviour that cannot by any means be relied upon to occur. When accusations are made, they are likely to be part of a political, if not a military, conflict between nations, and in that case they are likely to make the tension worse. If hostility is therefore strong and propaganda intense, there is a risk of intemperate behaviour, the flat denial of accusations, counter-accusations, and so on. That has happened over accusations of use of CB weapons.

The relative merits of reliance on formal international arrangements for inspection on the one hand, and reliance on national commitments supplemented in greater or lesser degree by complaints procedures on the other, were debated at length in the inter-war years. The debate was inconclusive. In 1926 the delegates of one group of countries, including Britain and the United States, declared that they were

> ... firmly of the opinion that any form of supervision or control of armaments by an international body is more calculated to foment ill-will and suspicion between States than to create a spirit of international confidence, [and] that the execution of the provisions of any Convention ... must depend upon the good faith of nations scrupulously to carry out their treaty obligations.[13]

Another group, of which France was the leading member, took the opposite view. The French argued that in the absence of a supervisory system

> ... you will have created a state of mistrust and that, in the absence of detailed information and with a prevailing impression that the Convention is not being scrupulously applied in one quarter or another, other parties will be tempted to embark on the same course?[14]

[13] League of Nations, Preparatory Commission for the Disarmament Conference: *Report of Sub-Commission A (Military, Naval and Air)*, C.739.M.278.1926.IX–C.P.D. 28 (Geneva, December 1926), pp. 167–169, cited by R. D. Burns, *infra*, note 12, p. 590.
[14] *Docs. Prep. Conf., Series IV*, C.310, M.109.1927.IX–C.P.D.1(c) (Geneva, 1927), pp. 24–25, cited by R. D. Burns, *infra*, note 12, p. 592.

It is striking how the United States and the Soviet Union have reversed their positions since that debate. Until late in the inter-war years the United States opposed supervision arguing that disarmament must rest on good faith.[15] The Soviet Union, in its disarmament plan of March 1928, proposed supervision and inspection based on openness.

The present position

Viewed against this background, the positions now taken on chemical verification in Geneva, and the strengths and weaknesses of these positions, appear to be as follows:

1. The position taken by the Soviet Union means that disarmament should rest upon trust, subject to provision for complaints. This can be a respectable position. But trust between nations or any groups of people is not likely to exist unless there is open communication between them. To propose a procedure which depends upon trust when that general freedom of communication which is a prerequisite of trust is lacking is a contradictory position. But this does not mean that the Soviet Union's position is now the operational obstacle to agreement. As noted earlier, chemical verification seems unnecessary anyway between the two superpowers. In other words, not much trust is called for.

2. The position of the United States might be explained by a reluctance to forego formal provision for verification in a way that created a precedent for other types of disarmament. The view that a CW capability does not matter in the confrontation between the United States and the Soviet Union because nuclear weapons are decisive could be extended to other non-nuclear weapons. But this seems a weak explanation; it was not the policy followed on US unilateral biological disarmament, where verification was not demanded. Most probably a whole combination of considerations and pressures contributed to the formation of the US position. In 1970 it seemed to become rather inflexible. In the summer, the US delegate in Geneva restated his country's requirements for verification in terms that were incapable of satisfaction. Thus whereas the United States had previously stated that on-site inspection was needed, with the implication that it had in mind some demand for inspection that was technically capable of satisfaction if the other side made concessions, the US delegate in August asked the rhetorical question: "... What would be adequate verification for a comprehensive chemical weapons convention?" and provided the answer, "in all frankness we must respond that we do not know the answer to that

[15] *See* Professor R. D. Burns, "International Arms Inspection Policies Between World Wars, 1919–1934", *The Historian* 31 (4), August 1969.

question. Only future study ... will in time provide the answer."[16] In this speech the US delegate had said, by way of explanation of his country's decision to renounce biological weapons and to support a disarmament treaty covering biological weapons only, "I might add that this was a political decision, one based on all relevant factors: political, military and technical."[17] The message of the speech seemed pretty clearly to have been that the United States was simply not ready to agree to chemical disarmament.

3. The smaller countries—in so far as one can generalize—say explicitly or implicitly that reliance should be placed on trust plus open information flows, provision for the analysis of public information and so on. Positions differ in detail. The emphasis on openness seems entirely right. If there is a weakness in their positions it is that they concentrate on possible solutions to the verification argument between the two superpowers. That is understandable, given the bi-polar nature of the debate. But the effect may be to aggravate rather than to ease the impasse. It might be more valuable if they were to question more closely whether the two superpowers are not the two nations who, so far as their security is concerned, need not bother about mutual verification of chemical disarmament now.

V. *CB disarmament or biological disarmament only?*

Before the *volte face* of the Socialist countries, the major controversy was whether it would be better to have only a biological disarmament treaty than to have nothing, if this were the only alternative. Even now the issues involved are by no means academic.

The main argument usually made against the adoption of a treaty dealing with biological weapons only is, of course, that it would be a less comprehensive and militarily less meaningful measure than a treaty prohibiting both chemical and biological weapons. Further, because it would split the category of CB weapons in respect of which there has been a single taboo and a single body of law hitherto, and because it would single out biological weapons for abolition while permitting the continued production and possession of chemical weapons, it might come to be understood or construed as an act which in some degree condoned chemical weapons. The strategic theorist may argue that the purpose of possessing chemical weapons would be only to prevent use through deterrence, but the layman or ordinary soldier,

[16] Disarmament Conference document, CCD/PV 491.
[17] *Ibid.*

whose instincts in these matters are perhaps more relevant, may feel that the existence of a weapon in the armoury is bound, through familiarity and availability, to make the possible use of that weapon more credible and acceptable than if it were not there.

To the risk of appearing to condone chemical weapons must be added the risk of confusing the public as to what is forbidden by splitting up the traditional unity of CB weapons in law and policy. This risk is aggravated by two factors. First, the unity of the category is already threatened by the use of irritant agents in war and the attempts to claim legality for it. Second, as noted earlier, it is debatable how the boundary between CW and BW agents should be drawn.

Moreover—and this is an important point—a biological only treaty might have little practical effect. Biological weapons have already been renounced unilaterally by the United States, the one power which is known for certain to have had an offensive BW programme. So a biological disarmament treaty would abolish a weapon that may effectively have been rejected anyway.

Recently, there has been a trend to negotiate "partial measures" of disarmament whose contents have been strictly limited. Treaties banning the militarization of Antarctica, the conduct of nuclear tests above ground and the placing of nuclear or CB weapons in orbit have been concluded, as well as a treaty banning nuclear weapons in Latin America and the Non-Proliferation Treaty whereby most nations without nuclear weapons have agreed to stay without them. A treaty banning the fixing of "weapons of mass destruction" (a term which certainly embraces nuclear, chemical and biological weapons) to the ocean bed has recently been signed. These treaties have stopped activities which were marginal to the arms race. Thus the military attractions of Antarctica and of putting weapons in orbit were not great when the treaties were made; the Partial Test Ban Treaty has reduced contamination of the atmosphere but nuclear tests, now conducted underground, have continued unabated; the nuclear-free zone treaty for Latin America and the Non-Proliferation Treaty have mainly meant that those who had neither the resources nor the desire to acquire nuclear weapons have acknowledged those facts. The draft treaty for demilitarization of the ocean floor is almost devoid of content. In short, these treaties have forbidden people to do things that they actually have little or no interest in doing.

The trend towards treaties of this kind can readily be explained. The hesitation of politicians in approaching disarmament, the opposition of the militarists and the ignorance of the public are such that agreements that deny little to the military yet have a "cosmetic" effect, giving the public an impression of order and progress, are likely to be the easiest to negotiate

between the various factions within the national administrations and, consequently, between the nations.

A treaty dealing with biological weapons only can be seen as another "cosmetic" treaty arrived at in the same way as its precursors. Chemical weapons are the important category militarily and, precisely for this reason, their abolition is obstructed. Biological weapons have few, if any, military attractions, so the opposition to their abolition can be overcome.

In defence of a treaty dealing with biological weapons only, it can be said that it would have much more substance and value than some of the cosmetic treaties that have been achieved so far. There may be countries which secretly possess offensive BW capabilities now which would be persuaded to abolish them, and in future all countries which subscribed to the treaty would be deterred from acquiring biological weapons both by the letter of the treaty and by its general effect in helping to prevent a biological arms race. The future technical development of biological weapons, the nature of which cannot be known, would be stopped. The spectre of biological warfare might be buried, the long-term risks described in Chapter 2 avoided.

Various compromises have been proposed whereby a treaty would be made which introduced biological disarmament now and committed the parties to take steps of some kind in the direction of chemical disarmament later. The British draft biological treaty includes a commitment to pursue negotiations on chemical weapons "in good faith", and rather more binding provisions for further action on chemical disarmament are contained in the Socialist countries' new draft.

Analogous commitments to further action were written into the Non-Proliferation Treaty, both as regards the negotiation of safeguards (i.e., inspection procedures) to be applied compulsorily to non-nuclear nations, and as regards negotiations between the Soviet Union and the United States to stop their nuclear arms race (i.e., the Strategic Arms Limitation Talks—SALT). It is too early to say how successful the procedure has been. The SALT negotiations and safeguard negotiations are both under way.

At the time of writing (August 1971), a biological disarmament treaty stipulating further action on chemical disarmament seems to be the most that can be hoped for in the near future. Yet, as we have emphasized in this volume, the present wave of concern about CBW, and the focus of attention on CBW in the international disarmament arena, provide a rare opportunity for action on both chemical and biological weapons. It is important that this opportunity be exploited to the full before concern about CBW abates. Already these weapons are nearer to elimination than any others. Moreover the United States has already gone a considerable

distance in reversing its active policies in the field of CBW. It has renounced possession of biological weapons and first use of chemical weapons, other than irritants and defoliants; it is ending the use of defoliants in Viet-Nam; it has stated that the permission of the President will be needed before irritant or defoliant agents are used in future conflicts; recently less has been heard about the use of irritants in Viet-Nam. It seems reasonable to ask whether the United States could not reconsider its policies towards chemical disarmament. Correspondingly, the Soviet Union might reconsider its policy towards verification, not just as regards chemical disarmament, but also in respect of other types of disarmament where verification may matter more. Such a move, even thought indirect, might help politically to ease the deadlock over chemical disarmament.

Appendix 1. The claims that CB weapons are less inhumane than other weapons

On many occasions since World War I—and even before it—the claim has been made that CB weapons provide a means for decreasing the barbarity of war. It has been argued that CB weapons can cause less human suffering than other types of weapon, and that they therefore provide the more humane alternative. This argument has been used on almost every occasion when the protagonists of CB weapons have tried to advance their cause or have come under attack. It has been used to justify actual use of CB weapons in combat, to promote claims for greater support of peacetime CBW programmes, and to resist drives for CB disarmament. With the United States at last moving towards ratification of the 1925 Geneva Protocol, the argument is again being heard from protagonists of CB weapons.[1] For these reasons, we have thought it useful to analyse its main features here.

I. *The origins of the humanity argument*

The first strongly-motivated use of the humanity argument was by wartime propaganda writers in Germany during World War I. Stimulated by the outcry raised by their counterparts in Britain against German use of poison gas in April 1915, they produced a succession of newspaper articles and radio broadcasts which maintained that gas was less horrible than explosives because it did not mutilate its victims and that in contrast to the British claims it produced a rapid and painless death. These propaganda controversies were intermittent and were never sustained for very long; not until some time after the war were their various contentions again exploited. As described in Volume I of this study, this occurred during the various publicity campaigns mounted during the 1920s in the USA and the UK by the chemical industries in their efforts to secure protective tariffs, by the US Army Chemical Warfare Service (CWS) in support of its continued existence as an independent Technical Service, and by opponents of the various international agreements that were being negotiated to abolish CBW.

[1] J. H. Rothschild, "The Myth of 'Humane' Weapons", *New York Times* 13 October 1970.

At this time there were two distinct strands in the humanity argument. First, there was the proposition that chemical weapons were less inhumane than other weapons because they could be militarily effective without killing large numbers of people: they could cause injuries that were as disabling as those caused by any other weapon but which their victims were more likely to survive. This proposition found support in the casualty statistics being published in the various official histories of the war. Those for the British Expeditionary Force are quoted in Volume I of this study: they disclose an overall mortality rate[2] among gas casualties of around 2 per cent, as compared with 20 to 30 per cent for other types of battle casualty. The figures for the American Expeditionary Force are still more striking, and in 1928 the US Army CWS published an entire book which exhaustively analysed these statistics in support of the humanity argument.[3]

The second strand in the humanity argument was the proposition that chemical weapons were less inhumane than other weapons because gas casualties suffered less from their injuries than did other types of battle casualty as regards both immediate effects and, if they did not die, chronic after-effects. Support for this proposition was taken from the official casualty statistics of the war and from the records of the various war-pensions offices, for these were claimed to show that the incidence of chronic disability was lower among war veterans who had been gas casualties than among those who had suffered other types of battle injury. Some veterans also claimed that, from their own experience, the effects of being gassed were less unpleasant than the effects of shell or bullet wounds. A British commentator who shared this opinion was J. B. S. Haldane who, in 1925, published a short book entitled *Callinicus: a Defence of Chemical Warfare* that even today remains the most forceful statement of the humanity argument for chemical weapons.

By this time a third and more ambitious input to the argument was beginning to grow in strength. This was the notion that chemical weapons held out the possibility not merely of reducing death and permanent injury in time of war but of eliminating them altogether. A gas might be developed which, instead of asphyxiating or burning people, might put them to sleep or otherwise incapacitate them for a while. This was in fact rather an old idea. In 1864, for example, Dr B. W. Richardson had written in connection with chemical weapons:

[2] The expression "mortality rate" is used here to indicate the proportion of casualties caused by a particular weapon who die from their injuries. When applied to biological weapons, it has the rather more specific meaning of the proportion of people infected by the weapons who eventually die from the disease that may follow infection.

[3] H. L. Gilchrist, *A Comparative Study of World War Casualties from Gas and Other Weapons* (Washington, 1928).

I feel it a duty to state openly and boldly, that if science were to be allowed her full swing, if society would really allow that "all is fair in war", war might be banished at once from the earth as a game which neither subject nor king dare play at. Globes that could distribute liquid fire [an allusion to the Greek Fire projectiles reportedly being used in the American Civil War] could also distribute lethal agents, within the breath of which no man, however puissant, could stand and live, ... I do not see that humanity should revolt; for would it not be better to destroy a host ... by making men fall as in a mystical sleep, than to let down on them another host to break their bones, tear their limbs asunder, and gouge out their entrails with three-cornered pikes;—leaving a vast majority undead, and writhing for hours in the torments of the damned? I conceive, for one, that science would be blessed in spreading her wings on the blast, and breathing into the face of a desperate horde of men a prolonged sleep—for it need not necessarily be a death—which they could not grapple with, and which would yield them up with their implements of murder to an enemy that in the immensity of its power could afford to be as merciful as Heaven.[4]

Likewise, in 1915, a patent application had been filed in London on a chemical weapon

... for rendering enemy troops incapable of offering effective resistance, without necessarily permanently incapacitating them.

Poisonous or asphyxiating gases have already been projected directly or in projectiles, or permitted to drift against troops, but the use of such gases with their frequently permanently disabling effects, is contrary to humane precepts. ...

Now according to the present invention, it is proposed to project against enemy troops a powder or vapour which, by its action on persons exposed to its influence, temporarily so excites same or alternatively so paralyses a physical function, that they become temporarily incapable of defending themselves. ... The effects of the above mentioned powder [veratrum, the active principle of green hellebore] when inhaled endure for a period longer than that necessary ... for the cloud of powder to become deposited or disseminated so that the troops overcome by the effects can be captured by their opponents after all liability has ceased of the latter also becoming affected by the powder on advancing.[5]

The comparatively mild character of mustard-gas injuries, and the claims made for their relative humaneness, revived this notion of incapacitating agents during the 1920s. At that time, however, such agents were not feasible technologically, and the "war without death" vision of future chemical warfare remained almost exclusively a subject for science fiction writers.[6] One

[4] B. W. Richardson, "Greek Fire: its Ancient and Modern History", *Popular Science Review* 3: 164–177, 1864.

[5] W. Hill, provisional specification for British Patent Application No. 8422 of 1915, filed on 7 June 1915.

[6] I. F. Clarke's recent study of speculative fictions about the nature of future war, *Voices Prophesying War, 1763–1984* (London, 1966), contains discussion of the works of many such writers.

such fiction was elaborated by H. G. Wells in his book *The Shape of Things to Come* (London, 1933). In this story, a broken-down society, which had been torn apart by war and had reverted to pre-industrial life under the rule of warlords, was conquered by a new science-based society, which overwhelmed it by putting everyone to sleep with bombs of anaesthetizing gas and then quickly took over to produce a new age of peace and technological progress. With the possible exception of J. B. S. Haldane,[7] very few military or nonfiction writers ventured at all seriously into this field until the late 1950s, when science had progressed rather further in the direction suggested by these science fiction writers. Until then, the possibilities of incapacitating agents were expounded for entertainment only, and not in support of objectives sought by protagonists of CB weapons.

It was in the late 1950s that the next substantial controversy arose in which the humanity argument was again widely deployed in the cause of CB weapons. At this time the US Army CWS, by now renamed "Chemical Corps", was seeking to expand its activities, and therefore wanted larger budgetary appropriations. The moment was favourable for this, for US military authorities were beginning to move away from the doctrine of massive retaliation to one of flexible response, and a case could be made that, in the absence of a first-use prohibition, CB weapons were suited to this new doctrine. Around 1958 the Chemical Corps therefore mounted an extensive publicity campaign for the express purpose of increasing the acceptability of CB weapons.[8, 9]

The outcome seems to have been successful. After a succession of hearings on CBW by Congressional committees, the appropriations for the Chemical

[7] In *Callinicus,* Haldane has this passage: "In order to make future wars humane it would only be necessary to introduce the two following rules: 1. No goggles or other eye protection shall be worn; 2. No shells shall be used containing any other substance save ethyl iodo-acetate (or other lachrymatory compound) and a small bursting charge. Certainly it is unlikely that such rules will ever be adopted, but I do contend that to forbid the use of such substances is a piece of sentimentalism as cruel as it is ridiculous." He went on to argue that "the objection to scientific weapons such as the gases of the late War, and such new devices as may be employed in the next, is essentially an objection to the unknown".

[8] In 1955 the *Miller Report* [O. N. Miller, et al., *Report of the Ad Hoc Advisory Committee on Chemical Corps Mission and Structure,* August 6, 1955] had advised the Chemical Corps to mount a publicity campaign in order to secure "a more candid recognition of the proper place of chemical and biological warfare". The report was the product of a special civilian committee that had been convened by the Chief Chemical Officer of the US Army in March 1955 in order to "study and evaluate the current mission assignments to the Chemical Corps and the existing organization structure and relationships, to make recommendations for mission change and for the optimum organization structure within which the Chemical Corps can most effectively accomplish its mission". The report was followed by a radical reorganization of the Chemical Corps (see *Armed Forces Chemical Journal* 10 (6): 18–19, 28, 1956).

[9] W. Schneir, "The Campaign to Make Chemical Warfare Respectable", *The Reporter* 1 October 1959, pp. 24–28.

Corps were quintupled over a five-year period and manufacturing programmes for CBW matériel were expanded. One result of this was the accumulation of a massive stockpile of a new type of nerve gas (VX) and a significant quantity of novel biological weapons.

The humanity argument was a central feature of this campaign. All the old propositions based on World War I casualty statistics were revived, sometimes with interpolations based on events of the intervening decades. One of these was the proposition that if US forces had used chemical weapons during the Pacific Islands campaigns of World War II, for example at Iwo Jima (where 21 000 Japanese inflicted 25 000 US casualties before succumbing), the total loss of life, Japanese and US, would have been much less. Another addition was a statement by someone who had recovered from a serious accident with nerve gas that he did not remember suffering at all during his intoxication.[10] By now, however, technological development had made the third strand of the humanity argument rather more credible. The possibilities of incapacitating agents now dominated the humanitarian case for CB weapons, and were graphically suggested by a well-publicized live demonstration to a Congressional committee of the effects of certain hallucinogenic and paralysant drugs on animals. A film was circulated showing a cat which had received a dose of LSD cowering before a mouse. Chemical Corps officials were in fact rather careful not to claim either that the available candidate incapacitating CW agents were yet well suited to procurement, or that they were especially attractive militarily. (In fact the Corps' initial interest in these substances seems to have been as training agents for use on manoeuvres:[11] for combat purposes the only incapacitating agents that had substantial attractions were biological ones, but scenarios illustrating the use of these were presented only in secret testimony.) But people's imaginations had been fired by what they had been told, so that a wealth of new speculations about war without death began to appear in the press, not only in American journals, but also in European ones. Among these was a suggestion that incapacitating agents might be used to arm international peace-keeping forces in a disarmed world.[10, 12]

While Chemical Corps spokesmen did not go so far as to argue that a future war was ever likely to be fought with incapacitating agents alone, they did maintain that the agents offered possibilities for reducing overall loss of life. Thus it was claimed that the use of "psychochemicals", which by a

[10] J. H. Rothschild, *Tomorrow's Weapons* (New York, 1964), p. 3.
[11] E. A. Metcalf, "Brainstorming in the Search for Chemical Warfare Agents", *Archives of Industrial Health* 17: 371–376, 1958.
[12] A. C. Nunn, "The Arming of an International Police", *Journal of Peace Research* 1965 (2): 187–191.

psychotropic action weakened the will to fight or upset the cohesion of fighting units, could hasten the defeat of enemy forces and thereby reduce the number of casualties. Similar results might be achieved, so it was suggested, with agents producing a more direct physical incapacitation that lowered the ability of the enemy to use his weapons or other equipment. Again, incapacitating agents might be used to engage enemy forces in populated areas without excessive damage to noncombatants, or to aid in the rescue of prisoners or hostages from enemy captivity. Many such examples were presented, and there can be little doubt that, through their apparent combination of military and humanitarian benefits, they aroused much interest in CB weapons in influential circles.

The most recent expressions of the humanity argument have been in connection with the use of irritant chemicals such as CS by US forces and their allies in Indo-China. When it was learned in 1965 that these agents were being used in the fighting, there was immediate hostile reaction in the outside world. In response to this, US officials sought to justify use of the agents by maintaining that it saved the lives of noncombatants. This justification, and its subsequent modification once it became apparent that CS was being used on a scale and in a manner that manifestly had little to do with preserving noncombatant lives, has been described in Volume I of this study, and is referred to again below.

II. *Modern CB weapons and past formulations of the humanity argument*

The humanity argument has generally been used to convince people who wished to be convinced, to relieve qualms of conscience about courses of action they felt obliged to pursue or unwilling to abandon. German officials used it in 1915, and US officials in 1965, to relieve fears among civilians that their armed services were behaving improperly. The US Army CWS, and later the Chemical Corps, used it to convince budgetary and other authorities that CB weapons were not barbaric (as their opponents had claimed) while at the same time convincing them that the weapons were militarily valuable and important for national security. But although the argument has often been an opportunistic one, carrying weight by playing on people's better feelings, it is unreasonable to dismiss the contention that a choice of weapons may sometimes be possible which is less inhumane than some other choice. Thus when troops use CS rather than explosive weapons to flush suspected enemy guerillas out of hiding in order to take prisoners,

it might be claimed that they are motivated as much by humanitarian principles as by considerations of expediency. For this reason it is proper to ask whether the elimination of all CB weapons by a disarmament agreement, including those based on CS, would seriously diminish the possibilities for relatively humanitarian conduct in war. In attempting to answer this, we must begin by examining more closely the various strands of the humanity argument that have been exploited in the past by CB weapons protagonists.

The principal claims have been that CB weapons are more humane than other types of weapons because the casualties they cause are less likely to die or, if they remain alive, are likely to experience less suffering from their immediate injuries, or from any long-term after-effects. It has also been claimed that certain types of CB weapon can reduce noncombatant deaths in time of war; this is a special case of the more general, but less confidently argued, proposition that some types of CB weapon hold out possibilities for completely eliminating death from war. These arguments are necessarily relative ones; they are based on assertions, sometimes supported by historical evidence, about what might happen if CB weapons were used instead of those other types of weapon that would normally be selected for the missions on hand. It should also be noted that the arguments involve several different criteria for assessing degrees of humanity, and that there are sometimes contradictions between arguments based on one criterion and arguments based on another. In discussing the arguments it is therefore important to see how their criteria apply to the different categories of CB weapons—to lethal, irritant-agent and incapacitating weapons.

Lethal CB weapons

The argument that lethal CB weapons are likely to cause lower mortality rates among their casualties than the weapons for which they might substitute can surely not be maintained nowadays. The experience of World War I, when it did indeed seem to hold, is not likely to be repeated. As table 1A.1 suggests, the most effective casualty-producing chemical weapons then were based on mustard gas, whereas today they would be based on nerve gas. In sharp contrast to nerve gas, mustard gas produces militarily significant casualties at dosages so far below its lethal dosage that it might today almost be classified as an incapacitating agent. This was, of course, an accident of history rather than the result of a German search for a relatively humane weapon. During World War I the mortality rate among the victims of non-chemical weapons was 25 to 30 per cent; today, nerve-gas weapons are expected to produce mortality rates of between 25 and 75 per cent

Table 1A.1. CW casualties among the British Expeditionary Force in France during World War I

Class of CW agent	Percentage of German CW agent production devoted to each class of CW agent	Percentage of total BEF CW casualties due to each class of CW agent	Percentage of total BEF CW fatalities due to each class of CW agent	Percentage of fatalities among BEF CW casualties due to each class of CW agent	Percentage of BEF battlefield casualties due to each class of CW agent during its main period of use[a]
Harassing agents					
Tear gases	4	<1	<0.1	<1	<1
Other irritants	11	10	0	0	1.6
Casualty agents					
Phosgene, chlorine, etc.	70	22	74	16	2
Mustard gas	15	68	26	2	11

[a] Tear gases were used mainly during the period April 1915 to July 1916, during which time there were about 494 000 BEF casualties. The "other irritants" were the Blue Cross arsenical sternutators used, like mustard gas, from July 1917 until the end of the war; during this period there were about 1 162 000 BEF battle casualties. Respiratory casualty agents (chlorine, phosgene and the Green Cross shell fillings) were used from April 1915 until the end of the war; during this period there were about 2 361 000 BEF battle casualties.

Source: This table draws upon data supplied in tables 2.2 and 2.6 of Volume I of this study.

among their casualties,[13] and they would probably only be used in preference to other weapons when they could be expected to produce higher casualty rates. The expected mortality rates of lethal biological weapons are at least as high as those of nerve-gas weapons.

The contention that CB weapons cause less human suffering (excluding dying) than the equivalent non-CB weapons was made on the basis of statistics about the after-effects of World War I battle injuries from chemical weapons. It was shown that gas casualties had a smaller chance of losing arms, legs or eyes than the victims of bullets or explosives, and that there was no appreciable difference in the incidence of chronic bronchitis or tuberculosis among the two categories of casualties. (It may be noted that when these contentions were originally advanced doctors were unaware that mustard gas could cause blindness decades after its initial effects on the eye healed, and the evidence showing that exposure to mustard gas could be correlated with the incidence of lung cancer had not yet been collected.) The argument was thus not directed at the immediate suffering caused by the weapons, and made no attempt to assess even the chronic suffering except in the crudest statistical terms. There was probably no

[13] D. Lindsey, "Selective Malfunctioning of the Human Machine: New Horizons in Chemical Warfare", *Military Medicine* 125: 598–605, 1960.

alternative. Individual suffering, which is essentially a subjective matter, does not lend itself easily to objective measurements. That applies to today's lethal CB weapons as well as to those of the past.

Nor does use of lethal CB weapons seem likely to decrease noncombatant deaths. Their use instead of conventional weapons on a battlefield would almost certainly increase deaths among civilians living in or around the combat zones. In the first place, the weather-dependence of CB weapons would often mean that their effect could not be confined to the immediate target area; in the second place, noncombatants are even less likely to be well protected against the effects of CB weapons than they are against the effects of other weapons. The only conceivable exception to this might be in the event that nerve gas was selected for use in preference to nuclear weapons, but it is hard to visualize the circumstances in which such a decision might be made. It must also be noted that, although armed forces might maintain stocks of lethal CB weapons primarily for battlefield use, the weapons could also offer attractions in counter-civilian operations. If they were used for this purpose, the only rationale would be that they would kill or injure more civilians than other types of weapon.

In summary, therefore, a convincing humanity case for today's lethal weapons cannot be made by reference to the criteria used in the past.

Irritant-agent weapons

The function of irritant agents is not to produce casualties among the enemy but to increase a combat unit's capabilities in firepower and manoeuvre. The weapons may be used, for instance, to upset the aim and coordination of the enemy's fire or to force him out of protective cover. They may also be used to contaminate terrain and thus make its future occupation by the enemy impossible or exceedingly uncomfortable. In that their role is essentially a complementary one, the question of whether they are likely to cause greater or lesser suffering must depend on the way in which their user deploys his other weapons. For example, in the case where CS rather than flame, say, is used to force the enemy out of cover it will depend on what then happens to him, on whether, for instance, he is taken prisoner or shot at with other weapons. It is, therefore, not the weapon that might be characterized as relatively humane, but the outcome of the engagement in which it is used. This will depend not only on the weapon, but also on the intention of the user and the extent to which intentions are translated into practice.

Irritant-agent weapons may, however, permit the application of armed force in a less destructive manner than otherwise. They can be used, for

example, on or off a battlefield to coerce unprotected enemy troops or non-combatants without risk of seriously injuring them. There are few other weapons that provide this option: bullets, explosives, and so on, are obviously incapable of doing so. If the user wishes to conduct his military operations with the least possible violence, the availability of irritant agents may indeed permit him to fight with less violence than if they were not available. But if, on the other hand, restraints on violent behaviour are weak, irritant agents may be used, in combination with other weapons, to increase the viciousness and destructiveness of the fighting. Whether use of irritant agents will reduce the total suffering experienced in a war must therefore depend on the relative frequencies of restrained and unrestrained combat behaviour. Intuitively it seems likely that restrained behaviour will dominate international peace-keeping operations of a quasi-police character as, for example, in Cyprus. But in real war—using the common-sense meaning of the term—unrestrained behaviour has generally sooner or later become the norm.

The experience of the Viet-Nam War supports the view that the introduction of irritant agents into a war is more likely to increase the level of violence than to decrease it. Here CS, whose employment was at first justified by one form of the humanity argument, came to be used on a sharply increasing scale in a context where vicious fighting rapidly came to dominate restrained behaviour. As more and more reports began to circulate of the ways in which CS was being used, the humanity argument put forward in justification for its use was gradually modified by US officials until its meaning was reversed. This process is described in Volume I of this study. The rationale for the use of CS given in most official US statements on the subject was that CS helped to save lives: but whereas this at first meant saving the lives of civilians and the enemy, it ended up meaning saving lives of US and allied forces regardless of the cost in enemy lives. Such a practice would no more deserve the label humane than would a policy of using nuclear weapons, if that saved American lives.

It is also to be noted that because irritant agents may permit the application of armed force without loss of life, they may increase the range of situations in which armed force can be applied. This is discussed below.

Incapacitating CB weapons

In contrast to harassing agents, incapacitating agents, like lethal agents, are intended to produce casualties—that is, to disable enemy personnel to such an extent that their continued presence on the battlefield is of no advantage

to the enemy. It is the function of most weapons to produce casualties; the principal difference between the two categories of CB casualty agent is that incapacitating agents may provide an option for producing a higher proportion of nonfatal casualties than lethal agents. As is described in Chapter 1, the military may believe this to be advantageous for three reasons. First, it may permit military operations to be conducted with more vigour in combat zones where friendly or neutral noncombatants are living (though whether the reactions of the victims and of public opinion will be so mild as to justify this view is a matter for speculation). Second, it can force the enemy to divert more of his resources into caring for his wounded. Third, it is a form of chemical warfare which the public might be persuaded to accept more readily than others.

This is the perspective in which the relative humaneness of incapacitating CB weapons should probably be judged. The notion that they might be instruments of a "war without death" is not realistic. The only way in which this might become valid would be through an international agreement that eliminated all armaments other than incapacitating CB weapons. That is not plausible. Otherwise it would require the technically-impossible task of developing an incapacitating agent against which the enemy was defenceless, which could not kill, and which was so effective over such large areas that it could neutralize the enemy's entire capacity for war at a stroke. If the agent did not fulfill these requirements, the use of it would not eliminate death from war; the enemy would not be prevented from taking countermeasures, and these would surely include the use of lethal weapons.

What is perhaps less inconceivable is that the military attractions of an incapacitating CBW option, as set out above, might eventually lead to incapacitating weapons at least partly superceding lethal ones in CB weapons arsenals. It is in fact known that a substantial part of the US stockpile of anti-personnel biological weapons (now being destroyed) comprises incapacitating agents. The reason why chemical incapacitating weapons do not appear to be stockpiled to anything like the extent that lethal chemical weapons are is probably as much due to underlying technical problems as anything else. This has been discussed in Chapter 1. These problems may yet be overcome if R & D work continues.

While it may be true that future incapacitants used on their own, rather than as complements to lethal weapons, would produce lowered mortality rates and might give noncombatants living on or near the battlefield a greater chance of survival, it is also possible that incapacitants, like irritant agents, might come to be used in conjunction with conventional firepower to increase killing and wounding. Again, it is not the agents themselves but the uses to which they are put that may be humane or inhumane.

It has been, and still is, claimed that, independently of the numbers of people they may or may not kill, CB weapons cause less human suffering than other types of weapon. But, as noted earlier, it is difficult to quantify suffering, and for this reason claims made about relative degrees of suffering are difficult to support. In war there are many kinds of suffering. People may be wounded in a wide variety of ways—such as burning, blast, blows, drowning, poisoning, disease, and so on. And they may suffer fear, economic loss or hunger. It is not likely that many people would know what their preferences are between all these alternative ways of suffering, nor that their preferences would be very firm if they did express them, since few will have had much experience to go on. Certainly most people might feel that in some circumstances the use of some types of CB weapon would cause less suffering than the use of some other weapon: most of us would rather be hit by tear gas than by a bullet; we might prefer nerve gas to napalm. But that does not tell us very much. It is equally true that we would often prefer truncheons to tear gas, or explosives to nerve gas. The comparison can be made with a weapon that is more or less nasty than a given CB weapon. The fact that the comparison can be made one way—with nastier weapons—does not prove that CB weapons are generally "humane". It is merely a piece of special pleading. And different people might rank their preferences in different orders. Take the irritants, for example: during World War I people exposed to them occasionally had to be restrained from shooting themselves in order to escape from their effects; and others were driven mad by the pain and misery caused by the agents.[14]

III. *Assessment*

Humanity in war is inevitably an imprecise and perhaps rather paradoxical concept. Allowing for all that, it can be seen that there are a number of fundamental defects in the humanity arguments that have been put forward for CB weapons:

1. The term humane is applied to weapons, not to the context or outcome of their use, despite the fact that the weapons under consideration —generally irritant or incapacitant weapons—can usually be used with humane or inhumane results, according to what other weapons are used in follow-up, how they are used, the temper of the conflict and so on.

[14] J. B. S. Haldane, *op. cit.*, pp. 10–11; W. G. Macpherson, *et al.*, [*Official*] *History of the Great War: Medical Services: Diseases of the War,* vol. 2 (London, 1923), p. 475.

2. The arguments often consist of saying that a CBW agent will be used intsead of something worse ignoring the fact that, if they are permitted, they are equally likely to be used instead of something less unpleasant.

3. The arguments often imply that a particular type of agent should be permitted for the sake of its humane application, ignoring not only the points above, but also that if one type of agent is admitted all agents are more likely to be admitted and, secondly, that if you admit today's CBW agents you are admitting those developed in the future, too, whatever they may be.

It may seem harsh to imply that the military should be denied the possibility of using in war irritant agents the effect of which, in a suitably restrained condition, could be considered humane. The same applies to incapacitants in so far as their use in some situations could be regarded as humane. For this reason it has been suggested that some sort of exception should be made to a CB disarmament treaty which permitted the possession of some or all of these so-called "nonlethal" weapons, and allowed their use under specified conditions. But any such proposition implicitly rests on the assumption that on the whole, taking all armies that are likely to be involved in wars and all soldiers down to the lowest rank to which this kind of decision would have to be delegated, the soldiers in making their decision would pay attention to saving the lives and limbs of their enemies, both military and civilian. Only then could the effect be a saving in life and suffering. Unfortunately, the experience of wars in which irritant agents have been used, notably the Sino-Japanese War and the Viet-Nam War, tells in the opposite direction. It might be objected that, in Viet-Nam and before, an inadequate effort or no effort was made to limit irritant agents to humane usage, so that the humanity argument for the weapons was unnecessarily brought into disrepute. But this is no answer since it is unreal to suppose that the pressures which caused the restraints to break down in these cases—pressures coming into play in the field and right up to the top of the political system—would not come into play in other wars too. The clear lesson seems to be that irritant agents, and therefore incapacitating agents too, should be kept out of places where there is a risk that fighting will become unrestrained—and war is as good a description of those places as one is likely to find.

Appendix 2. Verification of CB disarmament[1]

I. *Introduction*

It must not be taken for granted that formal machinery for verification is a prerequisite of disarmament measures over CB weapons or any other group of weapons.[2] This is an important caveat to the examination of the technical and operational problems of verification which follows. The techniques discussed here might be used by a team established under a standing international verification system, by a team established under a complaints procedure or by any other kind of body approaching these problems. A second caveat is that the political setting in which verification takes place must be kept in view throughout. Whether a particular means of verification is necessary and effective depends more on the political context than on the technicalities of that means itself.

There are many stages to a chemical or biological weapons development and production programme to look for; and there are several techniques to use—budgetary inspection, literature search, informal communication, direct inspection, and remote observation. In the light of these two sets of considerations, the following analysis considers which lines of approach are most promising. In the case of both chemical and biological weapons, inspection of the production of agents looks promising and so, possibly, does the monitoring of field tests. A biological weapons production programme will be conspicuous for its large scale, and for the extraordinary safety measures it requires. The SIPRI BW inspection experiment, described in Volume VI, yielded quite promising results. While further exploration is necessary, the conclusion is that, given access to relevant facilities, verification of development and production of CB weapons may be feasible.

The technical possibilities of verification examined here are relevant

[1] This appendix is an updated version of Chapter 1 of Part IV of the provisional edition of the CBW study which was circulated in February 1970.

More detailed studies of particular aspects of CBW verification and studies of the problem of early warning of attack with biological weapons and rapid identification of BW agents are included in Volume VI.

[2] The question whether—and where—verification is needed is discussed in Chapter 3 of this volume, pages 113–120.

to a wide variety of possible measures of disarmament—measures that might apply to biological weapons or chemical weapons alone or to both, to offensive or defensive programmes, and so on. They are not limited to any one policy.

First there are some general points to consider.

General considerations

In order to tell whether a CB weapons programme is being undertaken in a country, there is a standard set of facts which one would wish to know. These relate to whether or not the country is doing relevant research, is developing or producing weapons, is training troops to use them and so on. As between two countries which are very friendly and open to one another, the political leaders may feel that verification of a disarmament treaty is scarcely a problem: they could always come close to the facts if they felt the need. On the other hand, as between two countries which are hostile and partly closed to one another, the politicians on either side may feel that they could not, in the absence of special arrangements, obtain all the facts they might want from the other country. So suspicions of cheating may arise, unless special measures in the form of a verification system are introduced in order to provide more information. This has been the essence of the problem of inspection and disarmament. The lack of trust and information which gives rise to demands for a verification system is also the obstacle to its introduction.

In order to be sufficient, verification does not have to be 100 per cent efficient. What is required is a probability of detecting a cheat sufficient to reassure those who may suspect others of cheating and to deter those who contemplate it themselves. One may be a more exacting requirement than the other: a given probability of detection might be sufficient to reassure but not to deter, or *vice versa.*

The extent to which it is necessary to open up new channels of information through a special verification system depends firstly upon the extent to which the type of weapon or activity to which a disarmament agreement is applied is surrounded by military secrecy, a form of secrecy which exists in greater or lesser degree in all countries. Rifles are surrounded by much less secrecy than nuclear weapons. CB weapons are surrounded by rather a lot of secrecy.

Secondly, the need for verification procedures depends upon how open in general the countries under consideration are with information. It is useful to consider the channels through which information may flow from a country to the politician or authority abroad who is concerned with

the observance of a disarmament measure. Four such channels which are accessible, directly or indirectly, to government authorities can be distinguished:

Open flows—press, radio, parliamentary and official reports, reports in scientific and specialized journals, gossip, tourists and travelling specialists.

Secret flows—information obtained by methods such as espionage, radio monitoring and aerial or satellite surveillance or other forms of remote observation (e.g., remote sensors on the ground to monitor air or water flows from the suspect area).

Informal international verification whereby citizens of a country cooperate with an international inspectorate or with their counterparts abroad, for example, scientists exchanging information through international scientific societies.

Formal international verification arrangements—inter-governmental agreement to open up information not available through other channels, either regularly or upon demand.

The extent of open flows of information varies much from one country to another. As is evident from this whole study, a lot can be found out about biological and chemical warfare from the open literature, notably from the literature of the USA, the country which certainly has the most open policy towards information. But the supply is very uneven as between countries and subjects. Thus our knowledge of national programmes is far from complete.[3]

Secret information, insofar as it means information which cannot be revealed without compromising its source, is of limited use for verification of disarmament agreements. It can serve to reassure. It may support open information or provide leads which can be followed through open channels. But it cannot be laid on the table as evidence; and it may be misleading. An important new category of information which is now secret is that gathered by reconnaissance satellites. This information is known to be so detailed that it may have transformed the problem of verification of many types of disarmament.[4] It is likely to be less useful in verifying CB disarmament than in verifying disarmament of some other types. Those countries which possess reconnaissance satellites do not release the data obtained from them.

Informal arrangements imply that reliance is placed on people in one country to volunteer information to an inspectorate or people abroad if

[3] See Volume II for the available information on national programmes.

[4] J. Stone, in *ABM: An Evaluation of the Decision to Deploy an Antiballistic Missile System,* Chayes and Wiesner, ed, (New York, 1969).

they have evidence of suspicious work in their country—or in another country. In the case of CB weapons, it is almost inevitable in any country that some scientists engaged in peaceful work on the relevant parts of chemistry and biology—for example vaccine manufacture, insecticide research, and research into microbial virulence factors—will have a shrewd idea if a biological or chemical weapons programme is being undertaken there. They are likely to notice that colleagues with relevant qualifications are moving into secret work, or they may be approached about scientific problems or recruitment. There may be potential here for voluntary verification.

On the other hand, it is unrealistic to suppose that scientists will commonly be ready to volunteer information unless the government of their country has approved this kind of action. But approval alone will not be enough unless the scientists want to cooperate and have the confidence and desire to do so. Once approval has been given, and cooperation started, its cessation might arouse some suspicion abroad.

Voluntary cooperation is a natural corollary of any formal system of inspection: governments probably would not make a treaty establishing an inspection system to verify the abolition of CB weapons without considering the question what they should say to their public, including their scientists. If a government did not publicly encourage its scientists to cooperate with the inspectorate, that in itself would be suspicious. Indeed it is doubtful whether there would be a sufficient basis of confidence for the making of a treaty unless each government knew that in this respect the others were ready to tell their scientists to be open with information. In this way, the position governments were to take towards their public and scientists could become an issue for negotiation, probably at an informal level.

Proposals for voluntary inspection have a long history. In 1928 the USSR, for instance, proposed the following supplement to the Geneva Protocol of 1925:

> In enterprises capable of being utilized for the manufacture of means of chemical and biological warfare, a permanent labour control shall be organized by the workers' committees of the factories or by other organs of the trade unions operating in the respective enterprises with a view to limiting the possibilities of breaches of the corresponding articles of the present Protocol.[5]

In this chapter the problem of formal verification will be approached from two sides. First, what is one looking for? In other words, what

[5] League of Nations. Preparatory Commission, Eighth meeting of the sixth session [first part] of the Preparatory Commission for the Disarmament Conference (1929. IX.3).

are the characteristics and size of a CB weapons programme? Secondly, what can one find with different techniques of verification? At the end we shall look at the analysis by reference to four criteria:

The value of evidence if found. Is it conclusive, indicative or useless?

The extent of physical intrusion. Does the technique involve aerial reconnaissance, entry to factories, laboratories or military establishments, or no intrusion (e.g., it relies on reading published work abroad)?

Is it costly in effort and money to maintain a search of the kind specified?

Is it costly in effort and money to evade the search?

Activities to search for

The steps which it might be necessary to take in order to proceed from a government decision to develop an offensive CBW capability to the point where that capability was ready for use are set out in table 2A.1. This is an illustrative list. Some steps might be omitted, other refinements might be added. Volume II contains information about how countries organize their CBW programmes; and the example of the USA is described there in detail to show what table 2A.1 implies as regards facilities and personnel.

From this table it can be seen that there are various types of activity to look for:

1. Administrative and budgetary activity in the policy-making arena. Politicians, administrators, scientists and the military have to review alternatives, make decisions whether to start or continue a chemical or biological weapons programme, draw up plans and budgets and supervise their execution. Activity here is a prerequisite of activity down the line.

2. Research, which entails the discovery and study of toxic or infective substances and mechanisms for their dissemination. The discovery of a possible new BW or CW agent or family of possible agents may be an accidental by-product of academic, public health or industrial research or it may be the fruit of research commissioned or conducted by the military. An inspectorate probably could not, with certainty, say from the apparent nature of the work (without knowledge of its intent) whether it was part of a military programme. It might find it highly suspicious and watch it closely.

3. Development. When research yields promising new candidate CBW agents, they will be sifted. The more promising ones will then (*a*) be tested more intensely as regards toxicity and other properties to assess their suitability as CW or BW agents; (*b*) work will be done on the problems of producing them on the required scale, including the building

Table 2A.1. Stages in the development of a CBW offensive capability

1. Policy review of pros and cons of an offensive CBW effort and decision by government to proceed or continue
2. Preparation of detailed budgetary estimates for research and development
3. Voting of R & D budgets
4. Recruitment of R & D personnel
5. Organization of research facilities
6. Selection of projects for research
7. Selection of research projects for development
8. Organization of development facilities
9. Development of agent manufacturing techniques
10. Development of munitions, including test and evaluation
11. Standardization of weapons for possible procurement
12. Development of employment doctrine
13. Preparation of budgetary estimates for procurement and maintenance
14. Voting of procurement and maintenance budgets
15. Selection of standardized matériel
16. Importation (if any) of matériel
17. Procurement of raw materials
18. Manufacture of agents
19. Bulk transport of agents
20. Bulk storage of agents
21. Manufacture of munitions
22. Filling of munitions with agent (possibly included with item 18)
23. Storage of filled munitions
24. Deployment of matériel in forward areas
25. Training of individual troops in offensive techniques
26. Troop manoeuvres including agent exercises

of a pilot plant or plants; and (*c*) during this phase, work will be begun on the design or adaptation of dissemination mechanisms for use in weapons (e.g., bombs, spray tanks, etc.). During this phase the activity becomes explicitly military and begins to go beyond the point considered necessary for the design of defensive measures. We shall use the word "development" to describe work which is explicitly and visibly military and the term "development of an offensive capability" to describe development work which goes beyond the point necessary for the design of defensive measures.

4. Field testing will be undertaken as development proceeds, leading up to the demonstration of the weapon to the military in an "evaluation" exercise so that they can decide whether to adopt it. This is plainly a military activity and one for the most part needed only for offensive preparations; that holds for all activities that follow.

5. Production of the agent must be organized, entailing the building of a plant with the required safety measures for the manufacture of the agents as well as providing for a supply of raw materials (a bigger task for CW than BW agents). Production or adaptation of weapons to carry and disseminate the agent must also be organized, as well as the procurement of the inputs needed there.

6. Once production is started, it is necessary to transport and store

the CW or BW agent either in bulk or in filled weapons. For the sake of dispersal, all the stocks are not likely to be at the place of production, though the difficulties of storage may prevent great dispersal. This applies particularly to biological weapons.

7. It is necessary to develop military doctrine for the use of the weapons, to train troops and conduct exercises, but this will also be done for defensive purposes, and the two—defensive and offensive training—will be hard to distinguish.

Even if a nation was not looking for a new BW or CW agent but was setting out to use an existing one, it would not be able to avoid much of the effort entailed in developing a military programme, unless it was able and willing to obtain supplies from other countries. The phase of research which entails a search for new agents would be avoided, but the problems of developing the agent, its production and the development and production of weapons would not.

At various stages it will not be easy to distinguish CW and BW programmes from related peaceful enterprises, for example the development of insecticides or biological control agents.

Methods of inspection

There are five main methods which might be used for formal verification, leaving aside for the moment informal verification: administrative and budgetary inspection, literature surveillance, remote observation, economic analysis, and visiting inspection teams.

In table 2A.2, these methods are set against the six activities that one would be searching for. As is indicated there, some methods are of general application, while some can be applied only to one or a few activities. A further complication is that some methods apply equally, or almost equally, to biological and chemical weapons programmes, but with other methods the inspectability of biological and chemical weapons programmes differs owing to their different characteristics. This makes the logic of presentation somewhat complex. The sequence will be as follows:

1. Budgetary inspection and literature surveillance are two methods which apply in broadly the same way to biological and chemical weapon development efforts. So BW and CW are dealt with together here.

2. The possibilities of direct inspection at the stages of development, production, transport and storage of CW and BW agents is the most important subject. Since the technical problems differ considerably for biological and chemical weapons, they are dealt with separately.

3. The possibilities of verifying that weapons to disseminate BW and CW agents are not being developed or produced, the detection of field

Table 2A.2. Applicability of inspection techniques to different activities

Activities	Search method				
	Budgetary inspection	*Literature surveillance*	*Remote observation*	*Economic analysis*	*Inspection teams*
Research	↑		—	—	—
Development	Equally applicable to all activities	Mostly here	—	—	Possibly here
Field testing and evaluation		—	Possibly here	—	Possibly here
Production of agents and weapons		—	Probably here	Here	Mostly here
Transport and storage		—	Possibly here	—	Possibly here
Training	↓	—	Possibly here	—	Possibly here

tests, and training, and of defensive CBW programmes are again dealt with together since the problems they raise are similar.

A number of general issues are considered first.

II. *General methods*

Budgetary inspection

Decision-making and budgeting for such sensitive subjects as CBW are subject to complete secrecy in some countries and partial secrecy in others. The scrutiny of published policy documents, debates and military budgets is therefore of limited value now, providing information only for some countries. Even where CBW is mentioned in a budget, separate figures may not be given. For example, in the recently published British expenditure estimates, the provisions for chemical and biological defence R & D are lumped together with R & D into ordnance, military ground vehicles and Royal Engineer stores.

Budgetary inspection has been suggested specifically as a means of verifying CB disarmament[6] and was explored in detail by the League of Nations in connection with general disarmament. If governments were ready for the purposes of general disarmament to agree to standardized

[6] Report submitted to the Bureau on the prohibition of chemical warfare and violations of the prohibition to use chemical, bacteriological and incendiary weapons, in execution of the decision of September 22nd 1932. (League of Nations Document, Conf. D/Bureau 24, 1932).

and open budgetary procedures, giving considerable detail, this would be a useful form of inspection as regards CBW. But it is a form of inspection on which people are not likely to rely exclusively.

Literature surveillance

The basic scientific knowledge from which biological and chemical weapons are derived is largely generated in the academic world, meaning universities, research institutes, public health institutes and so on. Here science is open and widespread secrecy would be crippling: publication and discussion are essential as a stimulus and as the means of disseminating knowledge. In all countries the basic literature on microbiology and chemistry is published and available to people in other countries. Thus a considerable proportion of the scientific literature from the USSR is available in Russian, albeit with some difficulty, to people in, say, Sweden. But the USSR publishes much less literature that might have military relevance than does the USA.

This means that literature surveillance could be a valuable element in a system for monitoring CBW research and development.

Although the volume of scientific literature is expanding at a very rapid rate, the problems which this expansion poses for literature surveillance appear to have been more than outweighed by the application of computers to information storage and retrieval. These services are being developed and applied very rapidly in order to permit scientists, doctors and other scholars to find out what has been published on particular topics in their fields. At present these services are becoming available for much of the scientific literature of the developed countries.

As these computer information services, based on abstracts of articles stored in computers, are developed, it becomes very easy to search for literature on subjects related to BW or CW, to search for authors who have worked in the relevant fields or for institutions where relevant work has been undertaken or concentrated. In these ways it should usually be possible to keep up with technical developments, to follow who has the capability for a significant BW or CW effort, to watch for the disappearance from the published literature of authors with relevant qualifications, and so on. But if censorship exists from the start and little is known about the scientific community of the country, this method will be of little value.

Experience shows that even with a military CBW research programme, the pressure to publish in some countries is sufficiently great for articles to appear which give some indication of the work done in military es-

tablishments. But it is not to be supposed that after a disarmament treaty—or before it—one would ever find in the literature an article in which it was proclaimed that the authors were, with specific military intent, researching with a view to finding BW or CW agents, or some similar objective.

Literature surveillance may now be more effective with respect to BW than CW. Whereas research in biology and microbiology is still largely undertaken in the academic world, a substantial part of the chemical research that might produce candidate CW agents is undertaken by applied scientists or technicians working within the chemical industry where commercial secrecy is often closely guarded. Discoveries of importance may occur here, by design or accident, and are likely to be guarded against leakage to competitors, though they may be given in confidence to governments. In the years ahead microbiology is likely to follow chemistry, experiencing a relative shift from the academic to the industrial world, as large-scale applications of knowledge in these fields are developed. For some time microbiological knowledge has been used and pursued by the pharmaceutical industry, where secrecy is preserved just as intently as in the chemical industry. Such applications are now being used in the production of biological control agents, the use of which is increasing rapidly.[7]

It is possible that surveillance of the literature, including the patent literature, in some fields of applied science and technology, such as chemical engineering, pyrotechnics, meteorology and military equipment, as well as literature related to military, medical and political affairs, may yield information about the later stages of a military programme, but this plainly cannot be relied upon. In these fields ready-made computer facilities for systematic search are less likely to be available. As noted below in the section on safety requirements, reports of poisoning or infection of personnel in laboratories and other places are also indicators to watch for.

Economic data analysis of the flows of inputs needed for production of CW and BW agents might be useful in those countries where the open supply of data is great. It is often suggested that for purposes of verification a system should be established for reporting on production and trade of possible CW and BW agents and key inputs for them.

[7] See page 107 above.

III. *BW agents: the possibilities of direct inspection at the stages of development, production, transport and storage*

We turn now to the problem of verifying by inspection that BW agents are not being developed or produced. Development here can be divided into two phases—the selection of candidate agents for production and the development of production processes for them.

One feature of the selection phase which may help to distinguish it from civil research and development work will be the kind of experiments that are required. For example, an abnormally large number of special animals will be needed to evaluate the properties of candidate agents and the possible prophylactic and therapeutic agents to counteract them. At successive stages of development this will involve tests on small animals, on monkeys and, for some agents, on man. This work will be conducted inside special facilities where dosage and safety measures can be very carefully controlled. It may also involve small-scale outdoor tests to assess the effects of environmental factors which cannot be simulated indoors.

These kinds of testing are part and parcel of the laboratory work and are scarcely a separate objective for inspection—unlike field testing which is discussed below.

There would be nothing particularly conspicuous about tests on small animals. They are used in large numbers for scientific research. Tests on primates would be more conspicuous. They are scarce and expensive. In most temperate countries they have to be imported and kept in quarantine for long periods. Tests on man are usually conducted on volunteer soldiers or prisoners, the latter being granted special treatment if they submit themselves to tests. There is some possibility that word of such tests would get around.

In the case of BW agents, as opposed to CW agents, the development of production processes is scarcely separable from production itself.

There are several reasons for this:

1. Production of a military capability, because of its scale, cannot be undertaken in the laboratory, but it involves a lot of control and close contact with the laboratory. One does not build to the same extent as with CW agents, a continuous-flow plant for a single product. One uses more multi-purpose equipment which involves a less predictable process, likely to vary according to minor changes in the inputs and in other conditions.

2. In developing new agents, one may wish to use existing production equipment for production trials.

3. Many of the same safety systems and controls may be applied to both development and production.

Hence inspection for production and inspection for development of BW agents (and the later stages of research) tend to merge. It is quite possible that the three processes will be undertaken in the same place.

From the point of view of inspection, two distinctive features of an offensive BW weapons programme, both of which we shall consider below, are that production facilities have to be large if they are to yield a significant military capability, and that extraordinary safety precautions have to be taken at all stages if the workers are not to be the first victims of the weapons they are trying to make. It is the combination of size and safety factors at the production stage which provides the best target for inspection.

The required scale of production

There are two possible approaches to an assessment of the required scale of production—a theoretical calculation and an examination of the available evidence on the size of actual facilities known to have been in operation in recent times.

It is possible to calculate from first principles the approximate weight of BW agent needed to cause militarily significant harm to a target population. For example, taking into account such factors as agent infectivity, dissemination efficiency, biological decay, aerosol cloud behaviour, and urban-area micrometeorology one can make rough order-of-magnitude estimates of the amount of BW agent needed to produce 50 per cent casualties among the inhabitants of a city of specified characteristics. A model study of this kind is included in Volume II of this study; a typical result is that for an attack on a city of about half a million inhabitants, something like 10^{17}–10^{19} pathogens would be needed. (This is on the assumption that the attacker would rely on direct infection of the target population for the effects he was aiming at rather than on secondary infection through epidemic spread of the pathogen—i.e., that a noncontagious disease, one whose causative agent was not readily man-to-man transmissible, would be selected for the attack.[8]) 10^{17}–10^{19} pathogens are

[8] There is good authority for this assumption. A US Department of Defense spokesman testifying before a Congressional committee in June 1969 made the following remarks:
"We have had a policy that the biological agents that we would try to develop

a lot of material—something between hundreds of kilos and hundreds of tons of BW agent. For vaccine production, for example, such a quantity of pathogens would far exceed any country's conceivable requirements.

The foregoing orders-of-magnitude estimates are comparable with the estimates made by the Armaments Control Agency of the Western European Union, around which the WEU biological weapons controls are designed. Some of the WEU estimates are shown in table 3A.2 in Appendix 3; from these it seems that for the attack of a 500 km^2 town, the WEU would reckon that something between 500 kg and 125 tons of BW agent would be required.

From calculations such as these, one can guess how big a biological weapons manufacturing programme would have to be before it was of much military significance. One might take the 10^{17}–10^{19} pathogens consignment as a basic unit, and then make assumptions about the number of them that a military establishment might feel it would need in order to support biological warfare. The military would presumably want consignments of several different agents, for different types of effect; they would presumably also see a need to stock up with more than the bare minimum of consignments, given the inherent uncertainties in the underlying calculations and predictions.

On this basis one might guess that for an advanced country of medium size facing an equal opponent, a significant BW capability would require facilities for producing in a year, or perhaps more quickly, an armoury of at least a hundred of these consignments. (A long period to produce the armoury and, hence, a small production capacity will increase reliance on the survival of agents in store and diminish the speed with which the armoury can be replenished after use.) A superpower might require more, a small country less, though this would depend partly on the size of their potential adversaries. This implies that a medium-sized nation wishing to establish a biological weapons armoury within a year would have to operate a large number of 100 litre fermentors more or less continuously, necessitating the use of many cubic metres of cultivation medium each day. To handle these quantities, it would be necessary to have large mixing and storage tanks and heavy equipment for handling ingredients of media in tonnage quantities. Add to this the special equipment needed for har-

would be noncontagious; that is, that it could not be passed on directly from individual to individual. ... A contagious disease would not be effective as a biological warfare agent, although it might have devastating effects. It lacks the essential element of control ... since there would be no way to predict or control the course of the epidemic that might result." (*Department of Defense Appropriations for 1970*, Hearings before a subcommittee of the Committee on Appropriations, US House of Representatives, 91st Congress, 1st session, Part 6, page 120.)

vesting, freeze-drying and grinding, as well as that required for refrigeration and sterilization, and it becomes obvious that the production unit would be quite sizeable. Considering the safety techniques necessary and the need for auxiliary laboratories and animal quarters for preparing inocula and performing routine controls, a significant BW agent production plant would in fact go far beyond normal facilities.

From calculations like this, one would expect the facilities of a superpower with an active biological weapons programme to be large; and this is indeed confirmed by the information available on the biological operations sector of the US Army arsenal at Pine Bluff, Arkansas, in the days when it was active before the USA renounced possession of biological weapons. The arsenal as a whole had a production and storage mission for biological and chemical weapons. It occupied a 6 km^2 site (about one-quarter of which comprised the biological operations area) and, at the end of 1966, employed 1750 workers, more of whom were engaged on biological operations than chemical. At that time the real property and installed equipment was valued at $136 million, of which the biological sector accounted for 60 per cent. BW agent production and process development work took place in a ten-storey building that had cost about $100 million to construct and equip; more than one-third of this sum had been spent on safety measures. In the 1963 operating budget of the arsenal, $5.4 million out of a total of $13.9 million was allocated to biological operations.[9]

These figures illustrate the effort of a superpower. They cannot easily be scaled down to estimate what is needed for a more limited capability. The cost of safety will probably be proportionally higher the smaller the plant.

So far we have considered production facilities for a substantial modern biological weapons development effort. Apart from these, it is always possible that production might be attempted on a small scale and with primitive methods for the purpose of sabotage attacks aimed, say, at a water or food distribution system. Such attacks are discussed in Volume II. As noted there, the required amounts suggested in some scenarios for attacks of this kind might be around a kilogram of freeze-dried material or 10 litres of suspension. The preparation of these quantities would involve considerable technical difficulties and might well be detected by an inspection system of the type explored in the SIPRI inspection experiment (see below). But it is possible to envisage many types of sabotage operation

[9] US Army, Pine Bluff Arsenal, *The Role of Pine Bluff Arsenal in the Community*, a briefing dated 31 March 1966.

using even smaller quantities. It would not be possible to detect production of these smaller quantities with any system other than mutual checks within the relevant professional groups.

Between these extremes—a full military armoury and a sabotage kit—there is the possibility of a "low-grade capability" in which relatively small amounts of contagious agents are produced rather than large amounts of noncontagious ones.

The pursuit of a low-grade capability of this kind is more plausible in wartime than in peacetime. A country faced by military defeat or frustration might be tempted to resort to BW and might, if it had modest scientific facilities, be able to produce enough of some BW agents to launch one or a few attacks by crude methods. Verification procedures applied to production facilities would probably not be able to stop a country doing this, partly because an inspection system may break down or be thrown out in time of war or crisis. It is true that the very existence of a verification system and the possible need to evade it may act to some extent as a deterrent, but in the conditions postulated here the more powerful deterrent would probably be the existence of international machinery for investigating allegations of use—and a proper understanding by the country in question of the risks of attempting to use BW.

Some confirmation of this assessment of the scale of effort required for a BW programme is to be found in the assessment given by the US delegate to the UN Disarmament Commission in August 1952. He suggested that the size and variety of facilities needed for an offensive BW programme were such that they would not readily escape detection by the kind of inspection he believed to be needed for a comprehensive disarmament programme.[10]

Safety requirements

As noted earlier, safety precautions are the second key factor that distinguishes BW work from peaceful work. All BW agents suitable for use against man are capable of causing laboratory infections. The majority of them are not handled customarily in a routine microbiological laboratory. For example, the agents causing tick-borne encephalitis or tularemia are usually handled in special laboratories and only by specially trained and vaccinated personnel. Specimens which might contain such agents are sent to one of those laboratories.

Laboratory accidents are often insignificant and go unnoticed, until, after some delay, a clinical disease occurs. For this reason, safety precau-

[10] See Chapter 7 of Volume IV of this study.

Table 2A.3. Infection rates at four institutions in the USA

Institution	Period	Infection per million man-hours	95% confidence limits
Fort Detrick	1954–1962	9.06[a]	5.79–12.33
National Institute of Health	1954–1960	3.41[b]	2.16– 4.66
Pine Bluff Arsenal	1955–1962	2.86	1.25– 4.45
National Communicable Disease Centre	1959–1962	1.25	0.74– 1.76

[a] Includes non-lost-time infections.
[b] Includes diseases suspected of being of occupational origin but never confirmed.

Source: Phillips G. Briggs, "Microbiological Causal Factors in Laboratory Accidents and Infections, Table 7". *Miscellaneous Publication 2*, Fort Detrick, April 1965.

tions in all work with BW agents need to be massive. Even then, they will not prevent all laboratory infections, as can be seen from the statistics from Fort Detrick, as compared with other US laboratories, shown in table 2A.3.

In civilian production, precautions against infections sometimes have to be stringent, as for example, in the production of vaccines against plague, yellow fever, and other such diseases, but then one either kills the micro-organisms just after production/cultivation and thus before handling, or one uses living but attenuated strains. The problems are therefore much less severe than in a biological weapons programme.

In a biological weapons programme, stringent safety precautions will be necessary from the first moment of research and development all the way to the dissemination of the agent against the target. Biological weapons are like high explosive grenades fitted with an armed fuse at the time of manufacture.

Since workers in a biological weapons laboratory or plant cannot usually be kept isolated from their families and society, accidents with BW agents involve a risk of spread. This risk to public health reinforces the need for safety measures. It also means that evidence of accidents or of unusual infections caused by them may indicate the existence of a biological weapons effort.

Since many potential BW agents come under the heading of zoonoses, accidents may cause disease in animals as well as in humans. For example, it is known that foot-and-mouth disease has escaped from one laboratory[11] and it has been alleged that Rocky Mountain spotted fever has escaped from another.[12] Recent evidence of the importance of wind and precipita-

[11] UK Ministry of Agriculture, Fisheries and Food, *The Origin of the 1967-68 Foot-and-Mouth Disease Epidemic* (London: HMSO, 1968 Cmnd. 3560).
[12] "Defenseless", *Newsweek* 4 August 1969: 3.

tion in the spread of foot-and-mouth disease[13, 14] lends further emphasis to the need for stringent safety precautions.

Possible localities for production of BW agents

In the open literature, there have been several suggestions about the kind of facilities that could be adapted (or built) for production of BW agents. These are reviewed here since each would present different problems for a verification team.

Conversion of existing facilities for industrial fermentation

It has been feared that plants producing antibiotics, or breweries, could be used for the production of BW agents. The fact that one such conversion seems to have been tried in the case of anthrax does not mean that this type of conversion is generally feasible. Anthrax is relatively easy to handle, since it has a relatively high aerosol infective dose for man.

Production of antibiotics or beer does not require stringent safety measures to prevent contamination of the surroundings and the staff.[15] The fermentation is often performed under pressure in order to help keep unwanted micro-organisms out of the process. This is possible since small outward leaks have no untoward effects. But this system is precisely the opposite of what is required with pathogens. In the production of pathogens, for vaccine or for other purposes, caution dictates that the process should either be run under negative pressure or be provided with double barrier protection. Hence extensive conversion would be needed if an industrial unit were to be used for production of BW agents. Conversion would also have to encompass effective means to sterilize all effluvia (air, water, etc.). It would thus be a large operation and one that might arouse curiosity.

An advantage of converting an industrial plant for the production of BW agents would be that the staff in such a plant have experience in the production methods. But they would not be experienced in the handling of pathogens. That would require special training, which might be observed.

[13] P. D. Wright, "Wind and Precipitation, Foot and Mouth Disease", *Weather* 24(6): June 1969.

[14] L. P. Smith and M. E. Hugh-Jones, "Weather Factor in Foot and Mouth Disease", *Nature* 223(5207): 16 August 1969.

[15] J. B. Philippe, "The Extent to Which the Equipment and Processes Used in Industrial Fermentation of Antiobiotics can be Extrapolated to the Mass-production of Bacterial Vaccines", *Symposium Series, Immunobiological Standardization*, vol. 3, (Karger, 1967).

Table 2A.4. Application of the continuous or batchwise cultivation of bacterial vaccines by twenty-four manufacturers (1965)

Vaccine	Technique	
	Batchwise	Continuous
Anti Catarrh	9	—
BCG	13	—
Cholera	14	—
Diptheria	22	—
Paratyphoid	17	—
Pertussis	22	2
Staphylococcus	13	—
Tetanus	22	—
Typhoid	16	—
Plague	4	—
Total	**152**	**2**

Source: Å. L. Möller, "Bacterial Vaccine Production", *Symposium Series, Immunobiological Standardization,* Vol. 3, 1966, pp. 11–22.

Conversion of existing facilities for the production of vaccines

Large-scale production of BW agents in vaccine-producing facilities would seem an attractive alternative since they are likely to have relatively good safety measures as well as staff well versed both in the production techniques and the safety procedures required in the handling of pathogens. There is likely, for moral and psychological reasons, to be some resistance to this kind of perversion of such an institution's work, and some consequent risk of publicity. But leaving that aside there are several technical factors making such a conversion less straightforward than it might seem. As noted earlier, in vaccine production one either handles attenuated, living micro-organisms or kills them immediately after cultivation, whereas to produce BW agents it is necessary to work with highly virulent micro-organisms the whole time. The safety precautions would therefore have to be strengthened before production of BW agents could be started.

Few vaccine manufacturers are experienced in the use of continuous culture techniques (table 2A.4). The reason for this seems to be that the economic incentive to concentrate production in a few places so as to take advantage of such techniques has been offset by other factors, including considerations of national security. These may diminish in importance now that vaccines can be freeze-dried and kept in stock for long periods. If a shift towards a more efficient pattern of production, concentrated in a few countries, does occur, it should not be difficult to follow its evolution through published information on international

trade in vaccines, and it would then be possible for a verification system to concentrate attention on the few large plants in which production was taking place. Until such a shift does occur, vaccine plants will typically be too small for substantial BW agent production and the introduction of large-scale continuous-culture plant will be an indicator that something new—or odd—is happening.

An indication of the inadequacies of the typical national vaccine plant for biological weapons purposes is given by the following simple calculation. The number of births per year in an advanced country is typically equal to about 2 per cent of the total population. If vaccine production is geared to the inoculation of the new-born babies, then the amount of vaccine required to inoculate the whole population against a BW agent of similar production characteristics would be about fifty times the output of a vaccine for normal use (i.e., for inoculation of babies). Since babies are inoculated with several vaccines, and some adults are inoculated again, the multiple is less than this. Moreover, it will vary widely according to the agent. But it will still be a substantial number. Moreover the comparison here is only with the amount required to defend one's own population, a step which may be a necessary precaution before attacking another country. The amount required for an attack, where much is wasted, would be very much greater. Moreover, if a vaccine plant were turned to these uses, normal vaccination programmes would have to be stopped.

While it can be said that for these reasons the typical vaccine plant is inadequate for the production of a fully military capability, it would be adequate for the production of the quantities required for a sabotage attack or for the kind of low-grade capability that might be sought by a country in the face of military defeat or frustration.

Some common forms of vaccine production are very close technically to production of CBW agents and so offer easy opportunities for conversion. In particular, the capability of producing vaccines against tetanus and staphylococci is widespread and from these it is a relatively small step to producing botulinal toxin and staphylococcal enterotoxin, both potential CBW agents.

Defence laboratories

Defence laboratories, meaning those which have studied the problems of defence against BW and in this context have explored the possibilites of different offensive agents, would possess many of the assets required for production of BW agents on a large scale—experienced staff vetted for security, protective equipment and know-how. These laboratories are

likely to have produced agents in quantitites needed for tests. They would require an expansion of physical facilities—equipment, ancillary plant and safety measures, storage facilities and so on. It would not be difficult to detect these changes, if the establishment were subject to inspection.

Construction of a new laboratory exclusively for BW agent production

For a new production facility the recruitment of skilled personnel is probably the most important problem. They must be taken from somewhere. In a small or medium-sized nation this might cause a noticeable gap. The elaborate protective equipment and fermentors must be acquired. These cannot easily be made *ad hoc* and so would probably be bought from outside. The manufacturers of such equipment are very few. It might be possible to trace the purchases through industry, if it were very open.

"Kitchen" and "garage" production

It is often suggested that production of BW agents might be possible in a "kitchen", presumably on the grounds that the cultivation vessels take up very little room. The trouble is that in these circumstances the first victim would undoubtedly be the cook. With adequate protective equipment, the space needed is considerably greater than that of even a large kitchen. Moreover the amount of media (e.g., meat) needed is approximately the same as the amount of BW agent produced. This must be prepared and sterilized before use and the equipment for this takes space and energy.

A more real fear is that "a couple of microbiologists working in a lockup garage might brew up a bathtub of anthrax spores".[16] In the case of anthrax this is plausible. Anthrax is not too dangerous to handle and relatively simple to produce, but its military applications are limited.[17]

Storage and transport

BW agents need to be kept frozen or, better still, freeze-dried. Material that has been freeze-dried will keep best if stored at controlled temperatures. Except with advanced techniques, it will need to be suspended again in liquid before use.

This means that storage is fairly simple. Normally it is likely to be concentrated in one place or a few places where technical facilities and

[16] D. Fairhall, "Playing the Germ War Game", *Guardian* 6 August 1969.
[17] This is discussed further in Volume II.

safety measures are available; freeze-drying equipment and refrigerated storage are not difficult to identify; but the quantities of material to look for are not large as compared with other families of weapons. Moreover for purposes of evasion it would not be difficult to organize dispersed storage. On the other hand, the importance of stored material as an object for inspection may be limited because the life of biological material is limited. In recent testimony, a US Department of Defense official testified as follows: "The half-life of a few [biological agents] is something on the order of 3 to 4 years. Most biological agents have half-lives of 3 to 6 months, but only if kept under refrigeration."[18]

The microbiologists contributing to this study find these figures low in the light of their knowledge of the viability of micro-organisms. That may be explained by the selection of agents for the US biological weapons programme or perhaps by other special factors. The problem of finding concealed stocks at the time of transition to disarmament is considered at the end of this chapter.

Transport facilities would not appear to present a substantial target for verification. Refrigerated containers will be needed for most agents, and there will be a desire, for technical and security reasons, to release them from the central establishment only at the last possible moment. Moreover safety precautions will be needed. Nevertheless the objects will probably not be very conspicuous.

SIPRI inspection experiment

Some indication of the possibilities of inspection for BW agent production and storage is provided by the inspection experiment undertaken by SIPRI on the basis of a smaller experiment started by Pugwash. A detailed description is given in Volume VI. Briefly, fourteen research laboratories or production establishments in nine European countries—countries belonging to NATO and the Warsaw Pact as well as some non-aligned countries—were inspected during the second half of 1968 and first half of 1969 by varying small teams of well-known microbiologists.

The aim of the experiment was to ascertain whether it is technically feasible to discover if production of BW agents on a scale of military relevance could be carried out in a non-secret microbiological research or production establishment. The estimate of what quantity would be

[18] *Department of Defense Appropriations for 1970,* Hearings before a subcommittee of the Committee on Appropriations, House of Representatives, 91st Congress, 1st session, Part 6, p. 118.

militarily relevant was 10 kilograms of microbial paste or spores. The basis of this estimate was that it would be a sufficient quantity to make an attack over an area of a few square kilometres with an expectation of reaching a high proportion of the occupants of the area by direct contact. This is an extremely low estimate—really too low—of what is a militarily relevant quantity. The inspection technique employed was to enlist the cooperation of a laboratory, to arrange a visit well in advance and to send ahead a questionnaire saying what information would be wanted. The laboratory was then visited for a few days; during the visit the director and staff were interviewed and the establishment examined.

The project received good cooperation. One problem was that large establishments needed to marshal a lot of information in order to answer the questionnaire, and this was costly if the information was not kept in a way that fitted the questionnaire. One West European pharmaceutical company—the largest visited—estimated that it had cost it $10 000 to complete the questionnaire. This figure, incidentally, is an indication of the remarkable extent to which people were ready to cooperate in the experiment.

The idea of a positive experiment (i.e., an attempt by one team to develop a BW capacity in one of the visited laboratories, unknown to the other team consisting of inspectors) had to be given up due to the cost. It would have been necessary to convert the laboratory where production was to be undertaken, with an expensive outlay on new equipment and safety facilities, possibly including the modification of buildings. As has been noted previously, one cannot lightly embark on the production of virulent pathogens.

For an evaluation of the experiment, it was necessary to rely on the opinion of those associated with the project.

The following question was asked:

Suppose that a laboratory has been subjected to a series of five inspections by the same team composed of a microbiologist (bacteriologist or virologist), a biochemical engineer and an administrator specialised in the study of production records, how effective (expressed in per cent of complete) do you think that a subsequent visit would be in disclosing an ongoing secret evasion providing a military BW capability (10 kilogrammes or more of highly virulent microbial paste, hundreds of grammes of botulinal toxin or an amount of rickettsiae or virus sufficient for an aerosol attack over many square kilometres)?

A fully developed documentation back-up permitting an analysis of production records as well as cross-checking of professional competence is assumed to be available to the inspectors. It is further assumed that the visit is unannounced, following a frequency pattern geared to the chance for hitting on an actually ongoing evasion which is more than one in three.

This question was addressed to seventy-seven scientists immediately or peripherally involved. Fifty-five replies were received of which fifty-one provided a percentage figure in answer to the question. The mean of these answers was 60 per cent. Those not experienced in the inspection routine gave answers approximately 20 percentage points lower than those who had been directly involved. As noted below, a number of comments and qualifications were made. Regardless of these—they do not affect the picture much—it is not easy to interpret this percentage figure. Perhaps the important point to emphasize is that it means no more and no less than it says: that the average opinion of those involved in the experiment was that this kind of inspection had about a one in two chance of being successful. The respondents had the advantage of some acquaintance with the experiment and possibly the disadvantage of feeling committed towards it.

The main point to note, however, is that the quantity of material being looked for—10 kilograms of microbial paste or spores—is extremely small compared with the amounts which we have now estimated are needed to constitute a military capability. It is less than the amount needed for one substantial military attack; and it has been reckoned that an advanced country of medium size would need the capacity to produce in a year or less enough for one hundred attacks if it were to possess a full military capability (see above).

The comments made by those who answered the questionnaire were mainly about the possibilities of evasion. These would of course be fairly high with respect to the small quantities to which the experiment was addressed. It was pointed out that some laboratories would present greater problems than others—for example a laboratory where large quantities of potentially pathogenic material were handled normally, or a small laboratory with a very small trusted staff, or a laboratory which provided know-how for a separate secret production unit. It was also pointed out that it would be virtually impossible to carry out unannounced visits. Apart from problems of visas or travel permits, a surprise visit could be refused on grounds of problems in the laboratory, such as escape of radioactivity or decontamination in progress. False records and double books might be kept. It was also suggested that efficiency would be increased if the inspection technique was not always known beforehand and that inspection techniques should be further elaborated with regard to individual agents considered for biological warfare.

It is not possible to draw very extensive, firm conclusions from this evidence. This is partly because, as has been emphasized at the outset, the possibilities of inspection depend very heavily on the political back-

ground and atmosphere of cooperation or non-cooperation within which the operation is conducted. It is partly because our experiment was a limited exploration of the problem.

What can be said is that the experiment, together with our assessment of the required scale of a military capability and the very special safety measures required to produce it, tell against the view that verification is technically impossible regardless of the political circumstances. Plainly more work on the subject is needed—and more publication of the work that has already been done. Meanwhile the tentative conclusions from the SIPRI experiment and our analysis is that a substantial measure of on-site verification would be possible provided certain conditions were fulfilled: documentation, free access to all facilities and personnel, the possibility of visits at short notice or of "permanent" inspection by resident inspectors or by exchange scientists cooperating with them.

In Volume VI there is a discussion of the requirements of an inspection system designed to detect BW agent production down to the 10 kilogram level. The requirements might be relaxed and changed if the threshold were set higher.

Other studies

It is known that the Western European Union Armaments Control Agency and the US Arms Control and Disarmament Agency have conducted inspection experiments in this field but have not yet published their findings. The available information on the WEU inspection system, which applies both to chemical and biological warfare, is discussed in Appendix 3.

Some indication of the results arrived at by the US Arms Control and Disarmament Agency is to be found in their annual reports.

The sixth annual report of 23 January 1967 stated:

> The control of chemical and biological (CB) weapons of mass destruction is an area of serious concern to the Agency. It has been generally believed in the past that the problem of controlling the development and production of chemical and biological weapons was so intractable as to defy the design of a practical verification system. The Agency's research into this field is beginning to indicate, however, that such pessimism may not be justified.
>
> A study was undertaken under contract to investigate the production, transportation, and storage stages of the CB weapons cycle. The idea was to identify "checkpoints" along the processes of these stages which may be susceptible to control. In delineating and examining possible control points, consideration was given to the degree of intrusion required and the relative degree of confidence that might be expected. Its findings lend support to the hypothesis that the cumulative effect of a multiplicity of controls over the several stages

of the weapons cycle tends to create unacceptable risks for a nation contemplating evasion of a CB arms control agreement.

Preliminary results thus far are not complete enough for a valid determination as to the feasibility of controlling CB weapons by inspection, but the findings are encouraging, and the Agency has launched a systematic attack on the problem through research.[19]

The seventh annual report of 30 January 1968 stated:

The Arms Control and Disarmament Agency has completed three external research projects in its search for a basis for possible proposals on the control of chemical and biological weapons; three more are in progress. Complementing this effort is internal research on the implications for US policy of various proposals for CBW control. One important problem involves verification, particularly of comprehensive agreements. While preliminary findings indicate some reason for optimism about the chances of devising effective CBW control measures, results thus far are not sufficiently complete to allow a valid determination of the feasibility of such measures and work is continuing in the Agency.[20]

The eighth annual report of 13 February 1969 stated:

The Arms Control and Disarmament Agency has been engaged in research for several years on the technical aspects of controlling chemical and biological weapons (CBW). Two research contracts were completed in 1968. One concerned the feasibility of verifying a ban on CBW field testing; the other continued earlier studies investigating the production, transportation and storage stages of the CBW cycle.

These studies confirmed earlier tentative findings that the problem of controlling chemical and biological weapons may not be so intractable as generally believed. However, while these conclusions are encouraging, the inspection techniques and conclusions developed in the studies, and upon which the conclusions have been based, have not yet been validated. They need to be thoroughly and realistically tested to prove that what is believed can be done can actually be achieved. The Agency has started a programme to test the CBW inspection concepts.

The Agency also needs to know whether or not there are feasible means which a nation considering evasion of an arms control agreement might utilize in acquiring a CBW capability; how reasonable it would be from a technical and economic basis for a country to embark on such a course; and how such tactics could be discovered and countered. Knowledge of this nature will assist the Agency in assessing the probabilities that CBW arms control agreements can be verified, and determining the degree to which on-site inspection may be required to gain the necessary assurance of compliance. Research was initiated in 1968 to further investigate these aspects of the problem.[21]

[19] US Arms Control and Disarmament Agency, *Sixth Annual Report to Congress, January 1, 1966 – December 31, 1966* (Washington, 1967), p. 28.

[20] *Seventh Annual Report of the US Arms Control and Disarmament Agency,* (US House of Representatives, 90th Congress, 2nd session, document 256, Washington, 1968), p. 31.

[21] US Arms Control and Disarmament Agency, *Eighth Annual Report to Congress, January 1, 1968 – December 31, 1968* (Washington, 1969), pp. 19–20.

The ninth annual report of 20 January 1970 stated:

Limitations on chemical weapons raise more difficult problems. Extensive research has shown that a skillful and determined evader could make it difficult to detect his violations of a ban on production or possession of chemical weapons. Research into sensors and detection techniques is continuing, in coordination with other government agencies, and potentially promising developments are being tested. The current ACDA program will provide more insight into the probabilities of detecting clandestine or undeclared activities.

With the cooperation of the Department of Defense, ACDA is working out plans to investigate the problems of verifying the declared destruction of chemical weapons; these investigations will be conducted in connection with actual destruction and demilitarization operations to be carried out by the Department of Defense.

For chemical and biological weapons, ACDA research has developed a number of indicators for use by inspectors. In December [1969] Howard Furnas, Special Assistant to the ACDA Director, told a House Foreign Affairs Subcommittee, "We believe that major progress can be made toward resolving the technical problems involved in verification by direct observation, and we intend to devote greater efforts to this end."[22]

The tenth annual report of 27 January 1971 stated:

ACDA's research program on problems of chemical and biological weapons verification is examining all stages, from development to destruction, of the chemical and biological weapons life cycle. The research is designed to identify activities associated with the development, production, transportation, storage, or destruction of chemical or biological munitions and weapons so as to determine requirements for verification of compliance with limitations on these weapons. By close technical observation of the U.S. Army's destruction program for chemical and biological weapons, verification requirements and capabilities for this portion of the cycle will be examined during the coming months.[23]

A good deal of ACDA's work on CB verification problems has been performed under contract with research organizations involved in the US CBW programme. Likewise, some of the verification techniques that have been studied have been tested against different phases of the US CB weapons cycle. The first major contract, performed during 1964–66, yielded a nine-volume study on *Inspection for Production, Transportation and Storage of Chemical and Biological Weapons.* The results were developed into possible verification procedures during follow-on contract

[22] US Arms Control and Disarmament Agency, *Ninth Annual Report to Congress, January 1, 1969 – December 31, 1969* (Washington, 1970), p. 13.
[23] US Arms Control and Disarmament Agency, *Tenth Annual Report to Congress, January 1, 1970 – December 31, 1970,* ACDA publication 57, p. 14.

work in 1966–68. In the course of the following year, these procedures were examined against possible evasion techniques. The second major line of contract work, performed during 1965–68, concerned the detection of field-testing of CB weapons. Almost all of the contractees' reports on these topics were classified; but one thing which emerges from what little is known of them is the marked optimism of their authors as regards the feasibility of CW verification compared with the pessimism of the working papers on the subject that have been tabled by the US delegation at Geneva.

IV. *CW agents: the possibilities of direct inspection at the stages of development, production, transport and storage*

We now turn to the problem of verifying that CW agents are not being developed or manufactured.

There are many questions which have to be answered in detail before a decision can be taken about the manufacture of a candidate CW agent. These would be some of them: Are the toxicological characteristics of the agent superior to those of existing agents? Is its stability towards thermal and mechanical stress adequate for easy dissemination from weapons? Is its chemical stability adequate for prolonged periods of storage, and can it be improved? How are its physical and chemical properties likely to influence its persistency on the ground and its concentration in vapour form under varying conditions of weather and terrain? How well can existing anti-gas defensive measures protect against its effects? Can it be manufactured economically from readily available raw materials? Are any of its congeners superior in these respects?

The answers require much laborious experimentation by workers with particular skills with specialized equipment and facilities. Several different areas of science and technology will be involved, and as the development work advances, it is likely to become increasingly distinguishable to an outside observer from activities unrelated to chemical weapons.

If these development activities were concentrated in a single complex of laboratories and proving grounds, it seems unlikely that their existence could remain entirely unnoticed for any great length of time; and the CW agent development process is a lengthy one. The nerve gas tabun, for example, was discovered at the end of 1936, but it was not until the middle of 1942 that the German Wehrmacht began to possess militarily-

significant stocks of it, despite an intensive development drive.[24] For VX, the corresponding lead-time for the US Army was about seven years.[25] But the acquisition of firm evidence about a CW agent development programme would depend strongly on the degree of access permitted by the country concerned to a verification team. Furthermore, if the development work were dispersed among several military, industrial or academic facilities, the chance of concealment and the required degree of intrusiveness would increase considerably. From this point of view, then, it might be concluded that, by itself, the agent development phase of a chemical weapons programme would not be an especially promising one for verification purposes.

The phase of large-scale agent manufacture seems far more promising. In the first place, the facilities required are likely to have conspicuous characteristics, some of which may be apparent even without on-site inspection. In the second place, a large-scale manufacturing programme, with its heavy demands for specialized services and raw materials, is likely to perturb the overall chemical economy of the country concerned in a manner which a verification organization might be able to detect and characterize with only a limited degree of intrusiveness. These points are discussed further below. Taken together, they suggest that a verification process directed at the agent-manufacture phase could provide a considerable degree of reassurance without great intrusion. The need for actual on-site inspection could be reduced, and perhaps even eliminated, if the verification organization concentrated a good part of its resources on the collection and analysis of pertinent economic data. This monitoring process could be expedited by prior agreement among the parties to the disarmament treaty to provide the verification organization with specified industrial statistics (for example, annual production figures for certain key raw materials and intermediates, and information on the final disposition of these materials). But a great deal would depend on whether confidence existed that countries participating in the system would provide the necessary data on a continuing basis.

Characteristic features of CW agent factories

In order to acquire a militarily-significant stockpile of chemical weapons a country would have to embark on a substantial CW agent manufacturing programme. The figures given in table 2A.5 suggest its likely order of magnitude. Another indication of its size is the estimate sometimes quoted

[24] The development, testing and production were dispersed and escaped detection by the Allies during the war.
[25] See Volume I, p. 75.

Table 2A.5. Some figures for past CW agent production runs

Thousands of tons

Country	Production of CW agents during World War I	Production of CW agents during World War II	Unauthenticated estimates for present-day stockpile
Germany	62	74	0
UK	23	35	0
Japan	0	7.5	0
France	34	..	..
USSR	3.5	..[a]	0–350[b]
USA	5	135	50–100[c]

.. = not known

[a] During World War II, Germany estimated that the USSR was manufacturing CW agents at a rate of 8 000 tons per month.

[b] This is a figure quoted in the February 1968 issue of the West German periodical *Soldat und Technik*. A US Department of Defense official, when testifying before a subcommittee of the House Committee on Appropriations in June 1969, stated that current US intelligence estimates were that the Soviet CW stockpile was seven to ten times larger than the US one.

[c] The precise figure has not been published in the open literature. As explained in Volume II, the range given here is estimated from published figures for expenditure on CW agent procurement.

Source: Volumes I and II of this study.

in the USA that a major power would need supplies of nerve gas at a rate of 100 tons per day in order to support large-scale battlefield CW. As regards the size and number of factories that might be involved, it may be noted that the German stockpile of CW agents during World War II (around 74 000 tons) was derived from fourteen plants that were run at about 10 percent of their maximum capacity; rather more than 100 000 tons of the US stockpile came from seventeen US Army plants, the remainder being acquired from commercial sources.[26] Another relevant consideration is that a country planning to violate a chemical-weapons disarmament agreement would presumably see a compelling and fairly immediate need for stocks of chemical weapons in view of the possible consequences of the violation being detected. It therefore seems likely that a short-term rather than a long-term manufacturing programme would be envisaged.[27] One conclusion that might tentatively be drawn from this is that in a European setting, for example, a chemical plant having a

[26] The largest German CW agent factory during World War II was the Gendorf mustard-gas plant, whose capacity was 4 000 tons per month. The tabun factory at Dyhernfurth had a capacity of 1 000 tons per month, while the projected sarin factory at Falkenhagen was to have had a capacity of 500 tons per month. The figures quoted for by-product phosphoryl chloride suggest that, by the end of 1954, US Army Rocky Mountain Arsenal, Colorado, was producing sarin at a rate of about 300 tons per month.

[27] It is also worth noting that, in the design of industrial chemical process-plant, engineers commonly think in terms of a three-year useful life-cycle, particularly for plant handling corrosive materials of the kind likely to be involved in CW agent production (hydrochloric and hydrofluoric acids, for example).

capacity of less than about 5 tons per day would not be of obvious interest to a verification inspectorate. It is, of course, conceivable that a clandestine programme might be scattered around a number of smaller production plants; but the security of this arrangement against detection would be diminished by the transportation arrangements and so on needed to supply and link up the different facilities.

In some sectors of the chemical industry a plant of 5 tons per day capacity would be minute; in others it would be large. The following figures provide a perspective:

1. The British pilot-plant facility (now derelict) for the nerve gas sarin at Nancekuke, Cornwall, had a production capability of about 0.14 tons per day.

2. Some of the newest ethylene plants have a production capability of 1 500 tons per day or more.

3. Phosgene and hydrogen cyanide are manufactured commercially in the USA at rates of about 350 000 and 200 000 tons per year respectively. There are nineteen phosgene plants and eleven hydrogen cyanide ones: their average production is thus about 60 tons per day.

4. There are fourteen manufacturers of organophosphorus pesticides in the USA, and their present combined output is about 65 000 tons per year. The average manufacturer thus produces about 15 tons per day.

5. Outside the USA, the present total world output of organophosphorus pesticides is about 65 000 tons per year, and this is produced in more than fifty factories. The average plant output is therefore less than about 4 tons per day.

For an industrially developed country, the principal feature distinguishing chemicals that might be considered attractive as CW agents from normal chemical commodities is their toxicity. This would certainly be reflected in the facilities and construction of a CW agent factory. The provisions for disposing of plant effluents, for preventing leakages from process equipment, and for ensuring the safety of plant workers and local inhabitants in the event of accidents would be especially stringent, and therefore conspicuous to a visiting inspection team. Apart from this feature, the points of distinction between CW agent plant and normal chemical factories would depend on the nature of the agent.

It is possible to visualize a country finding military attractions in some of the more toxic of the chemicals it produces for industrial or agricultural purposes. Obvious examples here are hydrogen cyanide, phosgene and the simpler organophosphorus insecticides, such as Bladan or Paraoxon. Supplies of these might be diverted into stockpiles for CW purposes. Direct inspection of the factories in which they were made would clearly not

be much help in detecting this. The diversion would, however, produce dislocations in sectors of the chemical economy that depended on the chemicals concerned: it might create shortages of certain types of finished product, and surpluses of unconsumed intermediates or raw materials. These would be phenomena which an economic data monitoring system might be capable of detecting, particularly when it is considered that the countries which might contemplate such diversion would be unlikely to possess highly developed chemical industries.

As regards the distinguishing features of factories making single-purpose CW agents, the most closely studied from a verification point of view are those of nerve-gas installations. Other installations, such as those for mustard gas, have received less study. This concentration on the nerve gases is not entirely unjustifiable. The technology involved in mustard gas manufacture calls for sophisticated chemical engineering and skilled plant operation; a country that could provide these would probably also be capable of manufacturing nerve gas, and from a military point of view the nerve gases are far more attractive than mustard gas. There is thus a higher probability of a clandestine nerve-gas programme than a clandestine mustard-gas programme.

The nerve gases are organosphosphorus compounds, requiring elemental phosphorus as one of their basic raw materials. The world output of phosphorus is about a million tons per year (enough for at least 3 million tons of nerve gas), so that the industry based on it is a substantial one. However, as only a very small proportion of the phosphorus is processed into intermediates that might be used for nerve-gas manufacture, the sector of the chemical industry in which nerve-gas production might occur is in fact rather small. This will greatly facilitate the task of a verification inspectorate: preliminary knowledge of the nature of the raw materials entering factories would permit all but a very few to be eliminated as suitable targets for on-site inspection. This is discussed further below.

Having selected a factory for on-site inspection, how might a visiting inspection team then proceed? If the factory was in fact making nerve gas, there would inevitably be extensive safety precautions surrounding at least the terminal stage of its throughput. The only highly toxic organophosphorus compounds that are made commercially are insecticides. In the event that the inspection team discovered elaborate safety precautions, its main task would therefore be to decide whether the processes it was observing were for insecticides or for nerve gas.

In the case of an industrially developed country, the visiting team would probably find little difficulty in making this distinction. The principal criterion would be that of the level of safety precautions. Although the

Table 2A.6. The relative toxicity of nerve gases and organophosphorus insecticides

Acute lethality in mice, s.c. LD50, mg per kg bodyweight

Time of introduction	Insecticides[a]		Nerve gases[b]	
Early 1940s	Bladan	0.5	Tabun	0.27
Late 1940s	Dimefox	2.3	Sarin	0.20
	Parathion	16.2	Soman	0.16
Mid-1950s	Dipterex	500	Edemo	0.022
	Malathion	3 000		

[a] LD50 determinations made at the Israel Institue for Biological Research, Ness-Ziona (H. Edery, D. Soroker and W. Kuhnberg, *Israel Journal of Medical Science* 6: 209–218, 1970). *Bladan* is tetraethyl pyrophosphate; *Dimefox* is NNN'N'-tetramethylphosphorodiamidic fluoride; *Parathion* is 00-diethyl 0–4-nitrophenyl phosphorothioate; *Dipterex* is dimethyl 2,2,2-trichloro-1-hydroxyethylphosphonate; and *Malathion* is 00-dimethyl S-1,2-dicarbethoxyethyl phosphorodithioate.
[b] LD50 determinations made at the Institute of Pharmacology and Toxicology, Belgrade (B. Bosković and R. Jović, *Vojnosanitetski Pregled* 26: 179–182, 1969 and R. Jović and M. Milosević, *European Journal of Pharmacology* 12: 85–93, 1970). *Tabun* is ethyl NN-dimethylphosphoramidocyanidate; *Sarin* is isopropyl methylphosphonofluoridate; *Soman* is 1,2,2-trimethylpropyl methylphosphonofluoridate; *Edemo* (a V-agent) is 0-ethyl S-2-diethylaminoethyl methylphosphonothiolate. Figures for VX (O-ethyl S-2-diisopropylaminoethyl methylphosphonothiolate) have not been published, but are presumably close to those for edemo.

first organophosphorus insecticides to be marketed had a mammalian toxicity that was comparable with that of the nerve gases, this is no longer the case for those countries that are able to manufacture the newer organophosphorus insecticides. And while insecticides have become less acutely toxic to mammals, the nerve gases have become more so, as table 2A.6 indicates. It is worth noting, though, that the search for pesticides that impose a lighter burden on the environment may well reverse this tendency.

The differences between the safety precautions in a nerve-gas plant and those in a typical organophosphorus-insecticide plant have been described as follows:

> ... The measures that must be taken to protect personnel [in a nerve-gas plant] are unique in the chemical processing industry. One of the most easily observed attributes is the control exercised over the environmental air. Buildings are constructed air tight and operated at a negative pressure. Reactors are constructed for entirely remote operation. Safety equipment such as masks are carried by all personnel and protective suits are readily available. Gas alarms are present in the area to alert the staff. Plant medical facilities are much more complete than usual and may be equivalent to a small hospital. ...
>
> In contrast to this, an organophosphorus pesticide plant, which in commercial terms is producing a highly toxic material has none of the safety features associated with toxic agent manufacture. All vessels are open to ready access. No control of any kind is exercised on the plant air. In fact, where the climate permits, reaction vessels are open to the air with only shed roofs for personnel rain shields. Gas masks may be available but are not individually carried.

Plant medical facilities are restricted to the usual nurse, cot and first aid supplies.[28]

The filling of the end-product into shipping containers differs so greatly as between nerve gas and organophosphorus pesticides that no direct comparison is possible:

> ... A typical [insecticide] plant, such as C— in Kansas City, Missouri ... has the following type of filling operation. This plant, whose nominal output is about 10 tons/day, has a single filling line for containers up to 5 gallons in size. The operation is entirely open to the atmosphere and conducted in a light frame corrugated building, whose doors and windows stand open in summer. An open exhaust fan is used in the roof eaves to purge the building of fumes. The operator wears a rubber apron and gloves, a face shield and a dust respirator. Spills are slushed down floor drains and flow out into an open drainage ditch. The filling machine is open with containers moving along a conveyor belt to a position under the filling spout. Filling is automatic but the containers move out from under the filling opening uncapped and lids are attached in a separate operation farther down the line.[29]

Such procedures would be inconceivable on a nerve-gas filling line.

Manufacturing processes for nerve gases other than tabun involve several steps, and it is only the final one that requires peculiarly stringent safety precuations. A country wishing to evade inspection might therefore attempt to conduct the final step in hidden facilities. There might also—or instead—be other reasons why it would be advantageous to separate the final step. Germany, for example, conducted the first three stages of its World War II sarin process in one part of the country, while the final one was intended to take place in another part. The problem facing the inspection team visiting an intermediates plant would then be to distinguish production of a relatively nontoxic nerve-gas precursor from production of organophosphorus insecticides, or their precursors.

Here again the distinction might not be difficult to make, even in cases where the team was not permitted to analyse the plant output.[30] This is not the place to go into the technical details on which the distinction might be made. Several observations could contribute to it; in the main, these would relate to the different process equipments, utilities and operating conditions needed to produce molecules that could only serve as nerve-gas precursors. Thus, an essential stage in nerve-gas production involves the alkylation, generally the methylation, of a phosphorus atom. This is

[28] A. R. Pittaway, *An Approach to the Problem of Inspecting for Organophosphorus Chemical Munition Production, Transportation and Storage,* paper presented at SIPRI CW symposium, (unpublished), August 1968.
[29] *Ibid.*
[30] Arguments based on commercial secrecy could be put forward by the plant owner to prevent such an analysis. See pages 201–209 below.

a rather difficult reaction to conduct, and an experienced chemical engineer could almost certainly distinguish the necessary operations from those needed in insecticide processes. Methyl-phosphorus bonds do not occur in commercial insecticides, or indeed in any other peacetime commodity made on a large scale.

These considerations, of course, also apply in the case of a factory making fillings for "binary" nerve-gas weapons.[31]

It must be noted, though, that the inspection team's ability to distinguish nerve gas or nerve-gas precursor manufacture from that of commercial organophosphorus products would depend strongly on the degree of access to the plant and the cooperation of the plant personnel. If the team were allowed to intrude no farther than the plant perimeter, for example, its task would be a great deal more difficult. Nonetheless, some possibilities would remain. It might well be possible to characterize some of the activities within the plant either by remote observation of its installations, perhaps aided with special sensing equipment, or by analysis of materials leaving the plant. Access to finished products might be denied to the team, but access to waste materials or by-products might not be precluded, or might be impossible to prevent. Nerve-gas plants are likely to have features that could be identified by these different techniques, and distinguished with some degree of assurance from those of *bona fide* organophosphorus insecticide factories.

Many of the features of a nerve-gas plant that might be especially noticeable to on-site inspection—notably the safety precautions—would not be apparent to off-site observation, mainly because they concern the internal fittings of buildings. There are other equipments, though, which are not likely to be enclosed, and which might be conspicuous enough to be observed and identified at a distance. One example here would be the apparatus needed to handle heat-exchange fluids. An important factor in nerve gas and nerve-gas precursor production is that certain of the intermediates are highly sensitive to water—to the extent that if leaks occur in water pipes servicing reactor vessels there would be a strong likelihood of inflammation or explosion. The great majority of chemical process plants rely on water or steam for temperature control, but for nerve-gas work this would be precluded. Instead, special heat-exchange fluids—refrigerants and heating-oils—would have to be employed. These

[31] Binary nerve-gas weapons are described in Volume II. Instead of containing nerve gas, they are loaded with two different chemicals separated from one another until shortly before the weapon functions. One of them is a nerve-gas precursor; the other is a reagent for converting the precursor into nerve gas while the weapon is being delivered to its target.

are not cheap, and would be needed in substantial quantities. A nerve-gas production facility will therefore include a cooling-tower for processing refrigerant fluids before recycling. Such towers are tall and conspicuous, almost certainly distinguishable by an expert from say, distillation columns or gas-scrubbers. They are not a feature of commercial organophosphorus pesticide plants.

Comparisons of the processing equipments needed for nerve-gas production and insecticide production disclose differences that offer similar possibilities for off-site detection. None of them would provide conclusive evidence in itself, but each would be an additional element in the "fingerprint" that an inspectorate might construct from a set of different observations in order to identify nerve-gas factories. They could of course be masked rather easily, for example with deceptive architecture, in an attempt to evade detection. But there are other elements for which this might not be so easy.

Effluents from a nerve-gas factory, both liquid and gaseous, have to be carefully handled. Some sort of pre-discharge treatment would have to be applied to remove toxic materials. It is unlikely, however, that this treatment would destroy all indications of the types of process from which the effluents were discharged. Analysis of chimney-wastes or liquid-wastes would almost certainly yield useful information. There are many possibilities for collecting samples and conducting such analyses at points far removed from the plant.

The safe and efficient disposal of liquid wastes from nerve-gas factories was one of the more severe problems facing the designers of the Dyhernfurth and Falkenhagen nerve-gas plants in Germany during World War II, and has remained a problem for other plant designers since then. There have been three types of approach: (*a*) rigorous detoxification of the wastes and subsequent discharge into rivers, the sea, or permeable-bottom lagoons; (*b*) discharge into impermeable-bottom lagoons; and (*c*) discharge into deep subterranean wells. Method (*a*) was employed in the German World War II plants (discharge into the Oder River), at the British pilot plant for nerve gas at Nancekuke (discharge into the sea), and at the US Army sarin factory at Rocky Mountain Arsenal (lagoons). Methods (*b*) and (*c*) have also been employed at US nerve-gas factories. One of the difficulties facing all three methods is the sheer bulk of material to be handled. A typical sarin plant, for example, might generate something like 50 tons of liquid waste per ton of sarin output.[32]

[32] A. R. Pittaway, *op. cit.*

Discharge into river or sea water would not be particularly conspicuous in itself: it is a common method of waste-disposal for chemical factories. An inspection team might well be able, however, to characterize and identify waste from a nerve-gas plant. Whatever type of pre-discharge treatment was used, it would be most unlikely that all characteristic components would be destroyed: compounds containing phosphorus-methyl linkages, for example, would almost certainly persist and be identifiable for long periods after discharge.[33]

A nerve-gas waste lagoon, because of its size and proximity to a chemical factory, and because it would represent a rather unusual method of waste disposal, could quickly attract the attention of an inspection team. The microflora growing in it might be distinctive, say to aerial reconnaissance.[34] If access to it were possible, an inspection team should have little difficulty in identifying its function by chemical analysis.

Well-discharge, although expensive in terms of capital investment, and suited only to particular areas of the earth's surface, probably provides both the safest and the least conspicuous method of waste disposal. It has been one of the methods used at Rocky Mountain Arsenal, for example, and at the VX plant at Newport, Indiana.[35] Information about the

[33] A member of the US Army Chemical Corps, in the course of a paper outlining certain possibilities for monitoring a country's weapons-producing activities from outside its borders wrote as follows:

"It is characteristic of river entry into the oceans that the less dense fresh water may flow for miles atop the more dense saline ocean water before ultimate mixing occurs. The relative accessibility of the river effluent to sampling by ship or submarine suggests the utility of water contaminants as telltale indicators of various industrial operations in the country being drained by the river and its tributaries. For example, an as yet unvalidated technique has been calculated to be feasible for detecting nerve gas production and estimating production levels from nontoxic wastes discharged into rivers. Characteristic linkages appear in the waste product molecules which are highly stable, do not arise from other sources, and can be analyzed in the low concentrations that would be expected for typical situations." (G. H. Milly, "A Proposed Approach to Arms Control: Unilateral, Extra-territorial Inspection", *Journal of Arms Control* 1: 219–223, 1963.)

[34] Standing water having a phosphate concentration exceeding about 0.5 mg per litre is likely to provide an efficient culture medium for wind-borne algae. (See F. D. Dryden and G. Sten, "Renovated Waste Water Creates Recreational Lake", *Environmental Science Technology* 2: 258–278, 1968.) There is thus a likelihood that nerve-gas waste lagoons will become covered with a characteristic and prolific algal bloom.

[35] The Newport well was designed to handle waste at a maximum rate of 100 gallons per minute. It is located some 5 500 feet below surface, a depth that ensures that no waste can enter the nearby Wabash River, or infiltrate into potable underground water reservoirs. ("Chemical Waste Disposal at Newport Chemical Plant", *Armed Forces Chemical Journal* 16(2): 29–30, 1962.)

The Denver well was activated in February 1962, some time after the main bulk of sarin had been made at the Arsenal, and while the plant was being used by US army lessees for commercial pesticide production. When it was in operation, it handled waste at a rate of up to 9 million gallons per month, absorbing a total of about

former of these became widely available in 1968 when a remarkable correlation was established between waste pumping operations and local earth tremors.[36] Not that seismology seems a practical aid to CB verification, this phenomenon serves to illustrate further the range of possible data that might help an inspection team in locating a nerve-gas factory.

As with most chemical processes, the manufacture of nerve gas generates by-products whose identity depends on, and therefore characterizes, the production process being used. Information about factory by-products could therefore be valuable to an inspectorate. By correlating it with information on waste materials and inputs of raw materials, power and water, a fairly good idea about the purpose of a particular plant might be formed even without access to the site or to the main product. A particularly characteristic by-product of a favoured large-scale process for nerve-gas production is phosphoryl chloride. This material may be generated at a rate of up to 3 or 4 tons per ton of nerve gas produced. Even if an inspectorate is denied access to by-products, the disposal of large quantities of phosphoryl chloride is likely to be difficult to conceal. If it is dumped as waste, it will increase the potentialities of waste-disposal surveillance as a verification technique. If it is released into the commercial market, it is likely to cause repercussions that an economic-data monitoring service might detect, for the market for phosphoryl chloride and for the commodities that might be made from it is not large. This was indeed a problem that taxed the US Army when it embarked on large-scale production of sarin in the 1950s. In this connection, the head of the US Army Chemical Corps stated:

> It was determined that bidding through normal procedures by issuing invitations would not result in disposing of the necessary quantity in the required time. It was also realized that the quantity of material we had to dispose of could cause a very definite impact on the commercial market. Therefore, prior to negotiation for the disposal of this material, meetings were held under the auspices of the National Advisory Committee of the Department of Commerce with producers and consumers of phosphorus oxychloride. As a result of these meetings, a plan to restrict distribution to normal commercial producers of the material was recommended.[37]

He went on to say, however, that the Chemical Corps was endeavouring to avoid this disposal problem by applying conversion procedures so that the phosphoryl chloride could be recycled into the plant throughput. These

163 million gallons in all. It was located at a much deeper level than the Newport well, some 12 000 feet below the surface. (J. Eberhardt, "To Pump or Un-pump", *Science News* 93: 434–435, 1968.)

[36] One month after the well had come into use, Denver experienced its first earthquake in eighty years.

[37] "By-products Disposal", *Armed Forces Chemical Journal* 9(3): 38, 1955.

procedures were eventually developed, and a conversion plant was constructed. The presence of such a plant would, of course, add to the characteristic features of a nerve-gas facility, augmenting its dissimilarities to commercial organophosphorus facilities.

Inspectorate supporting services

Because there are so many chemicals that might conceivably find CW applications, and because of the variety of ways in which they might be made, it is conceivable that almost every sector of a country's chemical industry might be engaged in CW agent production. Against a large and thriving chemical economy, the task of providing reassurance that clandestine CW agent production was not taking place might therefore seem almost impossible. An inspectorate could not be expected to visit every single chemical plant, and if it were few governments might agree to its existence, or allow it to operate. It is one thing to identify the function of a plant by on-site inspection; but it is quite another to detect suitable plants for inspection in the first place.

But there are a number of limiting factors that might operate to make the task easier. While the number of candidate CW agents is large, rather few of them are likely to be so militarily attractive that a country might risk a clandestine and illegal manufacturing or stockpiling programme. Those that might prove attractive in this respect would make specifiable demands on the resources of raw materials, services and skilled manpower at the disposal of the country concerned. This is significant in two respects: the choice of agent for manufacture would be limited by the available resources; and the demand on the latter would have to be met from somewhere. A chemical economy is a closely balanced system: diversion of resources into CW agent manufacture could produce dislocations in the normal patterns of production and consumption that a verification organization might profitably monitor. If the resources were derived by expansion of the existing production base, rather than by diversion from it, the CW programme would become less well camouflaged by *bona fide* industrial activities, and therefore less inconspicuous.

These considerations suggest that one of the more important components of a verification organization would be an expert information service capable of defining the sectors of national chemical industries where clandestine CW agent production might conceivably occur, and of collecting and analysing all available information about them. An efficient service along these lines, using advanced data-handling equipment, could focus the activities of a verification system, thereby increasing its credibility and reducing its intrusiveness.

There are a number of ways in which the usefulness of such a service might be increased still further. One of these would be a system of data reporting whereby governments furnished the service with specified types of industrial statistics. At the present time most countries publish production figures and related material on their chemical industries, but these vary widely as regards scope, accuracy, format and timeliness. In addition, the product breakdown and so on given would generally be too coarse to be of much value to a verification organization attempting to detect and interpret dislocations in chemical economies. Proposals for industrial-data reporting agreements have been made frequently during chemical disarmament negotiations, both at the present Geneva talks and during the League of Nations days. The optimal requirements have been studied, but a good deal more work remains to be done. A difficult problem is that of commercial secrecy.

There are two distinct categories of data that might form the basis of an internationally-agreed reporting system. The first would concern those dual-purpose chemicals such as phosgene or hydrogen cyanide that are a common feature of peacetime chemical industries, but which might conceivably be used as CW agents. The second would concern single-purpose CW agents that have no peaceful applications. (A third category, relating to tear gases and anti-plant chemicals, might also be considered.)

While inspection of production plants would not be much help in coping with dual-purpose chemicals, the reporting of verifiable information about their use could be of value in providing assurance that they were not being diverted into military stockpiles. Physical inspection of, for example, the departure of dual-purpose chemicals from one site and their arrival at another might perhaps be needed to check the reported information, but its role would be secondary rather than primary in the overall verification system for these substances. The data requirements would presumably be for figures on the import, export, production and consumption of chemicals that exceeded a specified toxicity[38] and whose annual turnover

[38] The toxicity limit would have to be defined rather carefully. The normal toxicological practice of specifying it in terms of the dose having a 50 per cent chance of killing a subject, the "LD50" value, would presumably be followed. But chemicals can vary widely as regards their toxicity to different animal species and the routes whereby they are administered. For example, one laboratory has reported LD50 figures for methyl fluoroacetate by the intravenous route that show a 200-fold difference as between dogs and mice (0.08 mg/kg and 17 mg/kg bodyweight respectively). Another laboratory studying hydrogen sulphide lethality in rats found an LD50 of 0.27 mg/kg for the intravenous route and 4.8 mg/kg for the intraperitoneal. Furthermore there are different methods of determining LD50s, and values obtained by one method may not be comparable with those obtained by another. Thus the literature contains subcutaneous LD50 figures for the insecticide Amiton in mice that range from 0.14 mg/kg to 4.6 mg/kg. The LD50 thresholds that

exceeded a specified lower limit. The requirements would be more difficult to specify for the category of single-purpose CW agents. The focus would presumably be on the raw materials and intermediates from which they might be made, and on those sectors of the chemical industry that depend on these materials. The first step would be to decide on the types of potential CW agent to be accommodated—the nerve gases, the mustards, the carbamates, the arsenicals, and so on. Here the verification organization would have to keep abreast of advancing scientific knowledge. Then it would be necessary to identify all the critical raw materials and intermediates. If several families of potential CW agents were being covered, the list might be large, particularly for relatively complex chemicals like the nerve gases where several different preparative routes are feasible, even on plant scale, each one involving a different set of intermediates.

Despite the variety of ways in which nerve gases can be made, they all have one feature in common, namely a requirement for elemental phosphorus. (Another feature, one that is common to several of the cheaper preparative routes, is the involvement of methylphosphonic dichloride; but as this is a material which has, as yet, no commercial applications, governments could hardly be expected to report anything other than minute production figures if a nerve-gas nonproduction agreement were in force.) The only economical way of producing phosphorus is by the reduction of phosphate rock in electric arc furnaces. These are expensive to construct and run, and require very large supplies of electricity. For this reason the number of phosphorus plants in the world is small, about thirty-five or forty in all, and as of 1965 only thirteen countries had a phosphorus production capability exceeding 1 000 tons per year.[39] The sources of one basic raw material for nerve-gas production are thus strictly limited, and reported information from their production and distribution records could therefore be of crucial importance to a verification organization.

Information of this type, coupled with export–import records for elemental phosphorus, would provide the base from which a verification organization could track phosphorus through a country's chemical economy. The sectors of immediate interest would be those that combined phosphorus inputs with inputs of chlorine, for all nerve-gas processes re-

have been suggested recently in Geneva, 0.5 mg/kg, s.c., and 0.2 mg/kg, i.v. (subject species not specified), are both well below typical figures reported for hydrogen cyanide (ca. 1 mg/kg, i.v.).

[39] These countries, with their estimated annual production capabilities, in thousands of tons, were as follows: Australia (6), Canada (30), China (20), France (15), Germany (East: 20, West: 80), Italy (14), Japan (33), Sweden (1), the UK (35), the USA (612), the USSR (110) and Yugoslavia (1).

quire either phosphorus trichloride or, for tabun-type nerve gases, phosphoryl chloride as an intermediate. (It is worth noting that phosphorus pentasulphide is not a potential nerve-gas intermediate.) Such sectors comprise only a small proportion of the overall phosphorus industry—less than 3 per cent in the USA, for example, in 1965. They provide rather specialized products—insecticides, plasticizers, petrol additives, functional fluids and certain dyestuffs and medicinals.[40] Their surveillance by an inspectorate should not be an insuperable task.

In conjunction with chlorine, other inputs into a phosphorus-consuming industry that would be of interest to an inspectorate would be certain types of petrochemical—various sorts of alcohol and, for V-agents, ethylene sulphide and certain types of amine and thiol. In addition, hydrogen fluoride or fluoride salts, in conjunction with chlorine and certain alcohols, would be relevant for possible sarin-type nerve-gas production.[41] A further material that might be watched would be anhydrous aluminium chloride.

The tracking process envisaged above would be one of economic data analysis coupled with a certain amount of physical inspection of records at manufacturing installations. It might usefully be augmented by a monitoring of transportation records (waybills, shipping documents, etc.), checking them against shipments on a sample basis at the points of arrival and departure. It might be further augmented by physical surveillance of transportation networks, although this would introduce a high level of intrusiveness into the verification system.

If transportation surveillance were an acceptable verification technique,

[40] Of the 520 000 tons of elemental phosphorus produced in the USA during 1965, 0.6 per cent went to make insecticides and related products based on phosphorus trichloride, while 1 per cent went to make plasticizers, petrol additives, functional fluids, dyestuffs and medicinals and related products all based on phosphoryl chloride. Of the 8300 tons of phosphorus thus consumed by way of phosphoryl chloride and phosphorus trichloride, about 10 per cent went into insecticides, about 30 per cent into plasticizers, and about 12 per cent into petrol additives and functional fluids. The phosphorus trichloride-based insecticides accounted for about 40 per cent of the total US production of organophosphorus insecticides; the remaining 60 per cent were derived, together with other commodities, from phosphorus pentasulphide, whose production consumed 2 per cent of the available elemental phosphorus. A ton of phosphorus is enough for about 3.3 tons of nerve gas, 4.8 tons of phosphorus trichloride insecticide or 5.4 tons of phosphorus pentasulphide insecticide. The US output of organophosphorus insecticides was around 37 500 tons in 1965; as of 1970 it had increased to about 65 000 tons, about half the total world output.

[41] As an indication of the scale on which some of these materials are needed for nerve-gas production, the raw materials requirements which the Germans calculated for sarin manufacture during World War II may be quoted. They were as follows, per 100 tons of sarin: phosphorus trichloride, 510 tons; chlorine, 145 tons; methyl alcohol, 160 tons; isopropyl alcohol, 58 tons; and dry hydrogen fluoride, 20 tons.

despite its intrusiveness, its application might usefully be extended beyond the phase of CW agent production. In themselves, the phases of CW agent transportation and storage are probably not particularly promising for verification activities.[42] It is, however, probably true to say that transportation would be the most overt of the links between the multifarious manufacturing activities making up a chemical weapons production programme. CW agent raw materials, the agents themselves, empty weapons and filled weapons would all have to pass along a transportation network having outputs at one or more storage depots. While the passage of individual consignments of material along this network might be inconspicuous—intentionally or unintentionally—corroborative evidence could build up quickly, should suspicion fasten upon these consignments. Once perceived, suspicious activity could be followed forwards and backwards over the network, and the suspicions would gain in strength as additional suspicious activities were thereby discovered. Once the pattern of the network began to appear, more specialized inspection techniques could be put into operation.

V. *Development and manufacture of weapons*

Weapons to disseminate BW and CW agents, despite their rather specialized features, have much in common with conventional munitions and even with certain types of civilian equipment. To take some examples: some toxic-agent spray tanks are identical with smoke-agent spray tanks and are similar to aircraft crop-spraying units; a tail-ejection air-burst design of mustard-gas bomb can be used with a napalm filling instead; cluster units of stick-bombs designed for toxic particulates and certain BW agents can also be used to spread DDT over mosquito-infested areas; the standardized US cluster units for CBW bomblets, whether for missile or aircraft delivery, are equally well suited to fragmentation, smoke, or incendiary bomblets, and the different bomblets themselves often have interchangeable components; to a first approximation, some types of chemical artillery shell are normal high-explosive shell with part of the charge replaced by CW agent; other types of CW shell are similar to smoke shell. Under these circumstances, verification techniques aimed at possible production of munitions for disseminating CBW agents would have to be applied to a wide sector of a country's munitions industry and probably

[42] A ton of nerve gas occupies about a cubic metre of storage or shipping space (although filled munitions would occupy considerably more), so that a single lorry could transport each day's output away from a 5 ton per day manufacturing plant.

to some other industries too. They would therefore almost certainly be unacceptably intrusive.

A similar problem would arise over verification techniques aimed at developmental work on CB weapons. Furthermore, some (but not all) of the work could be dispersed among civilian laboratories where studies of the dissemination of harmless simulant CBW agents could be pursued. For example, pyrotechnics or explosives laboratories could take on such tasks as the determination of the most satisfactory propellant for disseminating a particular agent, while paint laboratories could look into the optimum formulations for munition loadings—what sort of anti-agglomerant to use, what sort of microencapsulant, and so on. But some testing of weapons filled with real agents is bound to be wanted. This is discussed in the section on field testing below.

It would not be possible to place controls on the production of delivery systems for biological or chemical weapons (aircraft, for example, or artillery ordnance) in the absence of a general disarmament agreement, because in most cases they would be identical to systems for delivering non-CB weapons payloads. Almost all forms of military transport, and certain civilian vehicles as well, could be used to deliver a CBW attack, whether through the intermediary of special munitions, or by direct dissemination of CBW agent into the atmosphere.

VI. *Field testing and evaluation*

Field testing and evaluation is as important with chemical and biological weapons as it is with most new weapons. Since the atmosphere is used as the final vehicle for the BW or CW agent, the efficacy of the system is highly dependent on meteorological conditions: it may be influenced by the speed and direction of the wind, by relative humidity, temperature, precipitation, cloud cover and so on. Thus tests must be conducted in a wide variety of conditions.

Obviously large-scale outdoor tests with real BW and CW agents are avoided as far as possible. As noted later, accidents have happened, agents have been known to spread outside test grounds, and test areas have suffered prolonged contamination. It has been alleged that antibodies against Venezuelan equine encephalitis in the population living near the main US proving ground are the result of virus escaping from tests there.[43]

In order to avoid the dangers, outdoor tests can be conducted with

[43] S. M. Hersh, "Germ Warfare: for Alma Mater, God and Country", *Ramparts* December 1969: 21–28.

Table 2A.7. Some prominent proving-grounds for CBW matériel

Country	Location	Area of facilities (km^2)	Year opened
UK	Porton Down, Wiltshire	25	1916
USSR	Shikhani, Saratov	?	1928
Germany	Raubkammer, Lüneburg Heath	120	1930s
France	Beni Ounif, Algerian Sahara[a]	5 000	1930s
Canada	Suffield, Alberta	2 500	1941
USA	Dugway, Utah	3 400	1942

[a] This establishment, which was the venue for a joint Anglo-French CW testing programme during the late 1930s, ceased operations as a chemical weapons proving grounds in the mid-1960s.

Source: Volumes I and II of this study.

simulants. Special large chambers can be built, so as to permit the indoor testing of toxic agents in conditions as close as possible to those out of doors. These, however, are large objects, difficult to conceal. Moreover simulant tests of these various kinds cannot wholly replace outdoor tests with toxic materials or virulent micro-organisms.

The requirements of a testing ground are that it should be large, remote and possess as much variety as possible of meteorological and topographical conditions. Table 2A.7 gives an indication of what this means. For some countries, where the space available for CBW testing has been too limited, test programmes have been conducted abroad. The UK, for instance, has in the past relied on proving grounds in overseas dependencies, and on joint testing programmes with allied countries. It has also, like the USA, conducted CBW studies over open sea.

There are several ways in which a testing ground might be detected, none of them very reliable:

1. Local reports and rumours.

2. Reports of accidents (for example, the accident at Dugway in 1968 in which the sheep outside the testing ground were hit by nerve gas.[44]

3. Reconnaissance from aircraft or satellites. Large isolated areas with buildings, access roads, test equipment and animals, sometimes tethered in a pattern to be subjected to tests, may be detectable. Search may in any case be conducted for testing grounds for all kinds of weapons, conventional and nuclear as well as chemical and biological. Since infra-red photography from satellites can detect atmospheric pollution, it is always possible that it might be used to detect aerosol clouds at testing grounds.[45]

[44] See page 238 n below.

[45] P. G. Thomas, "Earth-resource Survey from Space", *Space/Aeronautics* 50(1): 46–54, July 1968. Raman spectroscopy using laser light might even provide possibilities for long-distance chemical analysis.

4. Remote sensors at ground level. These might be used to detect particles released in tests. Particles may travel very long distances. For example dust particles have been followed for 2 000 miles after becoming airborne in the Sahara and urediospores of around 20 microns in diameter are known to have been carried 600 miles in sufficient quantities to produce a severe crop loss.[46]

It would be necessary not only to detect that a particle had been present in the atmosphere but also what it was. The dilution factors as well as background pollution could easily make this impossible with chemical agents, and micro-organisms which have travelled long distances will have spent a long time aloft, exposed to both ultra-violet and ionizing radiation and would offer great problems. However identification might be possible. On the basis of experiments where the micro-organisms contained an appreciable amount of moisture (T 1 coliphage), it was believed that practically all micro-organisms become non-viable under such circumstances. But a recent study, where certain thoroughly dessicated micro-organisms were subjected to ultra-violet and ionizing radiation, indicates that, after a rapid exponential decline of the number of viable micro-organisms down to about 10^{-4} in three minutes, the rate of decline is then appreciably flattened so that 10^{-6} is reached after three weeks.[47] This study makes the prospects of long-range detection of field tests look less unpromising. Moreover certain techniques of microbial identification, for example, the fluorescent antibody technique, could be useful for this purpose, at least for some time after the death of the cells. But exhaustive study would be needed before it could be known whether this method of inspection could be made to work at long ranges. One crucial problem is that it is not known whether micro-organisms which have been subjected to the intense solar radiation for a long time retain their immunological profile. So far, all that exists is some evidence that short-term irradiation does not alter the result of fluorescent antibody tests.[48] Another crucial problem would be the technical one of sampling enormous volumes of air, and then of distinguishing possible CBW agent residues within the accumulated concentrate of normal atmospheric chemical and biological material.

If effective remote sensors for the detection of field tests were developed, extraterritorial inspection might be possible, but that would not

[46] N. A. Perkins and L. M. Vaughan, "Public Health Implications of Airborne Infections, Physical Aspects", *Bacteriological Reviews* 25(3): 347–355, 1961.
[47] J. Hotchin, *Panspermia Revisited* (Vienna, 1966).
[48] E. Petras and K. Bisa, "Microbiological Studies on the Radiation Environment of the Ionosphere and Stratosphere", *Life Sciences and Space Research* 6: 115–22, 1968.

necessarily be so. It would depend on the size and shape of the country to be inspected, the prevailing winds and so on.

On-site inspection of suspected sites for field tests might meet political opposition, as has happened with other proposals for on-site inspection so far, if it were introduced on its own rather than as part of general disarmament. The search for residues after tests would involve techniques that might be used in checking on allegations that CW or BW had been used.

Altogether it looks as if there is some chance of detecting field tests. The possibilities may improve as technical progress and the concern with pollution lead to the development of improved monitoring.

It is possible to think of devious ways in which countries might attempt to avoid testing, at least on their own territory. One country might arrange for tests to be undertaken on the territory of another, or it might obtain advice and know-how from another country which currently or recently had a full CBW capability. Various countries are known to have arrangements for exchanges of such information. Tests on the high seas might be particularly difficult to find.

While it is not difficult to think how such arrangements might be made along the lines of those which exist now, this does not mean that they are likely to be made once there has been a move to CB disarmament.

It is always possible that a country might proceed to use CW or BW agents on the basis of laboratory and indoor tests, theoretical calculations and hopes. It might hope to learn from experience of battle or subversive use on foreign soil. There are examples in history where new weapons, for example the tank and CW in World War I, have first been used too hastily to achieve the maximum initial military advantage.

VII. *Instruction in chemical and biological warfare*

Training in chemical warfare requires a staff to study the strategy and tactics suited to these weapons, to write training manuals and undertake trials and training exercises. Training is likely to be carried out at two levels: instruction classes for individual troops and large- or small-scale troop manoeuvres. The last stage is the one most susceptible to verification.

The main object of training in chemical warfare is to teach troops to give and to heed warnings, to don protective equipment, to fight with their normal weapons while protected, and to cope with casualties and contamination. The procedures and equipment (e.g., respirators and protective clothing) are readily identifiable.

Offensive training in chemical warfare will be extremely difficult to distinguish from defensive training, since what is required of most troops is the same: an ability to continue fighting when CW agents are in use. There would be a difference only in respect of troops responsible for delivering chemical weapons, but here the evidence would not be great. Small numbers would be involved. Training for bombing with chemical weapons would be indistinguishable from training for other types of bombing, but some ground troops would have to be trained to handle chemical bombs.

Training in artillery firing of chemical shell would be the same as training in firing other ammunition, apart from the use of special tables giving the ballistics and the required pattern of fire for chemical shell, and again it would be necessary to train some ordinary soldiers to handle chemical munitions. These, however, would be variants on the normal training they had received with other munitions.

Although it may be less effective, troop training for biological warfare will be much the same as training for chemical warfare. Troops will be instructed in the use of respirators, protective clothing and decontamination. If there is an offensive capability, limited numbers of troops will need to be instructed in the handling of munitions.

While it would be hard to detect training for offensive use, i.e., for delivery of weapons, it should be possible to detect troop training of defensive or offensive intent if manoeuvres can be observed. This might be done by an inspectorate or by military attachés. Or it might possibly be done by photographic reconnaissance. It is not known whether satellites have this capability, but aircraft can of course photograph manoeuvres near a frontier at oblique angles without trespassing across that frontier. And the monitoring of radio messages is possible at longer ranges.

It has been reported that the NATO authorities are able, by one means or another, to form a fairly clear idea of what any given Warsaw Pact exercise involves. Thus one recent account of manoeuvres in Eastern Europe reported that: "The exercises are said to concentrate on day and night mobile operations based on deep penetration tactics, with tactical nuclear weapons as well as chemical and biological warfare, used from the moment any battle started."[49]

VIII. *Inspection of defensive measures*

From the point of view of verification, it would clearly be easiest if defensive as well as offensive CW and BW preparations and training

[49] C. Douglas-Home, "NATO Planners Wary of Soviet Intentions", *Times* 8 March 1968: 4.

were abolished.[50] If a treaty were made banning offensive but not defensive CW or BW programmes, the problem would arise whether an inspectorate, if one were created, should be permitted to see part or all of the defensive work. From the point of view of the effective verification of a ban on offensive programmes, it would be best if it were able to do so. The inspectorate could then look at any work that was going on in the BW or CW field and could check that it truly was non-offensive, defined, for example, to mean that field testing and production of militarily significant quantities were not taking place.

The problem is whether inspection of defensive measures, if permitted, might undermine defensive measures by revealing their secrets. Physical protective equipment, such as protective masks and clothing, air filters and decontamination equipment, raise few problems from this point of view. There is little need for secrecy about them. The main problem concerns warning devices and prophylactic measures. Here secrecy tends to be preserved now. The argument for secrecy is that if warning devices are specific to particular CW or BW agents, another country, if it finds out what that range of agents is, may seek to develop an offensive agent outside that range so as to catch his enemy unawares. In the BW field there is also a tendency in some countries to be restrictive with regard to such immuno-prophylactic and therapeutic defences as may be available or under exploration, since these may be specific to particular agents or groups of agent.

The question to consider here is whether after, or in the transition to, CB disarmament, secrecy of this kind would still matter.

First, there is a technical question: is it likely that general warning devices and nonspecific drugs will become so sophisticated that they will partly or wholly replace specific devices and therapeutic agents, and so remove or relieve the problem?

As regards CW, it seems that existing automatic field alarms apply to the whole family of nerve gases, but there is of course no guarantee that quite new agents may not be developed.

As regards BW, prediction is difficult. The borderline between early warning and identification devices is fuzzy. Moreover, a number of group-specific prophylactics (certain antibiotics and chemotherapeutic substances) are interspaced between the specific agents (vaccines) and non-specific agents (interferon inducers, etc.). However as indicated by the twelfth Pugwash Symposium on Rapid Detection and Identification of Microbiological Agents (Geneva, 18–21 February 1971), great improve-

[50] Other aspects of banning defensive as well as offensive measures are discussed on pages 111–112.

ments are likely in early-warning devices (for instance, increased sensitivity and large numbers of composite tests) and nonspecific drugs are also likely to be improved rapidly. Classified national efforts might be reduced if such developments occur within the framework of an international "Biological Agents Monitoring System (BAMS)" as suggested by the Pugwash Symposium, or as part of a major effort on the part of the traditionally open medical research organizations which exist in most countries. The problem of prediction is compounded by the fact that an enemy would probably try to adapt his attack to advances in alarm systems, employing new tactics, resistant mutants of BW agents and so on.

Second, there is the question of how much it would matter if specific defences were known? If a disarmament treaty were to fail, the failure more probably would take the form of a progressive deterioration in political relations and breakdown of inspection and disarmament arrangements over a period of time than the form of cheating and surprise attack. It is hard to say how much knowledge of defensive measures would matter in these circumstances. But even if it matters little, this is the kind of argument that can acquire psychological and hence political force.

One possible solution to the problem would be to make an international arrangement establishing a pool of defensive equipment and experts with resources to undertake or commission development work on a scale beyond the reach of individual countries. In the BW field this could be linked to public health work. If there were sufficient trust amongst the major countries to create and join such an arrangement, it could provide reassurance to smaller countries and it could help to stop proliferation. A proposal for an international information service for the collection of material on chemical warfare was put forward in the early 1930s but came to nothing. (See Volume IV, Chapter 5.)

IX. *The transition to disarmament*

So far we have dicussed the technical problems of verifying that research, development, production, testing and training are taking place, or that the facilities (such as production plant) for these activities do not exist. Thus, we have discussed the verification of CB disarmament once it has been achieved. We have not discussed the technical problems of verifying that existing stockpiles and facilities for production, testing, development or research are destroyed when disarmament is introduced. That is, we have not discussed verification of the transition to disarmament.

If governments were to demand verification of the transition to disarmament, they might agree on a fairly informal procedure resting on

some measure of mutual trust. For example, they might agree that some respected body in each of their societies which commanded an international reputation, say the Academy of Sciences or its equivalent, should be asked to verify the destruction of existing stocks and facilities and to issue a declaration when it had done so. Alternatively, they might feel the need for formal international verification. The task might then be handled in various ways. It might be given to experts from neutral countries, it might be undertaken on a reciprocal basis between the powers possessing or suspected of possessing relevant facilities or it might be given to an international inspectorate, including experts from a wide range of countries.

There might be hesitation about letting experts from other countries inspect the stocks or facilities to be destroyed, on the grounds that they might use information gained during the inspection if, at a later date, the nations they come from intended to cheat and develop an offensive capability. This seems a rather unreal fear—or in any event a problem that could be surmounted. An inspectorate, in order to see that something has been destroyed, does not have to examine it in detail while it is in working condition. It can observe from a distance, checking what goes in and out of the area, and afterwards look rather more closely at the destroyed remnants. In the case of BW agent production a good deal of equipment, once dismantled, might be removed and used elsewhere for peaceful purposes. With CW agents, production facilities for agents such as nerve gas might be converted to production of organophosphorus insecticides, but the costs and risks of conversion might be high and continuing periodic inspection might be needed to ensure that the plant was not reconverted to nerve-gas production.

Another problem which is commonly discussed in connection with the transition to nuclear disarmament is that it will never be possible to be absolutely sure that no stocks of weapons have been concealed. The problem is whether a country could or would cheat over a sufficient quantity for sufficient time to gain an advantage by some means or other. It cannot be said that there are any technical methods by which one could be sure of finding concealed stocks. Essentially it must depend on a combination of trust, cooperation, prior knowledge and cross checks.

Chemical weapons and agents would have to be stored in fairly large quantities to be of any significance militarily. After a period, which may be a matter of decades, the weapons may deteriorate and leak, giving rise to problems of disposal and difficulties of continuing concealment. It is much harder to know the life of BW agents. For some it may be a matter of months, for others probably much longer.

X. *Abuse of inspection*

There may always be fears that an inspection system will give rise to commercial espionage or military espionage. These risks may not be very real, but even if they are only imaginary they can be an obstacle to agreement; they can cause suspicion and misunderstanding. For these reasons it is advisable to devise an inspection scheme in such a way that the risks are minimized. The obvious steps to this end are to ensure that the inspectors see only as much as is necessary and that they are given sufficient independence and strength to acquire an *esprit de corps.*

The problem of commercial secrecy and inspection has recently been discussed at considerable length with respect to nuclear installations which are due to be opened for inspection by the IAEA in non-nuclear nations under the provisions of the Non-Proliferation Treaty, when that treaty enters into force. The final provisions of the inspection system have not yet been worked out, but it seems to be generally expected that they will not constitute an insuperable obstacle if the political will to ratify the treaty exists amongst the powers principally involved.

If the problem of nuclear inspection can be solved, it seems reasonable to hope that the problems of biological and chemical inspection could be solved. The precision of verification required may well be less for a biological or chemical disarmament treaty than it is for the Non-Proliferation Treaty, under which the task of the inspectorate is to ensure that fissile material under inspection is not diverted to military use. In other words, the aim of nuclear inspection is not to check what the plant is doing but to check that a proportion—even a small proportion—of its input or output is not being diverted. It would seem—though there is no special evidence to go on—that military espionage—meaning the acquisition of valuable information relating to military activities other than outlawed CB weapons—should not be much of a problem. In the absence of general and complete disarmament, the most sensitive forms of inspection would be on-site inspection of testing grounds, of military training and possibly of storage depots of munitions, if for these purposes an inspectorate were permitted access to any testing ground, training exercise or storage depot where it thought evidence of a CBW programme might be found. For in this event the inspectorate might gain access to facilities or exercises to which disarmament did not yet apply. At field testing grounds, a CBW inspectorate might examine the ground for the residue of past tests, and examine test equipment and weapons stocks for further evidence. If it could confine itself to the examination of the ground for residues, the fear of military espionage would be reduced.

XI. *Conclusions*

It is impossible to say flatly that verification is or is not feasible. As was emphasized at the start of this chapter, that depends on the political conditions postulated: it is necessary to assess the balance between technical means and political obstacles.

What is clear is that there is a variety of possible inspection techniques. In table 2A.8 the five principal techniques which we have considered are analysed by reference to the four characteristics suggested earlier—the value of evidence if found, the extent of physical intrusion, the costliness of search and the costliness of evasion. In each box a rough assessment has been given to each technique—for example, whether the evidence is likely to be conclusive or indicative, whether the costliness is likely to be high or low, and so on. These ratings are tentative suggestions. The reader is invited to consider what ratings he would give.

Table 2A.8. Characteristics of different inspection techniques

Characteristics	Search method				
	Budgetary inspection	Literature surveillance	Photographic reconnaissance	Remote sensors	Inspection teams
Value of evidence if found	Conclusive	Indicative	Strongly indicative	Indicative	Conclusive or indicative
Extent of physical intrusion	High	Nil	Nil by satellite, moderate by aircraft	Nil if abroad, low if at home	High
Cost of search	Low	Medium	Low/high[a]	High	Medium
Cost of evasion	Low	Low	Medium	High	Medium

[a] Cost is hard to reckon. It could be very low if technologically-advanced powers, which were taking pictures anyway, gave them to the international agency; or very high if the inspectorate had to commission a new system, including launchers and retrieval, bought from, say, Japan.

In the table no attempt is made to give an assessment of the probability of detecting infractions by each method. This is because, as indicated in the previous analysis, the probability varies according to the type of agent and activity being verified as well as according to the effort put into verification and, on the other side, the extent of cooperation or evasion. The most promising area for inspection appears to be production, followed probably by field testing. It is difficult to say whether inspection will be easier for chemical or for biological weapons.

With several alternative techniques of verification the chances of detecting an infraction will be substantial, even though the probability of detection with each technique is low. Thus if there were three techniques,

each with a one in five chance of detecting an infraction, the chance of avoiding detection would only be about one in two.[51]

As was emphasized at the start, verification does not have to be anything like 100 per cent efficient. What is required is a sufficiently high probability of detection to provide deterrence on one side and reassurance on the other.

Compared with pre-World War II years, the technical possibilites of inspection appear to have increased. There has been an increased divergence of production of chemical and biological agents from civil production, but with chemical weapons this trend may be reversed once "binary" nerve-gas weapons are successfully developed. Second, and more important, there has been a great improvement in transport, communication and monitoring systems. Information is gathered and transmitted more easily; except where prevented by their governments, people travel more and meet more often in international groups, such as scientific societies and technical committees of international organizations.

On the technical side, therefore, the position looks fairly promising. It certainly merits further work and more open discussion. But care must be taken to ensure that pursuit of the technicalities of inspection does not become a way of avoiding the political questions. Two are critical: Is inspection needed? Is intrusion accepted?

[51] The likelihood of avoiding detection will be $(1\text{-}p)^n$ where p is the probability of detection with each technique and n is the number of independent techniques in use. Thus with three techniques and a 1 in 5 probability of detection with each, the chance of avoiding detection is $0.8 \times 0.8 \times 0.8 = 0.512$.

Appendix 3: The CB weapons controls of the Western European Union Armaments Control Agency

For many years the Armaments Control Agency of the Western European Union has been carrying out controls for verifying that WEU member countries (Belgium, France, West Germany (FRG), Italy, Luxembourg, the Netherlands and the United Kingdom) are observing the armaments limitations to which they agreed in 1955. As CB weapons are included within the scope of the agreements, the Agency has by now accumulated considerable experience in the problems of verifying the nonproduction of CB weapons. The present Appendix describes the Agency's work in this connection, indicating its achievements as well as its deficiencies.

Our aim is to illustrate some of the problems of CB verification referred to elsewhere in this volume by reference to the only CB verification system in operation today.

I. *Background*[1]

WEU was conceived as a means for making West German rearmament acceptable to those in Western Europe who feared a resurgence of German military power, and thus for removing political obstacles in the path

[1] For descriptions of WEU, see the following publications: A. H. Robertson, "The Creation of Western European Union": *European Yearbook* 2: 125–137, 1956; A. H. Robertson, *European Institutions* (London, 2nd ed., 1966) pp. 111–134; and W. J. G. van der Meersch, *Organisations Européennes* (Brussel & Paris, 1966), Vol. 1, pp. 154–167.

For descriptions of the WEU Armaments Control Agency, see E. Ferreri, "L'Agence de l'Union de l'Europe Occidentale pour le Contrôle des Armaments", *European Yearbook* 5: 30–52, 1959; E. de la Vallée Poussin, "Erfahrungen der europäischen Rüstungskontrolle", *Europa-Archiv* 16: 681–684, 1961; F. C. Iklé, Appendix B in *Alternative Approaches to the International Organization of Disarmament*, RAND Report R-391-ARPA, February 1962; R. Fletcher, "Existing Arrangements for International Control of Warlike Material—1. Western European Union", *Disarmament & Arms Control* 1 (2): 144–154, 1963; A. van W. Thomas and A. J. Thomas, *Legal Limits on the Use of Chemical and Biological Weapons* (Dallas, 1970); and *The Brussels Treaty and the Control of Armaments*, a report by the WEU Assembly Committee on Defence Questions and Armaments in reply to the 16th Annual Report of the Council of WEU, *WEU Assembly Document* 536, 5 May 1971.

Apart from these publications, and the sources cited in footnote 37 below, the other main sources consulted in preparing this Appendix were the *Proceedings* of the annual Ordinary Sessions of the Assembly of WEU. There are generally two parts to these sessions, the first in the early summer, the second in the autumn. The pro-

of a West German contribution to NATO. The first moves in this direction had been the proposals of the early 1950s for a unified Western European Army. These failed in 1954 when France declined to ratify the European Defence Community Treaty of 1952. The UK then proposed a less federalist formula whereby the FRG (and Italy) would be admitted to the 1948 Brussels Treaty of alliance between France, the UK and the Benelux countries in return for alliance controls over FRG armaments and force levels. The other members of the alliance were to submit themselves to controls also, although much less restrictive ones, and the UK was to maintain armed forces on the European mainland. With these arrangements, the occupation regime in West Germany could be terminated, and West German sovereignty restored. At conferences in London and Paris in the autumn of 1954 a series of Protocols amending the Brussels Treaty along these lines were agreed—as part of the so-called Paris Agreements—and by May 1955 these had been ratified by the countries concerned. Belgium, France, the FRG, Italy, Luxembourg, the Netherlands and the UK thus became linked into a "Western European Union" with their armaments and force levels subject to varying degrees of control by a central Armaments Control Agency. Other limitations, such as the provision for a centralized and internationalized command structure, were pursued through NATO; the revised treaty laid down that WEU was to act in close cooperation with NATO.

Under the terms of the Treaty, which remain binding at least until 2005, the FRG agreed never to manufacture CB or nuclear weapons on its own territory, and only to manufacture certain major weapons-delivery systems (the long-range or guided missiles, the heavy bombers and the large warships or submarines specified in Annex III of Protocol No. III) on its own territory if the Council[2] of WEU agreed by a two-thirds majority, and if NATO concurred. As regards other types of armament, the FRG was subject to the same sort of controls as other WEU members: the stocks of specified classes of weapon (Annex IV of Protocol No. III) main-

ceedings of each part of each session are published in two, sometimes three, volumes, at first in Strasbourg, and later in Paris. (The citation *"WEU Assembly Proceedings* VII (1961) 2: 206" indicates page 206 of volume 2 of the proceedings of the 7th Ordinary Session, held in 1961.)

[2] The Council of WEU, which is to be "so organised as to be able to exercise its functions continuously", theoretically consists of the seven Foreign Ministers of the WEU member countries. It is based in London, and in practice it generally consists of the ambassadors of the WEU countries resident in London and an Under-Secretary of the British Foreign Office, under the chairmanship of the WEU Secretary-General. Such meetings, which are often attended by members of the US Embassy in London, take place fortnightly; full ministerial sessions occur quarterly.

The list of major weapons which the FRG is not permitted to make has been amended seven times since 1954, the last occasion being in 1968.

tained on the mainland of Europe were not to exceed NATO requirements nor levels approved by the Council of WEU. The Armaments Control Agency thus had two different types of control to apply: nonproduction controls in the case of FRG, and quantitative (level-of-stocks) controls for all WEU countries. For these duties the Agency was instructed both to "scrutinize statistical and budgetary information supplied by members of Western European Union and by the NATO authorities" (controls from documentary sources) and to "undertake on the mainland of Europe test checks, visits and inspections at production plants, depots and forces" (field controls).[3] Field controls were not to be applied by the Agency to depots and forces under NATO authority (although since the distinction between NATO and national authority has sometimes proved difficult to define in practice, NATO depots and forces receive combined Agency/SHAPE inspection visits). As the armaments limitations of the treaty referred only to the mainland of Europe, the Agency was not empowered to inspect sites within the UK. Neither has it any powers of control over US forces or depots in Europe—the chemical weapons storage depot at Hanau, for example.

Should the Agency detect violations of the agreed armaments limitations, it was to report the fact to the Council of WEU; in the case of major infractions, the Council, acting on a majority vote among its members, was to

> invite the member concerned to provide the necessary explanation within a period to be determined by the Council; if this explanation is considered unsatisfactory, the Council will take the measures which it deems necessary in accordance with a procedure to be determined.[4]

No infractions have yet been reported by the Agency.

The Council is subject to a form of parliamentary control in that it is required to make an annual report on its activities, including those of the Armaments Control Agency, to the Assembly[5] of WEU. The Assembly meets twice a year, generally in Paris; and each year its debates encompass the Council's annual report. On a number of occasions the Assembly has

[3] For a text of the *Brussels Treaty as amended by the Protocol modifying and completing the Brussels Treaty signed at Paris on October 23, 1954*, see *European Yearbook* 2: 313–341, 1956. Both the Assembly and the Council of WEU have published books which collect together the text of the Treaty, the other "Paris Agreements" and certain other legal instruments concerning WEU. The quotations here are from Article 7 of Protocol No. IV.

[4] Article 20 of Protocol No. IV.

[5] The Assembly of WEU comprises the representatives of the WEU member countries at the Consultative Assembly of the Council of Europe. The number of representatives which each country has at the WEU Assembly, all of them members of their national parliaments, is thus roughly proportional to the country's population.

been strongly critical of the Council's annual report, both as regards the amount of information presented in it, and the manner in which the Council has discharged its duties.

The revised Brussels Treaty laid down that the Armaments Control Agency was to draw its staff "equitably" from nationals of WEU member countries. Its Director was to be appointed by a unanimous decision of the Council of WEU for a five-year period. The first Director was Admiral Emilio Ferreri, previously Chief of Staff in the Italian Navy, and the custom has since grown up that the Director be Italian. He and his staff, who are based in Paris, are subject to the general administrative control of the WEU Secretary-General, and are responsible to the Council of WEU. At the present time there are fifty-two people on the Agency staff, and its budget for 1970 was £294 000. As in previous years, the Agency accounts for about 30 per cent of the total budget and establishment of all WEU organs.[6] The Council of WEU is required to approve the plans, organization and activities of the Agency, and to define the thresholds and types of armaments to be controlled. For advice on military matters, the Agency and the Council are to "rely on the appropriate military authorities of NATO". Officials of the Agency are "bound by the full NATO code of security"; in addition, it is laid down in the treaty that "they shall in no circumstances reveal information obtained in connection with the execution of their official tasks except and only in the performance of their duties towards the Agency".[7]

These security precautions are specially relevant to the question of commercial secrecy, and the need to reassure manufacturers that Agency inspectors will not become involved in industrial espionage. As it was feared that the requirements of effective verification might be incompatible with the security of commercial secrets, the revised Brussels Treaty contained two additional safeguards. The first specified that in its field controls at production plants, the Agency was to concentrate on the products ("end-items and components") and not on the processes used for making them, and to ensure that products destined for civilian use were excluded from its operations.[8] The second safeguard specified that the "Director shall propose to the Council detailed regulations for the conduct of the inspections providing, *inter alia,* for due process of law in respect of private interests".[9] The regulations thus called for were duly prepared and, in

[6] That is to say, the Secretariat-General, the Standing Armaments Committee, the Armaments Control Agency, and the Office of the Clerk of the Assembly.
[7] Article 6 of Protocol No. IV.
[8] Article 10 of Protocol No. IV.
[9] Article 11 of Protocol No. IV.

May 1956, approved by the Council.[10] Among other things, they set out in some detail the powers vested in a visiting Agency inspection team by the Brussels Treaty.[11] As for provision for "due process of law in respect of private interests"—i.e., legal guarantees against violations of commercial secrecy and other damage—an appropriate convention was drawn up and, in December 1957, signed by all members of WEU.[12] It comes into force when it has been ratified by all seven countries. The main provisions of this "Due Process of Law Convention" concern the establishment of a tribunal that will determine any claims for compensation or damages that may be made against the Agency. The Convention also includes an undertaking that WEU members will pass whatever national legislation is needed to ensure that the Agency can fulfill its obligations under the Brussels Treaty in each country.[13] Of particular relevance here is the requirement that "inspections by the Agency shall not be of a routine character, but shall be in the nature of tests carried out at irregular intervals". Until the Convention becomes law, there can be no question of meeting this requirement adequately: unannounced inspections can always be blocked by uncooperative officials or managements. At the present time, six of the seven WEU members have ratified the Convention,[14] but France has declined to do so. Because the Convention is not yet in force, the Agency can conduct field controls at private production plants only when and where agreement can be reached with the governmental authorities and factory managements concerned.[15] Some hundreds of on-site inspections have been performed by the Agency, but only a

[10] *Regulations drawn up in execution of Article XI of Protocol No. IV of the Brussels Treaty as modified by the Protocols signed at Paris on October 23, 1954.* Published as Document No. 2 by WEU, London, 1958.

[11] Thus Article 5 (B) of the *Regulations* stated that "The powers vested in officials of the Agency are the following: For inspections and test-checks in depôts and production plants other than military establishments (*a*) the right to question the management of the unit or their deputies; (*b*) the right of access to premises of the unit. This right means (i) access to premises used for storage, with ability to make a detailed survey of stocks of end-items and components, as referred to in Protocol No. III, as well as access to the offices of these establishments; (ii) access to production plants and their offices in order to check production of the end-items and components listed in Annexes II, III and IV to Protocol No. III; such control can be carried out at the assembly stage of the aforementioned end-items and components. (*c*) The right, where necessary for the execution of their mission, to inspect documents and accounts and to take extracts therefrom."

[12] The text of the Due Process of Law Convention can be found in *WEU Assembly Proceedings* IV (1958) 1: 70–75.

[13] Article 1 of the Convention.

[14] The dates of ratification were as follows: the UK, 2 July 1960; the FRG, 10 July 1961; Belgium, 16 April 1962; the Netherlands, 10 February 1963; Luxembourg, 13 November 1963; and Italy, 22 September 1966.

[15] France, for example, has refused to allow the Agency to apply field controls at military depots where weapons it considers "strategic" are kept.

fraction of these—ones where the interests of private industry are not involved—have been the full field controls envisaged in the Brussels Treaty. The remainder have rather been of the nature of control-exercises or trials, and in the annual reports of the Council on WEU they are now referred to under the somewhat self-contradictory heading of "agreed controls".

In terms of numbers of field controls per year, less than 10 per cent of the Agency's work is concerned with CB weapons. Table 3A.1 gives such annual figures as have been published for the numbers of field controls of different types applied by the Agency since 1956.

Table 3A.1. Numbers of field controls performed each year by the Agency

	Level-of-stocks controls (all WEU members)		Nonproduction controls[b] (the FRG only)		
Year	Forces & depots[a]	Production plants[b]	Non-CB plants[c]	Chemical plants[c]	Biological plants[d]
1956	*19*	*7*	*20*	0	0
1957	15	8	3	0	0
1958	22	11	3	*2*	0
1959	32	11	3	*5*	*1*
1960	41	13	6	*7*	*1*
1961	44	12	5	2	0
1962	46	11	5	2	0
1963	47	13	6	4	0
1964	58	13	5	4	0
1965	42	11	7		0
1966	ns	ns	ns	ns	0
1967	ns	ns	ns	ns	0
1968	ns	ns	ns	ns	0
1969	ns	ns	ns	3	0
1970[f]	ns	ns	ns	ns	0

ns = number of controls not specified in the Council's annual report. Italicized entries denote experimental control exercises.

[a] Full controls.

[b] "Agreed controls".

[c] By 1970, a total of 41 "agreed controls" had been applied to 18 FRG chemical factories.

[d] Although no "agreed controls" (other than purely experimental ones) have yet been applied to FRG biological production plants, 11 of them received 14 "technical information visits" from the Agency during 1959–1969.

[e] That is to say, plants other than those producing chemical or biological material, but which might be used to produce those weapons, other than atomic ones, whose manufacture on FRG territory is forbidden under Articles 1 and 2 of Protocol No. III.

[f] The total number of field-controls of all types performed during 1970 was 82.

Source: The annual reports of the Council of WEU to the Assembly of WEU.

II. *The CB weapons provisions of the revised Brussels Treaty*

As noted above, the revised Brussels Treaty prohibits the manufacture of CB weapons by the FRG on its own territory. For WEU members other than the FRG, the CB weapons limitations are as follows:

When the development of atomic, biological or chemical weapons in the territory of the High Contracting Parties who have not given up the right to produce them has passed the experimental stage and effective production of them has started there, the level of stocks that the High Contracting Parties concerned will be allowed to hold on the mainland of Europe shall be decided by a majority vote of the Council of Western European Union.[16]

Level-of-stocks, rather than nonproduction, controls are thus envisaged, but to date these have not been applied, for all WEU member countries concerned have apparently always reported to the Agency that they have not started "effective production" of CB weapons. In accepting this, and in not seeking to apply quantitative controls, the Council of WEU has presumably decided to ignore the matter of "dual-purpose" CB products—those substances that are normally produced for civilian purposes, but which might also be used as CBW agents. Neither, apparently, does the Agency seek to verify that there is in fact no "effective production".[17]

The antecedents of the FRG undertaking not to manufacture CB weapons are the various restrictions imposed on Germany by the victorious Allied powers after World War II. The CBW provisions of these are described in the annex to this Appendix. The undertaking itself was contained in a declaration issued by Chancellor Adenauer during the London Conference of September–October 1954 which led up to the formation of WEU. (The Benelux countries announced at the time that they also were planning to make similar commitments about nonproduction of nuclear and CB weapons,[18] but later decided not to.[19]) It was incorporated in the Final Act of the conference,[20] and subsequently annexed to Protocol No. III of the Paris Agreements. Article I of the Protocol was as follows:

[16] Article 3 of Protocol No. III.

[17] Neither has the Agency applied quantitative controls to nuclear weapons, even though France has long since been stockpiling nuclear weapons on the European mainland independently of NATO. The Council of WEU has stated that this is because it has not received notification from France that "effective production" of the weapons has started. Furthermore, the Council has consistently refused to authorize the Agency to hire experts in the nuclear field in order to work out a scheme of nuclear controls. This has been a long-standing source of dissatisfaction with the Council within the Assembly of WEU, and over the years the latter has passed a succession of "recommendations" calling upon the Council to discharge its duties under the Brussels Treaty in these respects.

[18] "Belgian Limit on Weapons", *The Times*, 5 October 1954; "Belgian Satisfaction", *The Times*, 6 October 1954; "After the Nine-Power Conference", *Netherlands News*, 6 October 1954; "Foreign Affairs Minister's Press Conference on London Agreements", *Netherlands News*, 13 October 1954.

[19] "Le Benelux ne renoncera pas à fabriquer des armes ABC", *Combat*, 2 November 1954.

[20] The conference was a nine-power one, attended by the seven future members of WEU, Canada and the USA.

The High Contracting Parties, members of Western European Union, take note of and record their agreement with the declaration of the Chancellor of the Federal Republic of Germany (made in London on 3rd October, 1954, and annexed hereto as Annex I) in which the Federal Republic of Germany undertook not to manufacture in its territory atomic, biological and chemical weapons. The types of armaments referred to in this Article are defined in Annex II. These armaments shall be more closely defined and the definitions brought up to date by the Council of Western European Union.

In that Protocol No. III formed an integral part of the revised Brussels Treaty, the FRG's unilateral renunciation of CB weapons thus became hardened into a formal international treaty commitment. Furthermore, in that the Council of WEU was instructed to define more closely the weapons concerned, it had the authority, provided it could reach unanimous agreement, to specify the precise types of armament that Germany would renounce. As it turned out, though, the categories of CB weapon that the Council eventually decided to control were a good deal narrower in scope than those which the FRG had originally renounced.

In the Adenauer declaration, the FRG undertook "not to manufacture on its territory any atomic weapons, chemical weapons or biological weapons, as detailed in ... the attached list". The CB paragraphs of the attached list (Annex II to Protocol No. III) were as follows:

2. CHEMICAL WEAPONS

(a) A chemical weapon is defined as any equipment or apparatus expressly designed to use, for military purposes, the asphyxiating, toxic, irritant, paralysant, growth-regulating, anti-lubricating or catalysing properties of any chemical substance.

(b) Subject to the provisions of paragraph (c), chemical substances having such properties and capable of being used in the equipment or apparatus referred to in paragraph (a) shall be deemed to be included in this definition.

(c) Such apparatus and such quantities of the chemical substances as are referred to in paragraphs (a) and (b) which do not exceed peaceful civilian requirements shall be deemed to be excluded from this definition.

3. BIOLOGICAL WEAPONS

(a) A biological weapon is defined as any equipment or apparatus expressly designed to use, for military purposes, harmful insects or other living or dead organisms, or their toxic products.

(b) Subject to the provisions of paragraph (c), insects, organisms and their toxic products of such nature and in such amounts as to make them capable of being used in the equipment or apparatus referred to in (a) shall be deemed to be included in this definition.

(c) Such equipment or apparatus and such quantities of the insects, organisms and their toxic products as are referred to in paragraphs (a) and (b) which do not exceed peaceful civilian requirements shall be deemed to be excluded from the definition of biological weapons.

The scope of these definitions was thus remarkably broad, particularly as regards chemical weapons. The CW agents renounced were not limited to the traditional "poison gases" but also included tear gases and other irritant agents. Neither was it confined to anti-personnel chemical weapons; by specifying "growth-regulating, anti-lubricating or catalysing" chemicals, it also included anti-plant and anti-matériel[21] weapons. It is not clear just how, and by whom, the definitions were formulated; they were copied verbatim from Annex II to Article 107 of the abortive European Defence Community Treaty of 1952.[22]

It was not until four years after the Armaments Control Agency had been set up that the Council of WEU decided on the types of CBW agent whose nonproduction by the FRG the Agency was to verify. The lists which were eventually produced were prepared for the Agency at meetings of experts nominated by WEU member governments; (it is not clear whether experts from NATO countries participated as well). The experts felt that the agents needed to be defined very precisely (e.g., in terms of chemical structure rather than the broad categories set out in the Brussels Treaty) if the Agency was to obtain willing cooperation from factory managements. The list of chemicals was approved by the Council in 1958;[23] it was as follows:

Section I: Chemical products which cannot be used for civilian purposes:
(1) Alkyl alkylphosphonofluoridates
(2) Alkyl N-dialkylphosphoramidocyanidates
(3) Mustard gas
(4) Nitrogen mustards
(5) Lewisites

Section II: Chemical products which can be used for civilian purposes:
(1) Hydrocyanic acid
(2) Cyanogen chloride
(3) p-Chlorophenyldimethylurea
(4) Maleic hydrazide

[21] During World War II, Germany had a number of research projects under way concerning anti-matériel chemical weapons. These are referred to in Volume I of this study at page 69. The projects had to do with chemicals that could destroy lubricants or promote "knocking" in internal-combustion engines. Such substances were envisaged as fillings for anti-aircraft shell.

[22] The function of this Annexe was to specify the war materials whose production in, import to, or export from, "strategically exposed areas" of the Community was not to be permitted except by the unanimous decision of the Council of the EDC. For a text of the EDC Treaty, see *Traité instituant la Communauté européenne de défense et documents annexes:* La Documentation Française: Receuils et Monographies: Paris, 1952.

[23] The list is contained in the 5th Annual Report of the Council to the Assembly of WEU: *WEU Assembly Proceedings* VI (1960) 1: 10–42.

When set against the categories of chemical contained in the Adenauer declaration, this list is remarkable for its omissions. The classical "asphyxiating" agents of CW—chlorine, phosgene and diphosgene—do not appear on it, neither do any "irritant" or "paralysant" agents (except insofar as the two families of G-agent nerve gas listed—Section I items (1) and (2)—can be regarded as "paralysant"). Items (3) and (4) of Section II, both of them anti-plant agents, are certainly within the category of "growth-regulating" chemicals, but there is no mention of the two best known—and most militarily efficacious—members of this category, namely 2,4-D and 2,4,5-T. No "anti-lubricating or catalysing" chemicals are included. The list is reviewed at intervals, but the only substantial change came in 1960, when the family of O-alkyl S-2-NN-alkylalkylaminoethyl alkylphosphonothiolates (i.e., the V-agent nerve gases) was added to Section I.[24]

The list of biological products to be controlled was approved in 1959. It was as follows:[25]

Section I: Biological products which cannot be used for civilian purposes:
NIL
Section II: Biological products which can be used for civilian purposes:
(1) Botulic toxins
(2) *Malleomyces mallei* (glanders agent)
(3) *Malleomyces whitmori* (melioidosis agent)
(4) *Bacillus anthracis* (anthrax agent)
(5) *Brucella* (brucellosis agents)
(6) *Pasteurella tularensis* (tularemia agent)
(7) *Rickettsia burneti* (Q fever agent)
(8) *Pasteurella pestis* (plague agent)
(9) Rinderpest virus.

[24] Other amendments to the list comprise the incorporation of structural formulae for chemicals listed in Section I. These are as follows:
(1) R′O·RP(O)F, where R is a C_{1-3} alkyl group, and R′ a linear or branched alkyl or cycloalkyl group of unspecified size.
(2) MeRN·P(O)CN·OR′, where R is a methyl or ethyl group and R′ a linear or branched alkyl or cycloalkyl group of unspecified size.
(3) $S(CH_2CH_2Cl)_2$
(4) $N(CH_2CH_2Cl)_3$
(5) $(ClCH=CH)_nAsCl_m$, where $n+m=3$, and $n \neq 0$
And, for the V-agents added in 1960: RO·R′P(O)$SCH_2CH_2NR''R'''$, where R′ is a methyl or ethyl group, and R, R″ and R‴ are alkyl or cycloalkyl groups of unspecified size. R″ and R‴ may also be linked into a single cyclic radical, and the ethylene linkage between the nitrogen and sulphur atoms can be methyl-substituted.
These structural formulae are notable for the extent to which they exclude important members of the sulphur and nitrogen mustard gas families from the Agency's controls.

[25] The list is contained in the 5th Annual Report of the Council to the Assembly of WEU: *WEU Assembly Proceedings* VI (1960) 1: 10–42.

As of 1970, a decision was still pending on whether to add psittacosis agent and smallpox virus to this list; otherwise there have been no changes since the list was drawn up. It is to be noted that while it includes potential anti-animal BW agents as well as anti-personnel ones, it does not include anti-plant agents. The list is in fact a highly selective one. There are several hundred disease agents which theoretically might be used for BW purposes, and the criteria for selecting BW agents from among them are by no means obvious, given the unproven character of BW. Different experts might well put together entirely different lists. It is relevant to note that the WEU list excludes several of the pathogens and toxins which reached advanced development or production in the US biological weapons programme.[26]

So far, the Agency's CB verification activities have mainly been concerned with potential CBW agents. No controls have yet been applied in respect of the "equipment or apparatus expressly designed to use" these agents for military purposes. To date, the inspectable characteristics of this hardware have not yet been defined.

It is also to be noted that the Brussels Treaty does not prohibit the FRG from conducting CBW R & D work, whether offensive or defensive. The Agency's controls are thus solely concerned with non-production.

III. *The control methods applied by the Agency in respect of CB weapons*

General features

The Agency did not begin a close study of CB control methods until 1957, when a meeting of chemical and biological experts nominated by WEU member governments was convened. The initial task of the experts was to draw up the lists of products to be controlled by the Agency that were described in the previous section.[27] In the course of the next two years, groups of experts met at intervals to discuss possible control methods, and during March 1959 the general procedure that was to govern the Agency's chemical inspections was worked out.[28, 29] This was refined

[26] For example, staphylococcal enterotoxin B, saxitoxin, Venezuelan Equine Encephalitis virus, Chikungunya virus, *Rickettsia rickettsii*, rice blast fungus and a wheat rust.
[27] 3rd Annual Report of the Council: *WEU Assembly Proceedings* IV (1958) 1: 23–78.
[28] 4th Annual Report of the Council: *WEU Assembly Proceedings* V (1959) 1: 25–58.
[29] 5th Annual Report of the Council: see note 23 above.

during a series of experimental field-control exercises, and in the course of 1960 was incorporated into the Council's "provisional directive to the Agency concerning non-production control methods for chemical weapons".[30] In 1961 the first non-experimental field-control exercises took place; these established that neither lewisite nor sulphur or nitrogen mustards were being produced in two FRG chemical factories. Following these "agreed" inspections, the Council reported that "this experimental confirmation that chemical weapons can be controlled effectively, despite the inherent difficulties, is particularly worthy of mention".[31] By 1970 the Agency had performed forty-one on-site "agreed controls" at eighteen German chemical factories.

Progress in the biological field was much less rapid. During April 1959 the experts had recommended that the same general principles proposed for chemical controls should be used for biological controls.[32] Experimental field-control exercises were mounted during 1959–60 but these did not enable the Council to issue control directives similar to those laid down for chemical inspections. Over subsequent years the Agency continued to study the problem, with the help of "technical information visits" to biological facilities in the FRG and other WEU countries, but by 1970 no "agreed controls" had yet been applied in the FRG. In 1970 the Council reported this situation as follows:

> In the absence of regular control activity, which is still not possible, [the Agency's experts] achieve their purpose:
> —by constant study of the most recent documentation, and in particular, by regular visits to the Documentation Service of the Pasteur Institute in Paris;
> —by technician information visits at the invitation of member countries.[33]

And in 1971 as follows:

> The Agency is unable to carry out its activities in the field of biological weapons. One of the principal reasons for this situation is the absence of any legal guarantees to protect private interests.[34]

The problem that has continually faced the Agency is that of commercial secrecy. As noted earlier, the Paris Protocols contain provisions for safeguards, but in many ways these seem to have created more difficulties than they have resolved. Because the Due Process of Law Convention is still not law, the Council has considered it impossible to en-

[30] 6th Annual Report of the Council: *WEU Assembly Proceedings* VII (1961) 1: 8.
[31] 7th Annual Report of the Council: *WEU Assembly Proceedings* VII (1962) 1: 10.
[32] 5th Annual Report of the Council: see note 25 above.
[33] 15th Annual Report of the Council: *WEU Assembly Proceedings* XVI (1970) 1: 14.
[34] 16th Annual Report of the Council: *WEU Assembly Document* 532, 16 April 1971.

force full controls at private factories, so that even after 15 years the Agency has still not been enabled to meet its CB-control obligations to the full. As regards the other main safeguard—"[the Agency] shall ensure that materials and products destined for civilian use are excluded from its operations[35]—the inherent contradiction is obvious enough: the Agency has to apply some sort of controls in the civilian sector if it is to ensure that illegal products are not being made.

In an attempt at resolving this particular conundrum, the 1956 Regulations had laid down that field-controls in private establishments were to be carried out at the "assembly stage" of the items to be controlled. Stages in the production process prior to the "assembly stage" were not to be inspected. While the meaning of this was reasonably clear for such things as missiles or aircraft, it was much less obvious in the case of chemical products, and almost completely obscure in the case of biological products. The question of defining the "controllable stage" of the CB weapons cycle in a manner that security-minded factory managements might be willing to accept was discussed at the 1959 meetings of CB experts, but no solutions were reached until after further study by the Agency. Then, in 1960, the Council approved the following definition for chemical products:

> Control in factories as regards the chemical products (chemical weapons) on the list approved by the Council can take, as its starting point, the chemical reaction or reactions immediately preceding the possible creation of the product on the list, in whatever form it may be.

For biological products the following definition was approved in 1961:

> Control of the biological products (biological weapons) on the list approved by the Council may be carried out in biological production plants from the germ culture stage onwards. In the event of toxins being obtained by chemical synthesis, the scope of the controllable phase will be determined for each type of case.

These definitions are discussed further below. The one for chemicals proved acceptable to factory managements, with certain initial reservations, but the one for biologicals did not. It is this fact which has largely been responsible for the lack of progress in the Agency's biological control activities: without the cooperation of factory managements, the Agency cannot apply "agreed controls", and without the Due Process of Law safeguards, it is not permitted to enforce the Council's definition.

Apart from trying to decide on an acceptable definition of the "con-

[35] Article 10 of Protocol No. IV.

trollable stage", other attempts were made to reassure factory managements about on-site inspections. Following a recommendation by FRG authorities in January 1960, the Agency agreed to adopt a stepwise control procedure at chemical factories whereby the control methods would be applied in the following order:

1. Observation of plant equipment, including safety measures.
2. Identification of the raw materials and intermediates being consumed.
3. Scrutiny of the factory accounts.
4. Sampling, and subsequent analysis, of plant throughputs.

The following provision was then written into the Agency's provisional control directive, and subsequently followed in on-site inspections:

> This order will be followed in carrying out control, on the understanding that the Controller, once he is convinced that the result of the control is satisfactory, shall decide to terminate the control and not to proceed with all the control measures listed above. [1]

By this means, control measures that might intrude deeply into areas of commercial secrecy would only be applied if less intrusive measures were not conclusive. FRG factory managements have been reluctant to accept measures (3) and (4), and they have opposed sample-taking on the grounds that the liability of WEU for accidents or damages caused by representatives of the Agency, or suffered by them, is not determinable under German civil law. This objection would presumably disappear if the Due Process of Law Convention were in force.

No comparable stepwise procedure has yet been approved for biological controls. Here sample-taking is even more strongly resisted by factory managements because the definition of the "controllable stage" embraces a much larger proportion of a biological plant's production activities. This is discussed further below.

The way in which the Agency, acting for the Council of WEU, has been seeking to verify nonproduction of chemical weapons in the FRG, and in which it contemplates doing so in the case of biological weapons, is, broadly speaking, as follows.

The broad categories of CB weapons specified in the Brussels Treaty have been reduced into lists of specific weapons whose nonproduction is to be verified. These lists must be approved each year by a majority decision of the Council, of which the FRG is of course a member. The lists distinguish between products which have no civilian application and civilian products which might find military application. Different procedures are then applied to the two classes. It is not known what arrangements

the Agency has for controlling production of the relatively small amounts of single-purpose products that the FRG might need for CBW R & D work; at present such materials are imported from allied countries, for example from the USA and France.

For the single-purpose products, the FRG is asked each year to provide a list of factories that might be capable of producing them, together with any evidence that might show that the factories do not in fact produce them. The FRG is under no obvious formal obligation to provide this information, but it has not yet declined to do so. From the list of factories, the Agency selects about half a dozen each year for on-site inspection. If it can obtain permission from the FRG Government and from the factory managements, a team of inspectors then visits the factories to apply inspection techniques that prior consultation has shown are likely to be acceptable to the managements. No illicit production of chemical weapons has yet been detected by these measures.

For the dual-purpose products, the FRG is asked each year to list those factories where they are made, to give the production figures at each factory during the previous year, and to give production estimates for the coming year. Again the FRG is under no obvious obligation to provide this list. For chemicals, the production estimates are accepted as the permitted level of production, and field-controls are then applied to verify that the levels are not being exceeded. For biological products (and there are no single-purpose biologicals on the Agency's list), a different method of establishing the permitted levels of production is to be used; this is described below.

To provide itself with background information, and to keep up with scientific development, the Agency maintains an extensive library of classified and unclassified documentation relating to CB weapons, particularly production methods. In 1961 it opened a technical index file to cope with new publications, and this has grown rapidly over the years. Its "technical information visits" have taken in some of the national CBW research establishments in different WEU member countries. In addition, it maintains contacts with the US Arms Control and Disarmament Agency and with the Arms Control and Disarmament Research Unit of the British Foreign Office, both of which have conducted studies of their own in the field of CB verification.

Special features of the chemical weapons controls

The 1960 definition of the "controllable stage" in CW agent production was not at first completely acceptable in the FRG, and to meet West

German reservations the Director of the Agency set out in writing the following explanatory comments:

(a) In conformity with Article 10 of Protocol IV, the Agency does not intend to control the manufacture of characteristic substances which would be necessary to make up the final product contained in the list, as these characteristic substances are substances for the civilian sector.

It is, nevertheless, necessary that, in the course of control, the Agency's effective inquiries should start as soon as these characteristic substances exist, in order to ensure that they will not result either in final products on the list which should not be manufactured, or in greater quantities than those of the limits imposed for the products on the list which may be manufactured.

(b) In simple cases, especially in regard to the manufacture of two products [hydrocyanic acid and cyanogen chloride] in Section II of the list, the term "the reaction" could probably be applied under similar conditions to those found during exercises already carried out.

This is not the case in the manufacture of certain products indicated in Section I, where a limited group of reactions must be considered which would produce the final product, if this were manufactured. These reactions can sometimes take place within the same apparatus (e.g. nitrogen mustard). They can also take place in a series of several apparatuses (e.g. sarin).

In the two latter cases, the reactions involved cannot be dissociated from the point of view of control, because they would only exist (it must be added, momentarily) in order to make it possible to obtain the final product, if this were manufactured. So long as these transitory substances have neither justified use nor justified existence in the civilian sector, their reactions can without difficulty be included in the control stage. This is equally valid in the case of non-production control and the control of production levels.

The characteristic substances mentioned in paragraph (a) above are thus, in all cases, the existing and concrete elements which the Agency can use as a base at the beginning of the control stage.

In practice, therefore, on-site inspections at chemical factories are only to be concerned with those parts of the site where the "characteristic substances" specified above (i.e., potential CW agent precursors) are being processed. The Agency duly prepared a list of "characteristic substances", and in its annual questionnaires to the FRG asked for details of all factories where they were produced or consumed. The list was as follows.[36]

[36] Items (1) and (2) were included as being relevant to production of the three types of nerve gas on the Agency's list: item (3) for the alkyl alkylphosphonofluoridate nerve gases: items (4) and (6) for the nitrogen mustards; item (5) for mustard gas; and items (7) and (8) for the lewisites. In fact, item (2) is relevant to only one of the three families of nerve gas, to which item (4) is also relevant. It is not known how the Agency verifies that CW agents are not being produced by processes that do not involve these characteristic substances. Mustard gas, for example, can be and has been made on a large scale by processes that do not involve thiodiglycol.

1. Phosphorus trichloride
2. Phosphoryl chloride
3. Hydrofluoric acid, anhydrous
4. Dimethylamine
5. Thiodiglycol
6. Triethanolamine
7. Arsenic trichloride
8. Arsenious oxide

In addition to these requests, and the requests for information on dual-purpose chemicals described above, the annual questionnaires that have been sent to the FRG since 1959 have also asked about West German factories producing organophosphorus insecticides. The Agency presumably considers that these hold out possibilities for nerve-gas production. The Agency apparently does not ask for information about other types of organophosphorus plant—for example those producing organophosphorus plasticizers—except insofar as they consume "characteristic substances". Neither does the Agency attempt to monitor flows of elemental phosphorus through the West German chemical economy.

The conduct of the Agency's on-site inspections at chemical factories has been described as follows:[37]

The Director of the Agency appoints two to four officials of different nationality, one of them a national of the country concerned, to carry out this inspection. A representative of the competent national authority assists the Agency in the execution of its controls in conformity with the Treaty.

During such controls, the representatives of the Agency enquire about the organisation, operation and production programme. Their questions are answered in so far as no business or production secrets are involved.[38]

The subsequent visit to the production plant covers only those departments where the decisive phase of reaction occurs.[39] The inspectors ask to be shown built-in measuring instruments so that they can verify the quantities of the pre-product or pre-products employed in the production of a substance and the final output. If further clarification is required, the findings are compared with the factory's records or books. Special attention is paid by the inspectors to the factory's safety regulations . . ..

[37] This description comes from a paper entitled "Surveillance of a prohibition of biological and chemical weapons" that was made available on 17 February 1970 to members of the CCD in Geneva by the FRG Foreign Ministry. The paper was also published in *Wehrkunde* 1970 (3): 152–154, and extracts from it appeared in *NATO Letter* 18 (7–8): 17–19, 1970. It is in fact an abridged rendering of more detailed information of FRG authorities.

[38] In particular, detailed information is requested on the relevant chemical substances, the quantities produced and sold, supplies, imports and exports, the production plant, the plant capacities and the civilian utilization of the products.

[39] That is to say, those sections of the plant in which the "characteristic substances" for the products appearing in the Agency's list are produced and processed.

After each field inspection the inspectors report orally to the Director of the Control Agency. They also prepare a written classified report which remains in the Agency's files. It may not be brought to the notice of any other body or individual outside the Agency. Neither the factory concerned, nor the competent national authority is consulted in the preparation of the report.

The representative of the national authority who has taken part in the control also prepares a report on the inspection so that the authority concerned may have its own documents available in the event of recurrent controls. That report is transmitted to the management of the factory concerned . . ..

The Control Agency reports to the Council of WEU annually. This report states the number of controls that have been carried out, the names of the firms concerned, and the outcome of the controls, indicating—but not specifying—any difficulties or problems that may have occurred.

Special features of the biological-weapons control plans

In contrast to the field controls applied by the Agency to chemical plants, those planned for biological plants are all quantitative controls, for the Agency's list of biological products contains none that are without civilian application—for vaccine or toxoid production, for example. Although the FRG is asked each year for production estimates in respect of each product on the Agency's list, these estimates are not then used to specify permitted production levels, as in the case of the dual-purpose chemicals. Much higher thresholds are used instead, ones fixed according to theoretical calculations of the quantities of the products that would be needed to produce significant military results. These thresholds were worked out at the April 1959 meeting of biological and military experts; they correspond to the amount of agent reckoned to be needed in order to obtain "direct military effect" over an area of 1 square kilometre. They are set out in table 3A.2. It may be noted that the figures arrived at by the experts do not specify the purity of the products concerned (and hence their potency): the specified weights of bacterial cultures, for example, do not distinguish between ones having a titre of, say, a thousand viable organisms per gram and ones with a titre of a thousand million.

In its annual "requests for information" concerning biological products, the Agency asks the FRG for the following information:

1. The names of West German production plants[40] capable of producing pathogenic organisms or toxins.

[40] By "production plants" the Agency means "every unit suitable for producing in such amounts as are covered by the definition of a biological weapon [i.e., the amounts set out in table 3A.2] those biological products which are to be controlled, regardless of its ownership, legal position, size and number of workers employed".

Table 3A.2. The thresholds for level-of-stocks controls of biological products (weights of product needed for direct military effect over 1 km²)

Product	Form	Weight (*kg*)
Botulinal toxins	Purified toxins	0.007
Malleomyces mallei	Bacterial paste	15–150
Malleomyces whitmori	Bacterial paste	25–250
Bacillus anthracis	Spores	1.75–17.5
Brucella pathogens	Bacterial paste	5–50
Pasteurella tularensis	Bacterial paste	1.25–12.5
Rickettsia burneti	Embryonated-egg culture	1–10
Pasteurella pestis	Bacterial paste	5–50
Rinderpest virus	Embryonated-egg culture	6.25–62.5

Source: See footnote 37.

2. The biological products on the Agency's list that were produced within the FRG during the previous year.

3. The names of the plants which produced or processed these products.

4. The names of plants which could have produced them but did not.

5. The quantities produced by each plant, and the quantities consumed for civilian purposes.

6. The quantities of civilian end-items made from these products during the previous year, together with production estimates for the next year.

7. The quantities of the products in stock at each plant.

These requests are duly answered each year by the FRG.

As noted above, the "controllable stage" at biological plants is at present considered as being "from the germ culture stage onwards". This is a somewhat vague definition. In the production of chemicals, the raw materials undergo a series of characterizable transformations into new chemical compounds until the final product is reached. In the production of biologicals, however, the final product is much the same as the initial raw material: the production process is essentially one of multiplication rather than synthesis. As the initial raw material has to be a "germ culture", the "controllable stage" as defined thus embraces the whole production process, so that under the existing definition virtually the entire production plant is open to Agency scrutiny. In theory, therefore, Agency inspectors would have access to almost all a plant's commercial secrets, particularly if they were empowered to take samples of the plant throughputs. It is perhaps not surprising, therefore, that the Agency has so far been unable to mount any "agreed controls" at FRG biological plants.

In trying to resolve this problem, the Agency has been making detailed

studies of biological production processes in the hopes, presumably, of coming up with a more acceptable and workable definition of the "controllable stage". In 1964, the Council had before it for consideration "a substantial working document for the study of possible control methods for biological weapons" that had been compiled by the Agency.[41] In 1968, however, it had to report that as regards biological controls "some foundations have been laid but the essential work remains to be done".[42] No new proposals have yet been adopted, so that the Agency has had to make do with "technical information visits". By 1970, there had been fourteen of these at eleven different FRG biological factories and institutes. These have in fact taken in almost all the production facilities within the FRG that are eligible for the quantitative controls.

IV. *The value of the Agency's CB weapons controls*

The Armaments Control Agency has been verifying portions of a regional armaments limitation agreement since 1956. Could its experience form the basis for the verification of a broader international agreement? This was a possibility which appealed to the Assembly of WEU, whose representatives often urged that it should be given prominence in the Council's plans for the Agency.[43] More cynical commentators have suggested that since the Agency, in their view, is now largely unnecessary, hopes for the future provide its only present justification.

The Agency has certainly gained valuable insight into the detailed problems of verification. It is to be hoped that its experience here will eventually be shared with people outside its own closed circle, for example by a declassification of some of its reports and studies. The disarmament negotiations at Geneva, for instance, could presumably profit from this.

An altogether different question is the value of the WEU verification system as a model for an international system going beyond the boundaries of a single alliance—a system that is subject to the strains of political and military polarities which it is an object of disarmament agreements to relieve or palliate. Some hold that the WEU system could be expanded

[41] 10th Annual Report of the Council: *WEU Assembly Proceedings* XI (1965) 1: 31–52.
[42] 13th Annual Report of the Council: *WEU Assembly Proceedings* XIV (1968) 1: 15.
[43] See, for example, the 1958 report of the Assembly Committee on Defence Questions and Armaments (*WEU Assembly Proceedings* IV (1958) 3: 75–78) and Assembly Recommendation No. 29 of 18 December 1958 (*WEU Assembly Proceedings* IV (1958) 4: 24–25).

into an effective international machinery. Others hold that its structure is too flawed for this, and its scope too narrow.

On the question of its structure, it is to be recalled that the revised Brussels Treaty had two main functions: to strengthen NATO with FRG participation, and to allay French misgivings about West German rearmament. The former would be possible only if the latter could be provided for, and this was the purpose of the Armaments Control Agency. For the Agency to be acceptable to the FRG, the other WEU member countries had to accept a measure of control also, but the FRG was in no position to insist on an equal measure. The UK attempted to exclude itself from controls altogether, but France would accept this only in return for the British commitment to maintain a substantial army on the Rhine. From the start, therefore, the Agency's controls were strongly asymmetric. However good the reasons for this may have been at the time, they have become less and less valid since then. Increasing resentment at the various discriminations seems to have prevented the Council from applying the provisions of the Brussels Treaty to the full, and to have hampered the work of the Agency.

The difficulties here were foreseen early on; so were the problems arising from commercial secrecy. In its comments on the Council's second annual report, the Assembly Committee on Defence Questions and Armaments spoke of "the anxiety which control may cause as to the economic independence of Member States".[44] Unless the Agency could provide guarantees for the security of the commercial secrets that it might acquire, WEU members might not adequately cooperate with it, particularly those against whom the controls discriminated. Likewise, resentment at discrimination might find expression in demands made for these guarantees.

These two inter-related problems have imposed severe constraints on the Agency's work, and the control measures which it applies are structured accordingly. As described above, in the planning of controls for the West German chemical and biological industries, the issue of commercial secrecy has been so obtrusive that the Agency has not yet been able to apply full controls.

Whether or not the particular reluctance of the FRG to accept the Agency's biological controls stems from fears for its industrial privacy or "economic independence", or from resentment of the discrimination involved (and here the discrimination may nowadays reasonably be regarded

[44] "Consideration of the Second Annual Report of the Council" by the Assembly Committee on Defence Questions and Armaments: *WEU Assembly Proceedings* III (1957) 1: 55–65.

as unjustifiable in that all WEU biological plants on the European mainland are liable to production-level controls under the terms of Protocol No. III) or both, or from other reasons, the concern of West German plant managements for their commercial secrets is reasonable enough. In any case, it may be argued that the obstacles to the Agency's activities arise as much from French and British intransigence, as from West German. The only WEU country that has failed to ratify the Due Process of Law Convention is France, and in ratifying the Convention, the FRG could hardly have been unaware that once the Convention was law, the Agency could enforce its controls at FRG biological plants (provided there was majority approval within the WEU Council for the Agency's control methods). France's decision not to ratify was expressed as an unwillingness to accept full controls so long as the UK was immune to them—particularly controls of its nuclear weapons stocks. These ought in any case to have been subject to controls, but France successfully blocked the requisite authorization from the Council. French nuclear weapons production commenced at a time when the UK was using the WEU Council as a forum for its attempts to enter the EEC (the Council is the only European organization composed exclusively of the six Common Market countries and the UK). Given that France was objecting to this "backdoor entry into Europe" to the point of threatening to withdraw from WEU, this was hardly an opportune moment to press for WEU controls over the French nuclear industry.

It is presumably France's blockage of nuclear controls that has also prevented the Agency from extending its level-of-stocks controls of dual-purpose CB products to all WEU member countries, for the provisions for such controls are all contained in the same article of Protocol No. III. This has added a further element of discrimination against the FRG, one that is potentially disadvantageous commercially.[45]

These are the grounds, then, on which the structure of the WEU verification system might be considered too flawed to admit wider application. With hindsight, it might be argued that if CB weapons had not been lumped together with nuclear weapons by the draftsmen of the Paris Protocols, the Agency might have been able to develop better CB control arrangements. The considerations that led France to exempt its nuclear

[45] The FRG has formulated the following specific objection to the Agency applying controls to the dual-purpose products of its chemical industry. Theoretically, the Agency should be checking the data which the FRG supplies on the final disposition of these products. These might necessitate field controls at the factories of FRG customers. Faced with this liability, the customers might well turn to other sources of supply.

weapons from control might not have applied so forcefully to CB weapons.[46] However, such attempts as the Assembly of WEU has made to lessen the discrimination have not yet been successful. Assembly Recommendation 93 of 4 June 1963 asked the Council to expand the "armaments control measures to the territories of all member countries" (that is, to the UK), but the Council replied, in October 1963, that it did not "consider it opportune, in the present circumstances, to amend the Brussels Treaty on the lines proposed". Likewise, in its Recommendation 209 of 17 June 1971, the Assembly has asked the council to:

(a) State in future reports, in respect of the countries concerned, that "no effective production of nuclear and biological weapons has yet been undertaken";
(b) Instruct the Agency for the Control of Armaments in the future to include appropriate questions in its annual questionnaire, to extend its special requests for information to nuclear weapons, and to undertake effective inspections to verify the validity of such statements in respect of nuclear, biological and chemical weapons.

The Recommendation also calls for the entry into force of the Due Process of Law Convention. At the time of writing the Council has not yet responded; if the Recommendation were to be accepted, it would of course lead to a major expansion of the Armaments Control Agency's activities.

It may also be asked whether the control techniques at present applied to WEU member countries would be sufficiently broad in scope for verifying a full international CB disarmament treaty. The WEU CB controls consist essentially of a monitoring of economic data provided by the FRG Government cross-checked with on-site inspections at voluntarily declared production plants. There are no formal inspections at R & D establishments, nor at weapons proving grounds, although some of them have received informal "technical information visits", including the two principal FRG CB defence installations. No attempts seem to be made to cope with any evasive activities there might be, such as CBW agent production in hidden factories or the omission of key information from the reported data. Within the limited context of WEU this degree of verification might be thought adequate, for nowadays it seems improbable that WEU member countries could reasonably suspect the FRG of clandestine CB weapons production (and in the improbable event that they did, they could hardly publish such suspicions without political damage to their alliance). But in a wider context, provisions for a greater degree of reassurance might

[46] The Agency has paid a number of "technical information visits" to French chemical and biological factories at France's invitation.

be thought necessary, as, for example, by extending the controls to stages of a possible CB weapons acquisition cycle beyond that of agent manufacture. This might serve not only to increase the credibility of the system, but also to reduce the level of intrusiveness involved in it. The tighter the controls over the critical stage of agent manufacture, the less would be the need for controls over other stages (e.g., research, development, testing and weapons manufacture), and *vice versa,* the determining factor here being, so it might be held, the degree of access to a country's chemical and biological industries. As it seems unlikely that international agreement could ever be reached on a verification system as intrusive as that of WEU, the trade-off possibilities between intrusiveness and breadth of controls might well need exploiting. And as regards credibility, one measure of the worth of a verification system is its ability to refute unfounded allegations or insinuations. If these were to concern a stage in the CB weapons acquisiton cycle which was not subject to controls, the verification system might then fail to meet a basic requirement.[47]

It has also been argued that because the WEU system does not function to the extent envisaged in the Brussels Treaty even with the degree of mutual trust that obtains between allies, it is unlikely to be any more efficient in a wider international setting. It is certainly true that potential enemies are likely to mistrust one another more than actual allies. But the discriminations present in the Brussels Treaty are themselves a source of mistrust, of a kind that presumably would not be present in an international disarmament treaty. No doubt there would always be some parties to a full international CB disarmament treaty that would feel discriminated against (for example, different levels of civilian requirements in different countries would lead to necessarily discriminatory interpretations of legitimate products). But an agreement in which controls were applied symmetrically to all parties would at least avoid many of the stresses and resentments that are a feature of the asymmetric WEU arrangement.

Since discrimination seems to have been the main operational obstacle to full Agency controls, one cannot judge how well the WEU system would have functioned had there been no such discrimination, or how well the verification techniques that have been used would work in a full

[47] In the past, the FRG has been accused by countries outside the WEU alliance of engaging in offensive CBW R & D. Such an activity is not in fact prohibited by the revised Brussels Treaty, and therefore lies beyond the scope of the Agency's controls. But in practice, the Agency's knowledge of chemical and biological activities within the FRG allows it to make informed assessments of such allegations. Sometimes these assessments have been made available to the governments of WEU member countries, a practice which amounts in part to an informal verification-by-challenge or "complaints" procedure. Only rarely does this aspect of the Agency's work become apparent to the general public.

international setting. But there can be little doubt that the technical expertise of the Agency's inspectors, and their long familiarity with the techniques they have been applying or studying, would be of great value to international CB verification.

Annex: The CB weapons stipulations of the European post-World War II peace settlements

The treaties of peace with Bulgaria, Finland, Hungary, Italy and Romania

The Allied powers, including the USSR, concluded peace treaties with Bulgaria, Finland, Hungary, Italy and Romania on 10 February 1947. All five treaties made identical provisions for CB weapons.

The military clauses of the treaties established the force levels that were to be permitted to the defeated countries in the post-war world.[48] Existing stocks of armaments in excess of those required for these permitted force levels were to be disposed of,[49] and it was forbidden to "manufacture or possess, either publicly or privately, any war material different in type from, or exceeding in quantity, that required for the forces permitted".[50] The term "war material" here was defined in annexes to the treaties.[51] Category VI of these annexes was as follows: "Asphyxiating, lethal, toxic or incapacitating substances intended for war purposes, or manufactured in excess of civilian requirements". No other portions of the annexes, or the treaties themselves, referred to CB weapons.

It is not clear from the texts of the treaties whether the five countries were to be entirely debarred from possessing CB weapons, or whether some sort of quantitative prohibition was contemplated. However, each of the treaties contained a clause in which the countries concerned were entirely forbidden to "possess, construct or experiment with" certain specified types of major armament.[52] While these armaments included nuclear weapons, and such things as guided missiles and influence-mines, CB weapons were not specified among them.

[48] Articles 56–66 of the Italian treaty, for example. For the texts of the five peace treaties, and for a commentary on them, see A. C. Leiss and R. Dennett, eds., *European Peace Treaties after World War II* (Boston, 1954).
[49] Article 67 of the Italian treaty, for example.
[50] Article 53 of the Italian treaty, for example.
[51] Annex XIIIC of the Italian treaty, for example.
[52] Article 51 of the Italian treaty, for example.

The Austrian State Treaty

France, the UK, the USA and the USSR reached agreement about the future of Austria shortly after the Western European Union had been created. The State Treaty for the Re-Establishment of an Independent and Democratic Austria was signed on 15 May 1955.[53] Its military clauses contained a more explicit prohibition of CB weapons than did the earlier peace treaties. Article 13 was as follows:

> 1. Austria shall not possess, construct or experiment with—(a) Any atomic weapon, (b) any other major weapon adaptable now or in the future to mass destruction and defined as such by the appropriate organ of the United Nations, ... (j) asphyxiating, vesicant or poisonous materials or biological substances in quantities greater than, or of types other than, are required for legitimate civil purposes, or any apparatus designed to produce, project or spread such materials or substances for war purposes.
>
> 2. The Allied and Associated Powers reserve the right to add to this article prohibitions of any weapons which may be evolved as a result of scientific development.

"Specialised installations, including research and production equipment" that were prohibited under Article 13 were to be destroyed or rendered "unusable for any military purpose".

In addition to Article 13, the treaty also placed restrictions on other categories of "war material", including "asphyxiating, vesicant, lethal, toxic or incapacitating substances intended for war purposes, or manufactured in excess of civilian requirements".[54] These war-material restrictions were identical with those of the earlier peace treaties. It is not clear why the treaty apparently makes both nonproduction and level-of-stocks stipulations concerning CB weapons.

The terms imposed on Germany

No single peace treaty has yet been concluded between Germany and the Allied powers.

Before the German surrender, the Allies had agreed to impose strict controls on German industry after the war to eliminate its war potential.[55] In the Potsdam Agreement of August 1945 between the UK, the USA and the USSR, it was stated that one of the main objectives in occupying Germany was

[53] For the text of the treaty, see *Department of State Bulletin* 32: 916–932, 1955.
[54] Annex 1, referring to Article 14.
[55] See B. R. von Oppen, ed., *Documents on Germany under Occupation 1945–1954*, (London, 1955).

The complete disarmament and demilitarization of Germany and the elimination or control of all German industry that could be used for military production. To these ends ... all arms, ammunition and implements of war and all specialized facilities for their production shall be held at the disposal of the Allies or destroyed. The maintenance and production of all aircraft and all arms, ammunition and implements of war shall be prevented.

The execution of these terms was to be the responsibility of the Allied Control Council at Berlin and the Allied Commission at Vienna.[56]

The first piece of actual legislation by the Allied Control Council that concerned CB weapons was contained in its Law No. 25 on the control of scientific research of April 1946.[57] The Law began as follows:

In order to prohibit for military purposes scientific research and its practical application, to control them in other fields in which they may create a war potential, and to direct them along peaceful lines, the Control Council enacts as follows:

Article I

All technical military organisations are hereby dissolved and prohibited. Equipment and buildings of a purely military character shall be destroyed or removed. Equipment or buildings having a possible peacetime application may be utilized for that purpose with the permission of Military Government.

Article II

1. Applied scientific research shall be prohibited on (a) any matter of a wholly or principally military nature; or (b) any of the matters specified in Schedule A hereto.

2. Applied scientific research on any of the matters specified in Schedule B hereto shall be prohibited unless the written permission of the Commander of the zone in which the research establishment is located is first obtained.

It then went on to make provisions for "fundamental scientific research". The relevant parts of Schedules A and B were as follows:

Schedule A: ...

8. The chemicals specified in Schedule C. [These were as follows: "Poison war gases (including liquids and solids customarily included in this term) with the exception of chlorine, phosgene, hydrocyanic acid, chlorinated ketones, halogenated carboxylic acids and their esters, cyanogen halides, lachrymatory halogen derivatives of hydrocarbons", together with "Highly toxic products from bacteriological or plant sources (with the exception of those bacteriological and plant products which are used for therapeutic purposes)"].

9. The methods of manufacture (but not the methods of utilization) of the chemicals specified in Schedule D. [These were "potential poison war gases", namely the seven chemicals or families of chemical excluded from Schedule C].

[56] *Ibid.* pp. 40–50.

[57] *Official Gazette of the Control Council for Germany,* No. 6 (30 April 1946): 138.

Schedule B: . . .

9. The methods of utilization of the chemicals specified in Schedule D.

Law No. 25 was concerned with military research and development work. Law No. 43 of December 1946 dealt with the manufacture, import, export, transport and storage of war materials.[58] Its terms were as follows:

In order to prevent the rearming of Germany, the Control Council enacts as follows:

Article I

1. The manufacture, import, export, transport and storage of the war materials specified in Schedule A annexed hereto are prohibited. All existing stocks of such materials shall be destroyed, removed or converted to essential peacetime use as soon as possible, according to the instructions of the appropriate Zone Commander (in Berlin, the appropriate Sector Commander). . . .

Article II

The manufacture, import, export, transport and storage of the war materials specified in Schedule B annexed hereto shall be permitted only with the authority and under the control of the appropriate Zone Commander. The manufacture of the materials in this schedule shall provide only for essential peacetime requirements; existing stocks of the materials in excess of such requirements shall be destroyed or removed according to the instructions of the appropriate Zone Commander. The export of materials specified in Schedule B may be permitted by authorization of the appropriate body of the Allied Control Authority. . . .

As in Law No. 25, Schedule A included single-purpose CB products. These were specified as follows:

Group I: (a) All weapons including atomic means of warfare or apparatus of all calibres and natures capable of projecting lethal or destructive projectiles, liquids, gases or toxic substances, their carriages and mountings. (b) All projectiles for the above, and their means of projection or propulsion. Examples of means of propulsion are cartridges, charges, etc. (c). . . .

Group VIII: (a) The following war chemicals: . . . Poison war gases (including liquids and solids customarily included in this term) with the exception of those listed in Group VIII b of Schedule B. . . . Highly toxic products from bacteriological or plant sources (with the exception of those bacteriological and plant products which are used for therapeutic purposes. (b) All special means for individual and collective defence used in peace exclusively by the armed forces, such as protective masks against toxic or lethal devices used for war, detection apparatus, etc.

Schedule B was concerned with dual-purpose products:

Group VIII: War chemicals which are nevertheless required for peace economy: (a) . . . (b) Potential poison war gases: chlorine, phosgene, hydrocyanic

[58] *Official Gazette of the Control Council for Germany*, No. 13 (31 December 1946).

acid, chlorinated ketones, halogenated carboxylic acids and their esters, cyanogen halides, lachrymatory halogen derivatives of hydrocarbons. (c) . . .

It is not known how the authorities concerned administered these two laws in the Soviet zone of occupation. As for the other zones, the laws were modified as the restoration of sovereignty to West Germany became increasingly acceptable in Western Europe. A Military Security Board was set up in 1948–49, among other things to verify that the armaments prohibitions imposed on Germany were being observed in the western zones. Previously this task had been among the duties of the military governors; they remained responsible, however, for the enforcement of the controls in their zones. Each of the three Western occupying powers was represented on the board.[59, 60] It is not known how the board conducted its verification of the CB weapons prohibitions; its inspection groups had the right of "free access at any time to inspect without prior notice . . . any place, installation or activity". Their responsibilities comprised "the whole field of disarmament and demilitarization, taking into consideration the laws and directives which have been agreed already on a quadripartite basis".[61]

In April 1949 the three military governors of the western zones promulgated an agreement modifying the restrictions placed on industries in their zones.[62] The restrictions were to remain in force until a peace settlement or until 1 January 1953, whichever was the earlier. The CB weapons provisions of this were contained in Article 3:

> The production or manufacture of the following substances and war materials shall be prohibited, and all plants and equipment for their production or manufacture not already removed or destroyed shall, as soon as possible, be removed from Germany or destroyed: (a) The items listed in Schedule A to Control Council Law No. 43 . . . (b) . . .

The Military Security Board was to perform the necessary controls.

Thus, for West Germany, the CB nonproduction provision of Control Council Law No. 43 became incorporated into the 1949 Tripartite Agreement, and from there in a modified form into the abortive EDC Treaty of 1952,[63] and finally into the revised Brussels Treaty of 1954. Quite what

[59] "London Conference Recommendations on Germany: Text of Communiqué", *Department of State Bulletin* 18: 807–810, 1948.
[60] "Military Security Board for Western Zones of Germany: Establishment by U.S.A., U.K., and France", *Department of State Bulletin* 20: 195–197, 1948.
[61] *Military Security Board for Western Zones of Germany: Directive on Organization:* paragraph 10 (c): *ibid.*, p. 197.
[62] For the text of the Tripartite Agreement, see *Department of State Bulletin* 20: 527–531, 1949.
[63] See above, page 198.

happened to the CB R & D provisions of Law No. 25 is not clear; certainly the revised Brussels Treaty imposes no restrictions on the FRG in this respect, and it is no secret that such work, stated to be of a defensive nature, is carried out in the FRG. Nothing is known about the subsequent history of these two Control Council laws under the Soviet administration in East Germany or in the present DRG.[64]

[64] However, the *Statement of the Government of the German Democratic Republic to the Conference of the Committee on Disarmament* of 6 April 1971 (CCD/326) states: "The Consitution and the Penal Code of the German Democratic Republic stipulate that any misuse of science directed against peace, mutual understanding among peoples, against the life and dignity of man is prohibited, and that the use of bacteriological and chemical weapons is subject to punishment."

Appendix 4. Investigations of the use of chemical and biological weapons

This Appendix is concerned with the verification of allegations of CBW. It begins with a discussion of the problems involved in investigating such allegations and is followed by two case studies.[1] The first deals with the allegations of chemical warfare during the Yemeni Civil War of the mid-1960s, and the second with the allegations of biological warfare made in 1951–1952 during the Korean War. In both cases we concentrate on the efforts made by outside parties to investigate the veracity of the allegations.

I. *Introduction*

The problems of organizing machinery for investigating complaints that CB weapons have been used were explored during the disarmament negotiations of the 1920s and 1930s. It was considered that investigation should take place rapidly and that it should be undertaken by an impartial and respected body. It was suggested then that the doyen of the diplomatic corps in the country concerned might take charge, calling upon agents such as consuls or military attachés, and also perhaps requesting the help of doctors or chemists. It was proposed that the results should then be forwarded to the permanent disarmament commission which it was hoped would then be in existence to supervise the enforcement of disarmament. Any state which placed obstacles in the way of supervision would create an unfavourable presumption against itself. (See Volume IV, Chapter 3.)

At a later stage it was suggested that the collection of evidence should normally be entrusted to "a commission for urgent initial investigation" which would be international in character. All this was linked to the general design for disarmament which was meant to include some action against transgressors. It was envisaged that all nations would be called

[1] The two case studies have been slightly revised since they were first circulated in February 1970 as Chapter 2 of Part IV of the provisional edition of this study.

upon to help the investigators perform their duty. (See Volume IV, Chapter 5.)

These discussions bore no fruit. No permanent international machinery for investigating allegations of the use of CB weapons was created then, nor has any been created since.

An account of verified and unverified allegations of CBW from 1914 to 1970 has been given in Volume I of this study (pages 125–230). It describes a considerable number of rather minor and usually questionable allegations on which the evidence remains scanty and, on the other hand, five important cases. It is worth reciting briefly what approaches to investigation, if any, were taken in these five cases:

1. The allegations of chemical warfare during the Italian invasion of Ethiopia in 1935–36 were taken to the League of Nations, but no official international investigation was made. The Italians never denied the use of chemical weapons, but accused the Ethiopians of other kinds of atrocities and claimed their right to exercise reprisals with CW. The evidence provided by journalists, and by medical teams including those under national Red Cross societies, was extensive and left little doubt as to what was happening. (See Volume I, pages 142–146, and Volume IV, Chapter 6.)

2. In the case of the allegations of chemical warfare during 1937–1945 in the course of the Japanese invasion of China, reports by journalists and other outsiders were scanty. The League Council invited the governments of member states to investigate the allegations through diplomatic channels. Little or nothing seems to have happened, although the Chinese Government made available a certain amount of corroborating evidence that was said to have been collected by officials of the national Red Cross organization and of the League Health Organization. Further information about the CW incidents did not become available until World War II had ended, when the Allies released captured Japanese documents describing the use of chemical weapons, and published some of their own intelligence reports on the incidents. (See Volume I, pages 147–152.)

3. The allegations of both chemical and biological warfare during the Korean War were investigated, but only with delay and by investigating bodies whose objectivity has been widely questioned. (See below and also Volume I, pages 158, 224–225, and Volume IV, Chapter 7.)

4. In the case of the chemical warfare allegations during the Yemeni Civil War, information trickled out over a period of years and even now it requires much patient research to sift the stories and reach conclusions. (See below and also Volume I, pages 159–161, 336–341, and Volume IV, Chapter 8.)

5. In the case of the chemical weapons used during the present war in

Indo-China, the fact that irritant and anti-plant agents were in use was confirmed by US authorities. Confirmation of the use of irritant agents was made only after reports had appeared in the press, and these referred to incidents three months earlier. Moreover the military purpose and pattern of use did not become clear for a long time, both with the irritants and with the anti-plant agents, and the effects of the use of these agents remain the subject of debate and concern. (See Volume I, pages 162–210; Volume II; Volume IV, Chapter 8.) The allegations about the use of more potent CB weapons by one or other side have received no form of outside investigation.

It is clear from these cases, and from the minor allegations described in Volume I, that the supply of information on alleged uses of CBW has been most imperfect. It has been slow, incomplete and often suspect. The possibility that one country may fabricate an allegation in order to slander another cannot be excluded, though it is also possible that false allegations will be the result of fear, hostility, muddle and opportunistic reasoning: in war, hostile myths and rumours about an enemy can gain currency with remarkable ease.

As we argue on pages 58–61 above, there is a case for improving the means available for verifying allegations.

Of the three desiderata suggested at the League of Nations—speed, impartiality and respect for the investigators—the latter two remain as important as ever. Speed has probably increased in importance. Chemical warfare has become much more deadly with the development of nerve gases, and biological weapons have been developed, bringing with them the risk of cumulative spread of death and disease through epidemics. Compared with the inter-war years there is also a need for more technical skill and equipment, notably for investigating allegations of BW. The ability of modern air transport to move people and equipment rapidly to any point in the world means that there need be less reliance on diplomats and military attachés present on the spot. Nevertheless such people are not irrelevant. They might act as an advance party before outside experts arrive. Moreover, the history of the Korean allegations given below shows that in the end one must decide which expert or group of experts to believe, and what is the relative worth of different bits of evidence. In this situation, there may be a role for the generalist who is respected for his judgement and who perhaps knows the country.

In trying to devise a system for investigating allegations of use, there are three points to bear in mind:

1. The nation making the allegation, i.e., the victim or his ally, is likely to obstruct impartial investigation if his allegations are false and

should in most cases welcome it if he genuinely believes there has been an attack.

2. The nation accused of making an attack, or on whom suspicion is cast, is likely to welcome investigation if he is innocent, and obstruct it if he is not.

3. No one is regarded by everyone as impartial and respectable.

The technical problems of investigating the use of *chemical weapons* should generally be easier than the problems of investigating the use of biological weapons. To a much more certain extent than with BW, the CW agents and their residues may be detected in the air fleetingly, on the ground or in or on the water after an attack, in living and dead people or animals, and sometimes in the effects upon vegetation. The strongest evidence is likely to come from the examination of people wounded or killed, and here the highly developed techniques of forensic toxicology will be available to the investigators. Speed is imperative. The sooner investigations are made, the wider the range of evidence is likely to be.

Teams of people trained and equipped to undertake this kind of investigation are likely to be found more or less ready in the defence forces of the advanced countries. Some of the techniques that might be used are similar to those which an army or civil defence organization would use in order to identify CW attacks. This being so, the simplest and cheapest way to establish a verification system would be for the defence authorities in a few neutral countries to be prepared to provide teams at short notice to undertake the job if called upon by an appropriate international body or by a victim country. The system might be analogous to the system whereby some countries keep peace-keeping forces trained and available to take part in UN peace-keeping operations.

The investigation of the use of *biological weapons* is likely to present greater difficulties, although early involvement of the World Health Organization (WHO) and the International Committee of the Red Cross (ICRC) could greatly facilitate the process. In fulfilment of its regular mandate, the WHO looks into outbreaks of disease and into outbreaks of poisoning of unknown origin. For example, it recently investigated the case of poisoning in North Africa resulting from the sale of contaminated hydrocarbon oil for human consumption. In this way it may come across evidence, conclusive or inconclusive, of a BW or CW attack. Similarly the ICRC and national Red Cross organizations may find evidence of BW or CW attack when caring for the victims of war. The history of past allegations shows that this has happened more than once.

It is tempting to conclude from this that the WHO or ICRC might be given the job of receiving complaints and organizing investigations. But that is scarcely realistic. They could hardly accept the task, with all its political significance, without prejudicing their chances of performing their normal and prime functions of caring for health and for the victims of war. For they would surely become involved in the crossfire of recriminations and suspicion which normally accompanies allegations. Their governing bodies, foreseeing this, would therefore be likely to reject such a proposal. On the other hand, they would probably not object to procedures which made it easier for them to pass on to the United Nations any evidence of the use of CB weapons they came upon in the course of their normal duties.

At the Geneva disarmament conference there has been extensive discussion of the role of the United Nations in investigating allegations of the use of biological weapons. The British draft BW convention provides for investigations of complaints of use of biological weapons to be arranged by the UN Secretary-General, and for a report of such investigations to be submitted to the UN Security Council. Some follow-up action is also prescribed, though in vague terms, in that states would assist any party if the Security Council concluded that the prohibited means of warfare have been used against it. The socialist and a number of non-aligned countries are in principle opposed to dealing with the prohibition of use in a treaty banning the production and possession of CB weapons; they consider that the 1925 Geneva Protocol has settled the question once and for all. In fact, though, the Protocol contains no enforcement measures. Apart from that, the USSR is strongly opposed to giving any independent investigating role to the UN Secretary-General, and insists that all complaints should be first considered by the Security Council, the highest UN political body. This would imply that all the five permanent members of the Council must be agreed before any investigation can be carried out. It would be idle to speculate on which solution will eventually be adopted, or how it will work in practice. This is a political issue, depending mainly on relations between the big powers.

Whatever the solution regarding the decision-making procedure, there is a case for setting up stand-by teams of experts who would be capable of carrying out investigations if upon invitation they were sent to do so—and were not obstructed in their task. However, as noted earlier, it would seem to be an appropriate task for the generally recognized neutral countries to set up such teams. A great deal of expertise can also be found inside some of the specialized agencies of the United Nations, such as the WHO, and some non-governmental organizations, such as

the ICRC. Therefore experts from these bodies ought to be involved in working out a system of investigating teams.

As a supplement to investigating teams, a Biological Agents Monitoring System (BAMS) was regarded as technically feasible by the 12th Pugwash Symposium on Rapid Detection and Identification of Microbiological Agents (Geneva, 18–21 February 1971). It was suggested that such a system might be developed by an international study group set up under the auspices of the United Nations. The aim of the system would be (*a*) to indicate the testing in open air of biological substances in connection with intended use of biological agents for warfare; and (*b*) to provide information to corroborate or refute allegations of use of such substances in a particular situation. The mandate of the study group mentioned could be extended to encompass the technical implications of on-the-spot investigations concerning development or use of biological agents. This latter suggestion brings out an important feature of on-the-spot investigations of BW allegations, namely that they are technically demanding if optimal use is to be made of currently available advanced methods. The supporting services required include protection equipment for non-vaccinated inspectors, liquid-air storage of biological samples, logistic support as well as equipment for mass-sampling of sera, facilities for rapid screening with fluorescent antibodies, etc.

Since evidence may evaporate or epidemics spread if there is delay, it is desirable that at any time a team should somewhere be ready to go to work at short notice. This might best be achieved by asking teams in neutral countries to take turns to be ready say, for six months or a year at a time. The members of the team would not need to leave their normal work. Equipment and working plans should be ready. A little international consultation would be needed to arrange the rota and to prepare plans.

II. *Allegations of chemical warfare in the Yemen, 1963–1967*

Chapter 2 of Volume I of this study contains a section (pages 159–161) describing the allegations of CW during the Yemeni Civil War of the mid-1960s. Appendix 1 to that volume (pages 336–341) summarizes the contents of the various press reports relating to the allegations. For the most part these reports appeared in US or West European publications; there seem to have been no reports at all in the Soviet or East European

press.[2] This section discusses the veracity of the overall picture presented by the various publications with the object of illustrating the practical difficulties of verifying allegations of use of chemical weapons.

The alleged CW incidents fall into three groups, each separated by quite long time-lags. The first group occurred during the summer of 1963; the second during the first half of 1965; and the third from the autumn of 1966 until the end of July 1967, shortly before the bulk of the Egyptian forces intervening in the civil war withdrew from the Yemen.

There were three types of foreign observers concerned with the allegations. First, there were journalists, both tied to a particular publication and free-lance. Many of these fulfilled roles other than those of journalism. Some were publicists for the Royalist cause, feeding information to pro-Royalist groups abroad to serve a variety of ends, or seeking support. Some were primarily concerned with keeping their respective governments informed about what was going on. Some were actively engaged in the fighting, training Yemeni soldiers and foreign mercenaries, and providing expert advice. Secondly, there were representatives of the International Committee of the Red Cross and of national Red Cross societies who provided essential medical aid to as many of the wounded of both sides as their resources or their transport would permit. And thirdly, there were the members of the UN Yemen Observation Mission (UNYOM) posted on the Yemen/Saudi Arabian border.

Accounts of purported CW incidents were first heard from members of the first of these three groups, at the beginning of July 1963. Soon afterwards, UN Secretary-General U Thant, at the suggestion of the British Government, instructed the UN observation team to collect whatever evidence it could about the use of gas.[3, 4] Shortly afterwards UNYOM reported back that it could find no evidence,[5, 6] but according to some accounts this was hardly surprising as UNYOM was apparently forbidden by its mandate to communicate with the Royalist leaders who controlled access to the relevant areas.[7] According to another account, it was the Royalist leaders who refused to communicate with UNYOM, or to let it enter their territory.[8] As regards the ICRC, representatives of that or-

[2] M. M. Dubinin, personal communication, June 1968.
[3] "Poison Gas Inquiry by U.N.", *Times* 10 July 1963: 9.
[4] "U.N. Will Weigh Gas-bomb Charge", *New York Times* 10 July 1963.
[5] "Poison Gas Charges", *Times* 16 July 1963.
[6] "U.N. Reports No Evidence of Use of Gas in Yemen", *New York Times* 16 July 1963.
[7] D. de C. Smiley, *Chemical Warfare in the Yemen,* SIPRI CW symposium, August 1968 (unpublished paper).
[8] N. McLean, *The War in the Yemen,* lecture given at the Royal United Services Institution, London, 20 October 1965.

ganization were not at the time operating in the areas where the CW incidents were alleged to have taken place, and the organization was not subsequently asked to make any observations on the allegations.[9]

Of the alleged CW incidents during the first period, the most extensively studied was that on 8 June 1963 at Al Kawma, a remote village in the mountains of northern Yemen. Within a month or so, two British journalists visited the village, independently of one another, and were soon succeeded by an investigating commission set up by the deposed Imam and which included a British Member of Parliament.[10] The gas attack had apparently killed six children, and severely affected twenty or so other villagers. Four bombs allegedly containing gas had been dropped, and fragments of these were collected by the journalists, some being sent to the headquarters of UNYOM, and some by diplomatic bag to the UK, eventually ending up at the Chemical Defence Experimental Establishment at Porton Down. Drawings of what the bombs were believed to have looked like were circulated in London. One of the journalists described the bomb design as follows: "I was shown the remains of what the villagers stated had been the gas bomb. It consisted of two circular bands of metal about two feet across. Into each were screwed 15 canisters about the size of a car's carburettor."[11] The British Ministry of Defence reported that traces of a tear gas had been found on the bomb fragments;[12] some officials took the view that the fragments might have been derived from bombs improvised from the CN tear-gas grenades that British forces had abandoned when withdrawing from Egypt.

The second series of allegations suggested that more lethal agents than tear gas were being used. Blinded and blistered casualties were reported, implying the use of an agent such as mustard gas. While the published evidence in support of these allegations is very weak, the evidence suggesting that mustard gas, supplemented by non-vesicant lung irritants, was used during the third series of alleged incidents is less weak.

It was not until 1967 that the CW allegations attracted anything more than partisan attention. But on 5 January 1967, an unusually large gas attack was reported to have taken place at Kitaf, a village that was comparatively accessible. The Royalist press officer organized a visit to the village by a party of twenty or so foreign journalists within three weeks of the alleged attack. Without exception, all the journalists agreed

[9] ICRC, personal communication, 13 March 1969.
[10] D. A. Schmidt, *Yemen: the Unknown War* (London, 1968).
[11] R. Beeston, *Daily Telegraph* 8 July 1963. *Quoted in* D. A. Schmidt, *op. cit.*, pp. 257–58.
[12] D. de C. Smiley, *op. cit.*

that it looked very much as though a lethal gas had been used. From their accounts, and their reports of interviews with eye-witnesses, it appeared that twenty-seven gas bombs had been dropped by nine bombers, and that 95 per cent of the people occupying the area up to 2 kilometres downwind of the bombs had been seriously or fatally gassed. A quarter of the village population had apparently been killed, and another quarter severely injured, some 250 to 300 casualties in all, and all apparently suffering from lung injuries. Most of the sheep, goats, camels and chickens in the area were said to have died also.

Journalists are not generally diagnosticians or pathologists, and one can therefore believe the reports of those that visited Kitaf only if one is swayed by the remarkable unanimity and vehemence of the accounts. Some of the journalists sought expert advice on their observations, but none of the doctors in the area were free to voice their opinions, all being Red Cross representatives. (They had reached Kitaf four days after the attack, so it is reported.[13]) One newspaper quoted an ICRC doctor as saying: "We are convinced, like you: but we cannot play politics."[14]

In public, the ICRC made only the most guarded allusion to the alleged use of gas at Kitaf, and since then has not made public its on-site observations concerning the incident. However, a considerable number of purported victims of the Kitaf air raid were soon afterwards transported to hospitals inside Saudi Arabia, and in due course the hospital doctors made available reports about the condition of their patients. The most detailed of these were eventually circulated at the beginning of April among members of the UN Security Council, at the request of the Saudi Arabian delegate.[15] But the fact of the allegiance of the Saudis to the Royalist cause is enough to throw doubt on the value of these reports, a doubt which certain of the passages in the reports do little to alleviate.

The Saudi Arabian reports presented four types of information: description of the symptoms of the patients; the results of autopsies performed on gassed animals; an analysis of a sample of blood from one of the patients; and an analysis of bomb fragments. The first of these, in retrospect, seems reasonable enough: the signs and symptoms of acute

[13] BBC, Arabic Service (Topical Talks Unit), *The War in the Yemen,* broadcast 12 January 1967.
[14] R. Beeston, "Nasser's Jets Bomb Saudi Border Town", *Daily Telegraph* 28 January 1967.
[15] UN Security Council, Exchange of communications with the Deputy Permanent Representative of Saudi Arabia to the United Nations, 6 April 1967, document S/7842.

lung oedemata are described, which strongly suggest that the victims had been poisoned with a lung irritant, such as phosgene.[16]

The remaining material, however, was presented as evidence of the use of organophosphorus poisons (nerve gases), substances which do not markedly irritate the lungs. Analyses of the (alleged) blood sample, and of the blood of the gassed animals, were given not for cholinesterase level but for "whole phosphorus": it is not unjustifiable to suppose that this was a somewhat misguided fabrication.[17] Finally it was stated that pieces of fabric sent to the Saudi analytical laboratory, along with the bomb fragments, but of no other stated provenance, "revealed traces of organic phosphoric compounds which laboratory examination showed to have the effect of reducing blood cholinesterase". Elemental analysis of the bomb fragments apparently showed traces of carbon, nitrogen and chlorine, but no phosphorus.

Like the journalists, the Saudi Arabian Government seems also to have appreciated the value of Red Cross comment on the Kitaf incident. It took the somewhat unusual step of circulating around the UN Security Council a document that was stated to be a copy of a cable sent by ICRC personnel to their headquarters in Geneva through Saudi telecommunication facilities at Najran. The cable referred to "gas bombs"

[16] The reports were reproduced in UN Security Council document S/7842 of 6 April 1967 cited above. There were two reports, one from Najran Hospital dated 8 January 1967, and the other, undated, from Taif Military Hospital. An extract from the Najran report reads: "A medical examination has been given to approximately 200 Yemenis in the town of Najran who are suffering from gas poisoning following the dropping of poison gas bombs by enemy aircraft on Yemeni territory. They were taken for first aid treatment to Najran Hospital, where the symptoms of the gas poisoning were diagnosed as follows: (1) Difficulty in breathing, with acute coughing; (2) Vomiting and the issuing of blood-flecked foam from the mouth; (3) Haemorrhage from nose and mouth; (4) Congestion of the face and eyes; (5) Haemorrhage of the conjunctiva; (6) Lowering of the blood pressure; (7) In some cases, incapacity to walk or move; (8) In some cases total unconsciousness; (9) In some cases swelling around the neck and chest; (10) In some cases blood in the urine; (11) In some cases subcutaneous haemorrhage; (12) In some cases bloody stools.

"The Najran Hospital provided first aid treatment and they were admitted to the hospital. We took twelve acute emergency cases to the Military Hospital at Taif to be treated there. . . ."

An extract concerning the Taif report reads as follows:

"Description of the patients' symptoms as stated in the report of physicians at the Military Hospital in Taif. Symptoms complained of: body pains, difficulty in breathing, coughing, dizziness, a burning sensation in the body and, in some cases, coughing with expectoration of blood from the lungs. Latent symptoms: (1) Inflammation of the conjunctiva; (2) In a few cases, inflammation of the throat with oedema; (3) In a few cases, erythema; (4) Oedema of the lungs; (5) The pressure was low and the pulse was rapid (80–110 per minute) and regular; (6) The blood pressure was low (100 millimetres of mercury, systolic). Diastolic pressure was less than 60 millimetres of mercury; (7) The patients were unable to walk unaided and complained of dizziness."

[17] See, for example, the discussion of the reports by J. D. Salvia in *Scientist and Citizen* 9(7): 149–52, 1967.

dropped some time between 2 and 7 January 1967, and appeared to be a request for supplies of gas masks.[18] According to the Saudi representative at the United Nations, the circumstances under which the cable was sent were that the ICRC team on the spot in Kitaf had been forced to flee from the area because it lacked anti-gas protection.[19] This assertion can be queried in a number of obvious ways.

The only pronouncement which the ICRC made at the time which might have been motivated by the Kitaf incident was a public statement from Geneva on 31 January 1967. This referred, in guarded tones, to the "alleged use of poison gas", to the importance of the Committee's restraint in publicising "the observations made by its delegates in the exercise of their functions" because to do so would not be "in the interest of the persons in need of its assistance", and made an urgent appeal "to all authorities involved in this conflict for respect in all circumstances of the universally recognized humanitarian rules of international morality and law".[20]

Although nothing has been published, it seems clear that the ICRC statement was based on observations made, and data collected, relating

[18] As translated (from the German) and published by Saudi Arabia, the cable reads as follows:

"The members of Yemen Unit 2 of ICRC reply to your cable of 14 January 1967 as follows: (1) You were at Cairo from 2 to 7 January. The gas bombs were dropped while you were there. (2) We continue to maintain that Dr L—was not at the scene and that the team which remained at the scene for the longest time was not consulted at all. (3) The assurance from the highest quarter and your assumption of responsibility are no guarantee for our safety, when the Geneva Convention has been violated previously. (4) The only realistic protection is masks, which we therefore suggest should be awaited. (5) In view of what we have observed, our remarks are not based on fear. Najran, 14 January 1967. [Nine names]"

[19] UN Security Council document S/7842, *op. cit.*

[20] The statement was printed in *L'Actualité de la Croix-Rouge,* Notes d'Information no. 91 (8 February 1967) as follows:

"Le Comité international de la Croix-Rouge, à Genève, est vivement préoccupé par les évènements qui se sont produits récemment au Yémen et dans les régions limitrophes: bombardements aériens de la population civile, emploi allégué de gaz toxiques.

"Devant les souffrances qu'ils engendrent, le CICR adresse un pressant appel à toutes les autorités impliquées dans ce conflit, afin que soient respectées, en toutes circonstances, les règles d'humanité universellement reconnues par la morale internationale et le droit des gens.

"Le CICR se permet de compter sur la compréhension et l'appui de toutes les autorités intéressées, afin que ses médecins et délégués au Yémen puissent poursuivre, dans les meilleures conditions, leur oeuvre d'assistance impartiale aux victimes du conflit.

"Le CICR saisit cette occasion pour rappeler que, dans l'intérêt même des personnes à secourir, il s'est fixé pour règle générale de ne pas donner de publicité aux constatations que ses délégués peuvent faire dans l'exercice de leur mission. Mais ces constatations lui servant à étayer les démarches appropriées qu'il ne manque pas d'entreprendre chaque fois qu'elles s'imposent."

to the use of chemical weapons. These observations might have included: (*a*) clinical observations of casualties; (*b*) autopsies performed on dead animals; and (*c*) chemical analyses of vegetation and sand around bomb craters.[21]

Discreet though the ICRC statement was, it nonetheless added a lot of weight to the allegations of people who had hitherto been regarded as Royalist propagandists. In the British House of Commons, for instance, the simmering debate on what was to be done about the allegations was stirred up by the entry into it of Members of Parliament who were not Royalist sympathisers.

For the British Government, the matter must have been a difficult one. The Foreign Office was trying to reopen diplomatic relations with Cairo, while the US Government was inclined to play down the allegations, and was in any case compromised by the use of CW agents by its forces in Viet-Nam. The British Government accordingly took the position that the gas question was "primarily a matter for members of the United Nations in the area immediately concerned. If they will take the initiative on this formally, we will consider supporting them."[22] "Formally" here was an important word. The Saudis had as yet tried only to get the UN Secretary-General to make a public statement, which he would not do: the UN Security Council had not been asked, and was not asked, to do anything beyond taking note of the Saudi allegations.[23]

On 31 January 1967 the British Prime Minister informed the House of Commons that he had evidence strongly suggesting that poison gas had been used in the Yemen. On the following day the Egyptian Minister of National Guidance issued the following statement in Cairo:

> World news agencies have reported a statement made in the House of Commons this afternoon by the British Prime Minister, Mr Harold Wilson, who commented on the allegations disseminated by Saudi Arabia and some propaganda elements cooperating with it, that the U.A.R. used poison gas bombs against the village "Kataf" on Yemeni-Saudi border. The U.A.R. deemed it wise hitherto to ignore these allegations which turned out to be untrue. But the remarks made by the British Premier in the House of Commons gave them certain colour. Although the British Premier was vague when he said that his

[21] The analysis might not only be for traces of possible CW agent, but also for traces of substances characteristic of the reaction of CW agents with soil components or with other chemicals present in the environment, particularly when searching for evidence of the use of agents that are too volatile to persist for any length of time on the ground. Thus, phosgene is capable of converting the iron oxide often present in sand to ferric chloride, a substance both easily identified and rarely found naturally on open ground.

[22] *Hansard* (Commons) 742: 77, 27 February 1967.

[23] UN Security Council document S/7842, *op. cit.*

Government had reason to believe that the allegations were true, his words might give a wrong impression.

In the name of the U.A.R. I have been entrusted to affirm once again and in a decisive manner that the U.A.R. has not used poisonous gas at any time and did not resort to using such gas even when there were military operations in Yemen.

I have also been entrusted with announcing officially that the U.A.R. is ready to accept a fact-finding mission from the U.N. and is ready to make necessary arrangements for the mission to go to Yemen immediately. Yemen has agreed to give the mission all facilities to expose the anti-U.A.R. propaganda and those who undertake it in London.

The Egyptian offer to make arrangements for a UN investigation of of the CW allegations was never taken up. A British Foreign Office spokesman stated that if a request for such a mission was made at the UN, the British Government would support it.[24]

On 10 May 1967 another incident allegedly involving gas occurred which was again to attract close outside scrutiny. This concerned an air raid on the village of Gahar in the Wadi Hirran, two miles from a Royalist headquarters. Journalists were able to reach this quickly: their reports were that seventy-five villagers had been gassed to death in the attack, most of them in the caves where they were accustomed to shelter from Egyptian aircraft. (British television viewers later saw a film purportedly made at Gahar some months after the attack, showing the discovery of further bodies in a cave that the burial parties had overlooked.) Eight aircraft were said to have delivered the attack. Eye-witnesses were reported to have seen a greenish-brown smoke drifting up after the bombs had detonated.[25]

A Red Cross aid team was summoned the day after the attack and duly set off, after getting the necessary permission from the Republican/Egyptian authorities, and giving them their itinerary and time-schedule in the process. En route, the team was heavily bombed from the air, despite its Red Cross insignia; much of its equipment was destroyed. The team pressed on, though, and reached Gahar on the night of 15/16 May[26] where it gave such aid as it could.

In a press release on 2 June, the ICRC took a very much firmer public stand on the CW allegations than before. The release referred specifically to the mission and to the bomb attack on the aid team; it said that the team "collected various indications pointing to the use of poison gas", and it ended by saying that the team's report had been communicated

[24] *Hansard* (Commons) 742: 74–77, 27 February 1967.
[25] D. de C. Smiley, *op. cit.*
[26] D. A. Schmidt, *op. cit.*

"to all authorities concerned in the Yemen conflict, requesting them to take the solemn engagement not to resort in any circumstances whatsoever to the use of asphyxiating gases or any other similar toxic substances".[27] By the end of June, the report referred to in the press release had surfaced in the press; presumably it had been disclosed by one of the governments to which it had been communicated. The report thus published was dated 18 May and had been written by two doctors in the team. It was published in company with a second report, dated 29 May, being the comments on the doctors' report made by a professor of forensic medicine in Switzerland. The reports pointed firmly to the use of mustard gas, the eye and skin lesions of the casualties being derived from its vesicancy, and the deaths from the pulmonary oedema caused by its inhalation.[28]

[27] In full, the press release, (ICRC Press Release No. 829b, Geneva, 2 June 1967), was as follows:

"The International Committee of the Red Cross has again received from its delegates in the Yemen reports of bombing by toxic gas.

"A medical team, led by the head of the ICRC mission in the Yemen, went on May 15 and 16 to a village in the northern part of the country to attempt to give aid to the victims of bombing having taken place some days previously and as a result of which, according to the survivors, many inhabitants had died of asphyxiation.

"Delayed by an air raid of which their convoy was victim, the ICRC doctors on arrival at the site immediately gave treatment to some of the wounded and collected various indications pointing to the use of poison gas.

"Extremely disturbed and concerned by these methods of warfare which are absolutely forbidden by codified international and customary law, the International Committee at once communicated its delegates' reports to all authorities concerned in the Yemen conflict, requesting them to take the solemn engagement not to resort in any circumstance whatsoever to the use of asphyxiating gases or any other similar toxic substances."

[28] The report of 18 May, from Najran, was first published in *US News and World Report*, 3 July 1967. In full, the report was as follows:

"The undersigned doctors, members of the ICRC medical mission to the Yemen, arrived at Gahar, in the Wadi Herran, on May 15, 1967, following an appeal for assistance from the inhabitants who claimed to have been under gas attack by airplanes on the morning of May 10, 1967.

"1. The following statements were made by the inhabitants who witnessed the incident:

75 persons died of poison gas shortly after the raid. They showed the following symptoms: shortness of breath, coughing, pink foam at the mouth, general edema, especially the face; no physical injuries.

"2. The undersigned doctors examined the four surviving victims and observed the following:

— subjective symptoms: burning eyes and trachea, internal thorax pain, extreme fatigue, anorexia;

— objective symptoms: dry cough, negative auscultation in two patients, signs of bronchitis in the other two, conjunctivitis, facial edema, no traumatic lesions, tympanum intact.

"3. The undersigned doctors examined a corpse, four days after death and 12 hours after burial.

"Immediately the common grave was opened and well before the corpses, which

The remarkably out-spoken ICRC press release on the Gahar incident in fact attracted little attention, for the June 1967 Middle East War was imminent. When the Egyptian Air Force afterwards resumed bombing operations in the Yemen there were renewed allegations that it was using gas bombs. Throughout July several CW incidents were alleged, one of

were only wrapped in shrouds, without coffins, were visible, there was a sweet penetrating smell not unlike garlic. The bodies showed no traumatic lesions. The skin was pink. Advanced and general edema all over the body.

"Examination of lungs: reddish-brown throughout, enlargement, consistence and fragility greatly increased, crepitation considerably reduced.

"The undersigned doctors draw the following logical conclusions from their findings:

"I. None of the victims examined, whether survivors or corpses exhumed from the common grave, showed any traumatic lesions.

"II. The statements made by witnesses who escaped from the raid unharmed, in respect of the circumstances in which 75 inhabitants were killed, are consistent with the ICRC medical mission's own findings by examination of the four survivors and the corpse exhumed from one of the common graves.

"III. The cause of death in the case of the corpse examined was pulmonary edema. The overall consistency of the ICRC medical mission's findings shows that in all probability this pulmonary edema was caused by inhalation of toxic gas. [Signed by two ICRC Doctor-Delegates.]"

The report of 29 May, from Berne, was first published in the same issue of *US News and World Report*. In full, it was as follows:

"In accordance with your instructions of May 21, 1967, we have duly examined the report drawn up by two doctors of the ICRC on observations made by them after the bombing of a village in the Yemen.

"Their investigations can be summarized in the following manner:

"1. Information collected from the survivors in that village regarding the death of seventy-five persons.

"2. Medical examination of four survivors.

"3. Examination of a corpse four days after death and twelve hours after burial.

"The phenomena observed are the effects of skin irritation, conjunctivitis, and of mucus in the respiratory tracts and lungs. General edema has been noted, especially facial and also haemorrhagic pulmonary edema. On autopsy, red hepatization and a liquid of reddish scrapings were observed in the lungs.

"The observations collected are gradually diversified and unspecific, but form a definite entity as a whole.

"We know of no epidemical disease presenting a similar symptomatology or clinical development. The conclusion, according to which the death of the diseased persons as a result of bombing is ascribed to a toxic gas, seems to us to be perfectly justified. This conclusion is supported by the total absence of traumatic lesions caused by the effects of pressure (explosion).

"Amongst the various poison gases which can produce the effects observed, phosphonic esters (nervine gas) would not in our opinion be involved, in view of the local irritations observed. Their effects would moreover have been characterized by copious salivation, myositis and muscular cramp. On the other hand the employment of halogenous derivatives (phosgene, mustard gas, lewisite, chloride or cyanogen bromide, Clark I and II, etc.) would appear to us the most likely. However, neither bromide nor cyanogen chloride cause edemic irritation of the skin. This also applies to phosgene. As against this, all the symptoms observed are explainable by the hypothesis of the use of mustard gas, lewisite or similar substances. The odour resembling garlic, smelt on opening the common grave, would indicate the employment rather of mustard gas ("S-lost"). These toxic substances are pulverized when the bomb explodes in the form of aerosol."

them, on 15 July, apparently being the largest of the entire war. Public pressure for some sort of international action again began to build up in several western countries, but as before no government felt it prudent to set in motion such international machinery as there was. Although the evidence as to the truth of some of the CW allegations was stronger than before, and by now virtually incontestable in some people's minds in view of the ICRC disclosures, the search for a settlement of the Arab-Israeli dispute was of overriding importance. The US Department of State confined itself to expressing hopes that the ICRC's appeals for restraint would be heeded; the British Foreign Office continued to say that the initiative was best left to the locals, although it presumably realized that the locals were unlikely to do anything that would disrupt their newly-created entente.

At the end of July, a third ICRC report appeared in the press, again, apparently, without authorization.[29] This purported to be an account by the chief ICRC represenatative in the Yemen of his mission's action after the Gahar incident in May. It gave full details of the circumstances of the incident and of the attack on the Red Cross convoy, and summarized the medical findings.[30] Even though this report seems to be genuine (and

[29] *New York Times* 28 July 1967.

[30] The report by André Rochat, head of the ICRC delegation to the Yemen, written in Jeddah and dated 21 May 1967, was as follows:

"On May 11, 1967, the ICRC delegation in Jeddah received appeals for assistance from the two villages of Gadafa and Gahar in the Wadi Herran, in south-western Jauf. According to these appeals a proportion of the inhabitants of these villages had been poisoned by gas dropped from raiding airplanes.

"Some hours later this news was confirmed by representatives of the Yemeni Royalists and by the Saudi Arabian authorities, who requested the ICRC delegation to go immediately to the assistance of the victims.

"The head of the delegation decided to proceed immediately to the scene, accompanied by another delegate, two doctors and a male nurse, members of the ICRC medical team, and a Yemeni escort. The two lorry convoy, loaded with food and medical supplies left Amara on May 13, after having given due notice of its line of march and time-table to the Egyptian authorities.

"Unfortunately, following an air attack on the ICRC convoy, it was not until the night of May 15-16 that the mission reached Gahar. This village is situated atop a hill some 500 feet in height. All the houses are clustered closely together, giving the appearance of a small fortress.

"According to the inhabitants, 75 people were gassed during a raid in the early hours of May 10, 1967.

"The account given by the survivors is as follows:

"The bombers circled the village for some time then dropped three bombs on the hillside, east of and below the village, two or three hundred yards away to windward (wind direction from East to West).

"No houses were damaged. The explosions were relatively mild. The bomb craters were about 8 feet in diameter and 20 inches deep; smaller than the usual craters.

"Twenty minutes after dropping the three gas bombs, the planes dropped 4 or 5 high-explosive bombs on the village and the western flank of the hill. Only one

the ICRC has never denied its authenticity, or that of the two earlier leaked reports, or said that their contents were falsely reported), it had no influence on the stated positions of governments, although on the previous day the British Government had announced that it proposed to consult with other governments as to what action might be taken to put an end to this breach of generally accepted rules of conduct".[31] Nothing more was heard of these consultations until September[32] by which time Egypt and Saudi Arabia had agreed, at the Khartoum Conference, to end their military aid to the warring parties in the Yemen. No further CW incidents were reported after July, but a dump of rusting gas bombs was said to exist in the Republican-controlled port of Hodeidah[33] after the Egyptians had withdrawn from the Yemen.

Despite the plethora of newspaper reports and other journal articles describing purported CW incidents, the conclusion is inescapable that it is only as regards two of the fifty-odd incidents that there exists a significant quantity of substantiating documentary evidence. While certain publications have referred to additional evidence that has not been pub-

of these bombs caused any damage; this was sustained by a house in the centre of the village.

"The 75 gas casualties were either within range of the gas when it was released or were in its path as it was blown by the wind. Some of the victims were found dead in their homes, as if they had died in their sleep.

"Other inhabitants, working in the fields or watching over the live-stock, were eastward of the area where the gas bombs fell, some of them very near to the spot, and none of them were affected.

"The four survivors who were in the contaminated area are all in pain from their affected eyes and almost blind. All have pains in the chest and none has any wound.

"Many animals, including almost 200 cattle, sheep, goats, donkeys and numerous birds were also killed. The villagers, who were not contaminated, buried the dead animals in a large pit west of the village, whilst the 75 humans killed were buried in four large communal graves.

"The ICRC delegates, for their part, observed the following:

"They inspected the village for several hours, checking, when ever possible, the accuracy of the information mentioned above.

"The doctors examined the four surviving gas casualties. Their medical report is attached hereto.

"The head of the mission had one of the four communal graves opened. There were 15 corpses in it. An immediate autopsy by Dr Brutschin and Dr Janin left no doubt that death was due to pulmonary edema (see attached medical report and photograph).

"The doctors cannot testify to an air raid with gas bombs of which they were not personally witness. On the other hand, they stress that all the evidence leads to the conclusion that edema was caused by the breathing of poison gas.

"The delegates were later informed that on May 17 and 18 the villages of Gabas, Nofal, Gadr and, for the second time, Gadafa were raided with gas bombs and that as a result 243 persons were killed."

[31] *Hansard* (Lords) 285: 1330, 27 July 1967.

[32] "Reply on Yemen Gas", *Times* 20 September 1967: 4.

[33] D. de C. Smiley, *op. cit.*

lished,[34] as things stand at present it is only those that are based on ICRC observations that provide anything other than weak and circumstantial evidence. Many people certainly consider that the ICRC reports adequately substantiate at least one of the allegations; for them, the general reputation of the ICRC, its customary modes of behaviour, and a more detailed knowledge of its work in the Yemen, are credentials enough. And if the ICRC reports are believed, the credibility of those allegations on which the ICRC has not published any information is increased.

Two points should be noted, however. Just as there are many people who trust the ICRC and are likely to believe its reports, there are others who do not. For them, the CW allegations remain unverified.

Secondly, the process of verification, such as it was, was a slow one. Although there would almost certainly have been little difficulty in finding conclusive material evidence, if it indeed existed, within a comparatively short time after certain of the allegations, a formal procedure for doing so was never set in motion by disinterested parties. Although the ICRC undoubtedly possessed strong material evidence on some of the allegations, it was prevented from doing very much with it. The ICRC was in the Yemen to give aid to the wounded of both sides; to have embarked upon overt political activities might have compromised its freedom to perform this task in the Yemen—and possibly in other conflicts thereafter.

As for the other investigations of the incidents, their limitations are obvious enough. The Imam's commission of inquiry could inevitably carry no weight in the outside world. The evidence presented by Ambassador Baroody of Saudi Arabia to the Security Council was likewise the evidence

[34] One example is the syndicated article by Jack Anderson that appeared in a number of US newspapers on 28 May 1967. It began as follows: "Ominous reports on the Middle East crisis forwarded to the White House by the Central Intelligence Agency say that the Egyptians have used lethal gas in battlefield tests against isolated Saudi Arabian villages. The highly classified reports were not intended for public release. The authorities consider the situation too sensitive to be issuing accusations against President Gamal Abdel Nasser. But there is no question about the accuracy of the reports. . . ."

Another example occurs in the book *Chemical and Biological Warfare: America's Hidden Arsenal* (New York, 1968) by the US journalist Seymour Hersh: "A classified State Department cable sent to Washington on January 29, 1967, from Beirut, Lebanon, relayed eye-witness details of a gas raid on January 5 on the village of Kitaf. Most of the details in the seven-page cable were supplied to the State Department by David Lancashire, an Associated Press correspondent who made on-site observations. . . . There is no sign that the Lancashire dispatch was ever relayed to American subscribers of the wire service. . . . The officials who supplied the cable to me said that the State Department had been attempting to limit newspaper coverage of the gas warfare aspects of the Yemeni war. The cable also notes that US intelligence officials, apparently agents from the Central Intelligence Agency, had "bomb fragments and soil samples" in their possession." (page 285).

of an interested party, and was further discredited by its endeavours to suggest that nerve gas had been used.[35] The evidence gathered and published by journalists was open to the usual criticism attaching to newspaper articles on sensitive political issues, and the Egyptian assertions that the newspaper reports were nothing other than propaganda could not be pre-empted by the reporters with convincing scientific evidence. The governments of uninvolved countries either saw no particular need to set in motion formal verification machinery, or were constrained from doing so, or from using such evidence as was available—either from ICRC sources or from secret intelligence activities—by the political environment of the Yemeni Civil War.

The Yemen history illustrates the practical, indeed largely political, difficulties of verifying allegations of CW. As noted at the beginning of this chapter, the technical difficulties of proving the use of CW agents are probably not great if the right experts with the right equipment are quickly on the scene.[36]

III. *Allegations of biological warfare in China and Korea, 1951–1952*

This section examines the reports made by two international groups of experts which investigated the allegations that biological weapons were used in the Korean War. As noted above, the object of the analysis is to see the problems posed by an investigation of this type. The debate about these allegations at the United Nations, during which various delega-

[35] Other publications as well have implicated nerve gas in the CW allegations. But the published evidence adduced in support of this is extremely slight, and is likely to convince only those who are strongly predisposed to believe it. The most detailed of these allegations are those published by Marquis Childs in the *St. Louis Post-Dispatch* on 18 and 20 June 1967, and by D. M. Van Rosmalen in *Elseviers Weekblad* on 25 November 1967. The ICRC has no evidence suggesting that nerve gas might have been used in the Yemen.

[36] One publication which provides much insight into the technical problems of verifying allegations of CW, and indeed some of the political problems as well, is the record of the hearings that took place during May 1969 before a subcommittee of the US House Committee on Government Operations (*Environmental Dangers of Open-Air Testing of Lethal Chemicals*). These hearings concerned the sudden death of six thousand sheep in Utah during March 1968. The immediate supposition that the sheep had been killed by nerve gas escaping from the nearby US Army proving-grounds was at first denied by the Army, which suggested, among other things, that poisonous plants had been responsible. Later on, however, as an increasing body of evidence began to accumulate from a succession of on-site investigations, the Army agreed to pay compensation to the owners of the sheep, and to increase the safety precautions at the proving-grounds. The hearings, which run to 260 pages, include several of the technical reports of the investigating teams.

tions commented on the allegations and the investigations of them, is described in Volume IV, Chapter 7 of this study.

The analysis concentrates mostly on the investigations by a group of scientists. But first, the general history is summarized and there is a brief analysis of a report made by a group of lawyers who were in Korea before the scientists arrived there.

The lawyers' report mentions twenty-two specific instances of the use of biological weapons in Korea or China and the scientists' report mentions fifty. No one incident is mentioned in both reports, so that together they refer to about seventy incidents. Much higher totals, without details of individual episodes, can be found in other reports. For example, a Chinese commission of investigation reportedly mentioned 1 165 incidents.[37] It is uncertain whether "incidents" and other such terms have the same meaning in the different reports.

Brief history

During 1951–1952, China and North Korea alleged that the US armed forces were using biological warfare on both their territories. These charges were supported by the USSR and by other Socialist states.

The earliest date of use suggested in any of the discussions of the allegations is the spring of 1951:

> This and similar accusations [that the American armies in Korea and Northeast China were using bacteriological weapons] had, in fact, already been uttered in the spring of 1951; but after the North Korean government's protest with the United Nations on May 8 of that year nothing much was heard about the whole matter.[38]

Aside from noting the accusation, the author gives no more details. The disease spread in this case was alleged to be smallpox.[39]

The main stream of accusations began in early 1952. On 22 February 1952, the Foreign Minister of the Democratic People's Republic of Korea, Mr Bak Hun Yung, officially protested against the use of bacteriological weapons by the USA. The protest was repeated on 8 March by Chou En Lai, Foreign Minister of the People's Republic of China.

The human diseases alleged to have been spread were plague, anthrax, a form of meningitis, cholera, and encephalitis. The spread of animal and plant diseases was also alleged: the organism producing the animal

[37] For details see the chronology in M. Schneider, "Bacteria as a Propaganda Weapon", *Internationale Spectator*, 8 May 1957.
[38] *Ibid.*
[39] See Chapter 7 of Volume IV of this study.

disease of Fowl Septicemia was reported to have been spread, and eleven incidents involving four different plant diseases were reported. Eighteen different species of insects and arachnids (spiders and ticks), as well as some small rodents, voles, were alleged to have been used as vectors. Infected clams, as well as various kinds of calcerious bombs and metallic, sectioned "leaflet bombs", were purportedly the dispersion media.

The report[40] of an International Scientific Commission, analysed below, became the main document around which the allegations were debated. The Commission *reviewed evidence collected by others.* It did not collect its own evidence or do its own laboratory analysis.

The "Conclusion" of that report was that:

> Since the beginning of 1952, phenomena of a very unusual character occurring in Korea and China, led to allegations by the peoples and governments of those countries that USA forces were waging bacteriological warfare. The International Scientific Commission which was formed to investigate the relevant facts has brought its work to a conclusion after more than two months in the field.
>
> It found itself in the presence of a mass of facts, some of which formed coherent patterns which turned out to be highly demonstrative. It therefore concentrated its efforts especially upon these.
>
> The Commission has come to the following conclusions. The peoples of Korea and China have indeed been the the objective of bacteriological weapons. These have been employed by units of the USA armed forces, using a great variety of different methods for the purpose, some of which seem to be developments of those applied by the Japanese army during the second world war. (*Report of the ISC,* p. 60.)

All the allegations relating to the use of biological weapons in the Korean War were strongly denied by US spokesmen at the United Nations on numerous occasions in 1952 and 1953 (see Volume IV, Chapter 7), as well as by the UN (US) field command. Early western press reports claimed that the diseases were of seasonal and regular occurrence in the area, and were simply being spread and exacerbated by wartime conditions. US Secretary of State Dean Acheson then said: "We will not commit aggression with chemical or biological weapons, which we have been falsely and slanderously accused of using." This position was rigorously maintained. Some years later a US Department of State spokesman stated that: "The charges [of BW] proved to be false in investigations conducted by members of the International Control Commission and were firmly

[40] The *Report of the International Scientific Commission for the Investigation of the Facts Concerning Bacterial Warfare in Korea and China* (with appendices), Peking, 1952, is hereafter referred to as the *Report of the ISC.*

denied by the United Nations Command ..."[41] It has however been impossible to trace the investigation referred to in this statement.

As for later views, it is noted in Volume I, Chapter 2, that the 1969 report of the UN Secretary-General on CBW states that BW agents have never been used as weapons of war. This report was signed by representatives of Canada, Czechoslovakia, Ethiopia, France, Hungary, India, Japan, Mexico, the Netherlands, Poland, Sweden, the UK, the USA and the USSR.

Allegations relating to BW came from Western sources as well. At the time of the Korean War, the *New York Times* reported from Pyongyang that: "Five thousand rats and mice, inoculated with deadly plague and other germs, were found today in a super-secret bacteriological laboratory operated here since 1947 under supervision of a Russian woman scientist."[42] None of the animals were "believed to have been turned loose or to have escaped from their sealed cages ..."[43] A North Korean doctor being interrogated by US intelligence agents is said to have reported the existence of the laboratory, adding "... that more than 5 000 rats and mice were inoculated with such diseases as bubonic plague and encephalitis immediately after the United Nations landing in Inchon ... Their furs were sprayed with a chemical that encouraged the multiplication of fleas.[44] No reports have been found of plague in Pyongyang or in South Korea.[45]

After 1952 no new reports appear to have been added to the allegations, but there was a lively debate about them, notably in sections of the scientific community, which continued into 1953 and 1954.

Report of the Lawyers

The Council of the International Association of Democratic Lawyers decided in September 1951 to send a commission to Korea to investigate various "violations of international law". The Commission[46] visited Korea

[41] R. Eder, "Cuba Charges US May Drop Germs", *New York Times* 2 June 1964: 9.
[42] "Germ-carrying Rats Bred in North Korea", *New York Times* 6 November 1950: 3.
[43] *Ibid.*
[44] *Ibid.*
[45] These charges were amplified in a series of articles on the Soviet BW programme written in 1952 by Ellis M. Zacharias, a former Deputy Chief of the US Office of Naval Intelligence. (*San Francisco Examiner* 1 June 1952: 1–2, 2 June 1952: 9, and 3 June 1952.)
[46] The Commission consisted of:
Heinrich Brandweiner, Professor of International Law in the University of Graz (Austria), President; Luigi Cavalieri, Advocate at the Supreme Court of Rome (Italy), Vice-President; Jack Gaster, Solicitor, London (Great Britain); Marc Jacquier, Advocate at the Court of Appeal, Paris (France); Ko Po-nien, Director of the Research Department of People's Institute of Foreign Affairs, Peking (China); Marie-Louise

from 3 March to 19 March 1952, just after the main accusations started, and visited China for the next few weeks. It issued its reports in Peking on 31 March 1952 and 2 April 1952.[47]

On 15 March 1952, a Chinese commission began its studies. It is presumably this commission which produced "the original scientific data which had formed the basis of the documentation issued from Prague during the earlier part of the year", referred to by the International Scientific Commission (*Report of the ISC*, p. 6). It is not known whether the Chinese commission provided evidence for the lawyers.

The *Report of the Lawyers* was submitted to the UN Security Council. The Commission's method of operation was:

> ... After examining the reports and statements supplied by competent authorities, the members of the Commission made direct investigations, in the course of which they questioned ... witnesses.
>
> The conclusions of the Commission are based on those cases proved before the Commission by direct evidence and duly corroborated together with the examination of all relevant documents. (*Report of the Lawyers*, p. 2.)
>
> On its arrival in Korea the Commission found itself faced with the unexpected task of investigating a most serious allegation that the American forces in Korea were using bacteriological weapons against the army and the civil population. Members of the Commission went to different regions of the country and took evidence on the spot, interrogated witnesses who found insects in unusual circumstances, examined and obtained evidence concerning the remains of containers found, examined experts, obtained data concerning health conditions during recent years and as to the outbreaks of disease from health service officials and experts and also examined official documents and other material put before them. The Commission was impressed by the clarity and obviously sincerity and veracity of the many simple peasants and others who gave evidence as to the facts. (*Report of the Lawyers*, p. 4.)

Different insects were found in 169 areas of North Korea. "The results of 15 typical cases in which expert examination were carried out and insects found identified between 28th January and 12 March, 1952"(*Report of the Lawyers*, p. 5) are listed. One case identifies a "military unit" as the source. The Commission's report gives details of twelve cases that it "particularly investigated", and which were "proved by the Commission". The kinds of bacteria reportedly found were: "Vibrio cholerae, pasteurella pestis, Eberthella typhosa, Bacillus paratyphi A and B, Rickettsia prowazeki and shigella disenteriae" (*Report of the Lawyers*, p. 6).

Moerens, Advocate, Brussels (Belgium); Letelba Rodrighes de Britto, Advocate, Rio de Janeiro (Brazil); Zofia Wasilkowska, Judge of the Supreme Court, Warsaw (Poland).

[47] The reports are attached to UN Security Council document S/2684/Add. 1, 30 June 1952. They are hereafter referred to as the *Report of the Lawyers*.

Most of the evidence concerns the same kind of anomalies in relation to the finds of insects as are presented in the *Report of the ISC:* anomalies of location, temperature, types of soil, season, fertility cycles—together with statements that these were "coupled with the circling aircraft and the containers", that the insects "were infected with cholera, typhus and plague; and that outbreaks of cholera and plague occurred within a few days of the finding of the insects, and only in the immediate neighbourhood of the deposits."[48] The scientific supporting evidence, however, is not presented at all, whereas it is presented in the *Report of the ISC.*

Several points in this report are particularly interesting, since they are not repeated in the *Report of the ISC:*

1. The use of *Rickettsia prowazeki* is alleged.

2. Several references clearly refer to the involvement of military personnel and units: "3 cases of plague have been proved in the army ..." and the report lists dates and places for when then soldiers fell ill. (*Report of the Lawyers,* p. 9)

3. Mortality figures are given: "Total number of cholera cases is 13, 9 of whom died ... The total number of plague-cases is 53, 39 of whom died ..." (*Report of the Lawyers,* pp. 8–9). However "no widespread epidemic has occurred in consequence of the deposits of infected insects ..." (*Report of the Lawyers,* p. 8). The Lawyers' report states that: "In North Korea there have been no previous epidemics for at least 4 years .... Where containers like leaflet bombs have been found it should be made clear that no leaflets have been found in the neighbourhood." The Commission concluded that:

> ... The deliberate dispersion of flies and other insects artificially infected with bacteria against the Korean People's Army and among the civilian population of North Korea, with the intention of spreading death and disease, ... has been perpetrated by US forces in Korea. (*Report of the Lawyers,* p. 32.)

In its survey in China, the Commission limited its investigation to ten cases, collected the statements of a number of witnesses, and heard several experts in the relevant scientific fields. These experts are listed by name, position, and training: five of the ten acquired their post-graduate training in the West. Rickettsiae were again implicated, among several other organisms. Sanitary measures were again said to have averted an epidemic but "seventeen persons contaminated by insects carrying bacilli [of the *Pasteurella* group] have died. (*Report of the Lawyers,* p. 9.) A total mortality of sixty-five is therefore given for the Korean and Chinese incidents in the report of 2 April 1952.

[48] "Germ Warfare" [letter to the editor], *Times* 27 March 1952.

Report of the Scientists

The International Scientific Commission for the Investigation of the Facts concerning Bacterial Warfare in Korea and China (otherwise referred to as the International Scientific Commission or the ISC), was present in China and Korea from 23 June 1952 to 31 August 1952.[49]

It is useful to begin by looking at the analytical procedure adopted by the ISC, and at tables it presented for the results obtained in eleven cases (tables 4A.1 and 4A.2).

Details of the evidence

The following features of the allegations are contained in the *Report of the ISC.*

1. The ISC spent time in laboratories both in China and in Korea checking on the methods, analyses, and results of the evidence offered them. (*Report of the ISC,* p. 6.)

2. The *Report of the ISC* includes a biographical register of Chinese and Korean scientists and medical men who presumably carried out investigations and supplied testimony; fifty-six of the ninety-three men listed received some or all of their post-graduate training in the West (pp. 635–66). The full ISC interrogated forty Korean or Chinese scientists of varying disciplines. (*Report of the ISC,* p. 67.)

3. The ISC described eighteen species of insects "identified as being not natural but possibly artificial vectors of disease in man".[50]

Judging from the circumstances in which insects were found, from their connection with the planes, and from various entomological anomalies, it can be

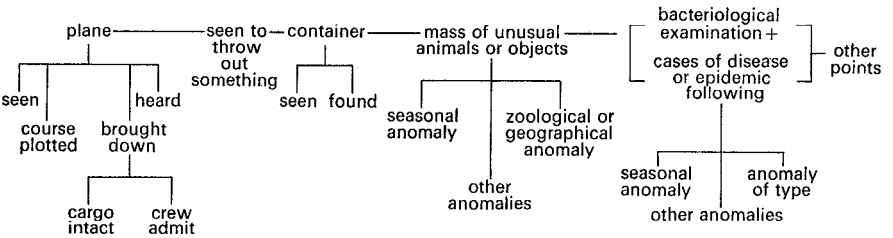
[49] The members of the ISC were: Dr Andrea Andreen (Sweden), Director of the Central Clinical Laboratory of the Hospitals Board of the City of Stockholm; M. Jean Malterre (France), Ingénieur-Agricole, Director of the Laboratory of Animal Physiology, National College of Agriculture, Grignon; formerly Livestock Expert, UNRRA; Corresponding Member of the Italian and Spanish Societies of Animal Husbandry; Dr Joseph Needham (UK), F.R.S., Sir William Dunn Reader in Biochemistry, University of Cambridge; formerly Counsellor (Scientific), H.B.M. Embassy, Chungking, and later Director of the Department of Natural Sciences, UNESCO; Dr Oliviero Olivo (Italy), Professor of Human Anatomy in the Faculty of Medicine of the University of Bologna; formerly Lecturer in General Biology, University of Turin; Dr Samuel B. Pessoa (Brazil), Professor of Parasitology at the University of Sao Paulo; formerly Director of Public Health for the State of Sao Paulo; Hon. Professor in the Faculties of Medicine of the Universitites of Recife and Paraiba; Dr N. N. Zhukov-Verezhnikov (USSR), Professor of Bacteriology at, and Vice-President of, the Soviet Academy of Medicine; formerly chief medical expert at the Khabarovsk trial of Japanese ex-service men accused of participating in bacteriological warfare.

[50] T. Rosebury, "Some Historical Considerations", *Bulletin of the Atomic Scientists* 16(6): 227–36, 1960.

Table 4A.1. Incident analysis adopted by the Commission[a]

On account of its very nature, the use of biological weapons is an act exceptionally difficult to prove. Perfect proof might require, for example, that an airplane be forced down with its biological cargo intact and its crew prepared to admit their proceedings forthwith. Obviously this would be a very unlikely occurrence for many reasons. It is therefore necessary to envisage a manner of grouping events into a coherent pattern so that they can throw light upon each other and perhaps build up a circumstantial case. A first necessity, therefore, for the thought and work of the Commission was some kind of scheme which could serve as a framework for the facts which it would have to study in each particular investigation.

The simplest scheme, in which, under ideal conditions, every component would be present and positive, was the following:—



Naturally this complete pattern will rarely or never be encountered. ...

[a] *Report of the ISC*, p. 13.

ascertained that such insects were definitely not naturally occurring in those localities, but were undoubtedly disseminated by American planes. (*Report of the ISC*, p. 126.)

The ISC lists seven reasons for this conclusion:

(*a*) Connection with air raids. Insects were found following intrusion of US aircraft. The finding of compartmentalized "leaflet bombs" in the same location as the insects is also considered very significant. One quotation, attributed to Congressman Robert Sikes, chairman of a House Appropriations Subcommittee, of 15 April 1952, reads:

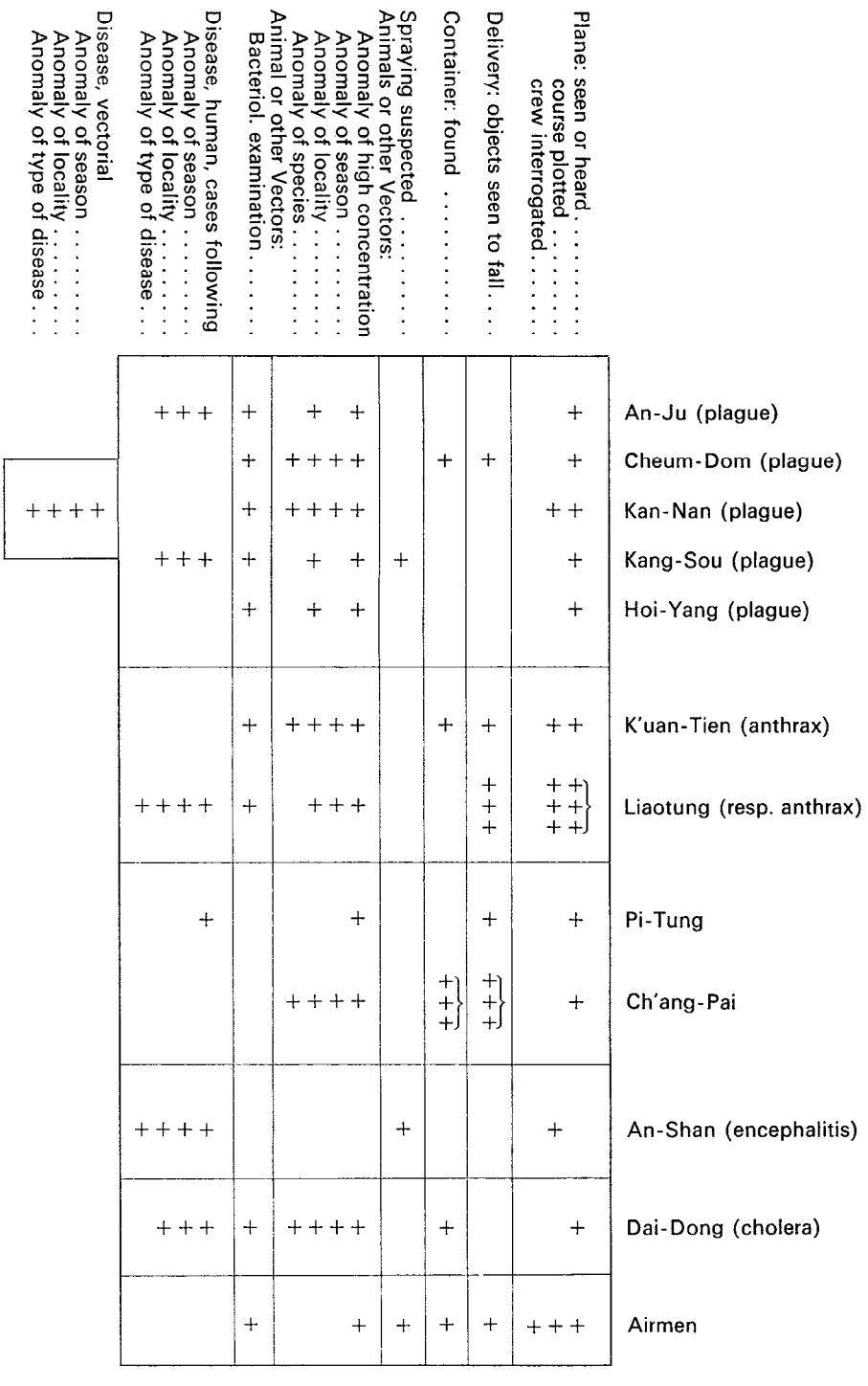
> The means of delivering germs to enemy territory, the General [Gen. Bullene, chief of US Army Chemical Corps] said, are simple and involve equipment of a type with which we are now already well stocked ... such as containers used currently for dropping propaganda leaflets. (*Report of the ISC*, p. 356.)

(*b*) Eye-witnesses. On one occasion two individuals "discovered objects dropping like snow-flakes", about ten minutes after the passage of four American aircraft. "After researching the ground" the witnesses found the objects to be insects.

(*c*) Anomalies in locality of discovery. Insects were found in wrong ecological habitats, and simultaneously not found "at places where they could naturally occur . . ." (*Report of the ISC*, p. 373).

(*d*) Seasonal anomalies of appearance. Most of the insects appeared

Table 4A.2. Data from the most fully analysed cases assembled in a synoptic table[a]



[a] *Report of the ISC*, p. 55.

at the wrong season (*Report of the ISC*, p. 371). A table is presented showing anomalies in the span of seasonal appearances of twelve insect species (*Report of the ISC*, p. 171).

(*e*) Anomaly of numbers of individuals. Anthomyiid flies were found "in tens of thousands and ... as many as 6 000–7 000 house flies were found in a single group. ... Tens of thousands of field-crickets [were discovered] at K'uan-Tien on the surface of the snow." (*Report of the ISC*, p. 127.)

It is also stated that field crickets do not swarm, should not be on the snow's surface and that these anomalies came on top of those of season and location (*Report of the ISC*, p. 127). "Many tens of thousands [of fleas (*P. irritans*) were found] at one time, on bare waste land remote from any human habitation"; it was emphasized that these were fleas parasitic on man (p. 25). The location of the fleas is described as "bare ... formerly ploughed land", where witnesses reported they "had definitely seen no fleas" the day before (*Report of the ISC*, p. 308).

An analysis is presented to show that such numbers could not have hatched by natural causes in one place (*Report of the ISC*, pp. 315–16).

(*f*) Anomaly of association. Insects with different habits were found together. In one place, feathers, flies and spiders, all allegedly infected by anthrax, were described as being found together (*Report of the ISC*, pp. 319, 345), along with fragments of a metal and calcerious container reported as seen to drop from a US plane.

(*g*) Anomaly of geographical distribution.

> The places where the insects were discovered are mainly points along lines of communication and all had been flown over by American planes. Nothing like this occurred in other places of the same latitude and the same geographical conditions. (*Report of the ISC*, p. 128.)

In fact, the ISC states that no cases occurred in the locations between two areas in which overflights and insect finds were reported. The ISC rebuts the argument that local heating effects on the earth's surface produced by napalm bombing could have been the cause of the insect anomalies. As an example, some particulars concerning anomalies are quoted:

> The species of *Hylemyia* (anthomyiid fly) identified repeatedly from numerous swarms collected, proved definitely not the same as any one of the four species common in Northeast China, nor with any one of the fifteen species previously recorded from all parts of China. The genus, however, has some 600 species, counting all parts of the world, and the true faunal areas of all of them are not yet perfectly known. Similarly, the sun-flies found (*Helomyza*

modesta Meigen) were certainly not identical with the single species of this genus previously recorded from China. . . .

In any case, the anomalies proved to be much more extraordinary on the ecological than on the zoological-geographical side. While the various species might or might not be strange to the region, it was certainly exceedingly strange to find them appearing in very large populations during the first three months of the year, when the snow is still on the ground in North and Northeast China and in Korea. . . . Of the eighteen species so far referred to, no less than twelve exhibited marked seasonal anomalies of appearance. In other words they appeared in mass with a precocity varying from 6–14 weeks earlier than the time of year at which, according to the personal experience and published works of competent entomologists, they ought normally to be expected to appear. The average shift was one of 9 weeks, more than two months.

. . . An observation of importance made by one of the Chinese entomologists . . . was that certain masses of *Hylemya* appearing when the temperature was −10°C contained a high proportion of individuals ready to lay eggs, thus still further deepening the mystery of their origin. Similarly striking was the case of the field-cricket *Gryllus testaceus*. . . . Thousands of adults of this species appeared in March near K'uan-Tien in Liaotung province, NE China (Manchuria), adjoining Korea, i.e. at a time when even in Peking, which has a warmer temperature than NE China, there should be present no individuals except those in the egg stage.

Now it may be granted that isolated and sporadic instances of the appearance of swarms of various kinds of insects in winter are to be found in entomological literature. But it is hardly conceivable that such phenomena could occur for so many species at once if its causes were purely natural. (*Report of the ISC*, pp. 14–16.)

The ISC itself "considered in this report" only fifteen of the eighteen species it refers to (*Report of ISC*, pp. 125–163).

4. Four fungal pathogens were described, three of them as having been dropped in packets of plant material by US aircraft. Witnesses described the air burst and scatter of the plant material. Eleven or more such incidents are alleged. The pathogens were:

(*a*) The purple spot fungus of soybeans;

(*b*) A wide host range strain of anthraenose, capable of infecting cotton, apple trees and pear trees, as demonstrated by inoculation tests;

(*c*) Ring spot fungus, causing apple and pear fruit rot;

(*d*) A legume pathogen "never previously reported from China", found on scattered maize kernels.

In two cases the infected leaf material that was dropped was claimed to come from trees whose distrubution included South Korea, and which were "quite unknown" in Northeast China or North Korea (*Report of the ISC*, pp. 22–23, 181–88, 191–93).

5. In one morning over 700 voles, dead or dying, were reportedly found

infected with plague in four villages. Some of the voles which were not brought into homes by domestic cats were found on the roofs of sheds, in ponds, and in wells. Anomaly of season (one month too early), of number and of location (close to human settlements and inside villages) were claimed. Fermentation assays were carried out to be certain that the isolated organism was *pestis* and not one of the other *Pasteurella* species. "There has been no plague of any form" in the villages before. No such voles had ever been seen by the villagers before. The ground was too frozen for the voles to dig burrows. No such voles were seen in the villages again. Subsequent attempts to set traps for voles in the villages and fields where they were found netted only rather small numbers of rats and mice, none infected with the plague. No voles were found in any surrounding villages, dead or alive. No evidence of a migration of the voles was found. No evidence of an epizootic was found.

6. Two persons in Korea died of cholera after eating clams. The clams were found in packages wrapped in straw on an open hillside. Four more packages of clams wrapped in straw were found. Some clams had broken shells (implying a fall from the air). Clams and the remains of clams in the patients' kitchen and clams from the packages discovered afterwards were all found to be infected with cholera. The location of the find, the broken shells, the straw wrapping, and perhaps the marketing season were all anomalous.

7. Confessions were made by four captured US aviators in radio broadcasts or in writing, but these were all repudiated upon the release and repatriation of the prisoners.

8. "The appearance of biological material founds to be infected with pathogenic micro-organisms was not always followed by human cases of disease." (*Report of the ISC,* p. 53.)

9. *Salmonella typhosa, paratyphosa* and *Shigella dysenteriae* were found on flies, "in areas where no cases of these diseases had been known. The Chinese medical literature contains studies ... [which] showed that in non-epidemic periods, normal flies did not carry the bacteria of typhoid or paratyphoid fever, or the cholera vibrio." (*Report of the ISC,* p. 56.)

10. Only nine of eighteen species of insects and arachnids claimed to have been disseminated from aircraft "have been definitely incriminated by bacteriological tests as infected with pathogenic micro-organisms" (*Report of the ISC,* p. 57). It was felt that no answer could be given as to whether the remaining nine were therefore pathogen free, or what this situation really meant, in view of the difficulties of culturing when one does not know what organism is being sought, and hence the correct media, conditions, etc., under which to culture.

The ISC admitted that quantitative investigations to determine the number of micro-organisms per insect could constitute a proof of artificial infection, since in that case the number carried would be very large or at best "... would permit of sharp comparisons between the suspected insects and control material ..." (*Report of the ISC*, p. 109). The ISC states, however, that quantitative studies are only possible, again because of culturing requirements, if one knows in advance the nature of the pathogen. One such investigation was made, but the ISC felt that:

> In general ... the evidence of the dissemination of insects for war purposes was so conclusive as to render the quantitative argument quite irrelevant. The consistently negative bacteriological findings from control materials of local origin, such as flies and feathers, further lessen the significance of quantitative studies in the particular cases included in the Report. (*Report of the ISC*, p. 110.)

11. The Commission commented on the apparent paradox of being convinced that the Americans had disseminated plague in Korea so close to the front lines. They tried to explain this by the "enormous progress in techniques of disinfestation" which had taken place since 1942, and by citing earlier assessments of likely field techniques for employing BW agents. The ISC also stated that the US forces in Korea were in possession of the requisite equipment that would be needed to prevent disease from spreading into their areas. (*Report of the ISC*, pp. 57–58.)

12. "One of the cases examined by the Commission ... raised the possibility that a virus [encephalitis] had been disseminated directly by the aerosol method" (*Report of the ISC*, p. 58). The evidence was deemed equivocal.

13. The ISC would give no data on the

> ... total number of Korean and Chinese civilians killed, nor the total morbidity, nor the fatality rate. It is not desirable that this should be done, since it would provide the last essential data for those upon whom the responsibility lies. The information is not necessary for the proof of the case upon which the Commission was invited to express an expert opinion. All that is necessary to know [is] ... that many human fatalities have occurred in isolated foci and in epidemics. ... (*Report of the ISC*, p. 59.)

The difference between total civilians killed and total morbidity would have been made up of military casualties. In some instances alleged discoveries of swarms of insects (*Pulex irritans*) were made by Chinese military personnel at places "often frequented by soldiers" (*Report of the ISC*, p. 311). One example comments: "Soldiers often came to this place" (*Report of the ISC*, p. 307). Nevertheless there is no explicit discussion

in the *Report of the ISC* of whether or not the BW it alleged was being aimed at military personnel.

The alleged pattern of attack, along the Northeast China rail lines, need not be so interpreted. The example just quoted seems to involve a bivouac area of some type for Chinese troops, since shelters were being built (pp. 307–14). Rosebury states that one incident involved "a plague outbreak with 50 cases and 35 deaths in a population of 600, occuring after the appearance of concentrations of the human flea *Pulex irritans* on a bare hillside in February".[51]

14. Questions directed to the Korean Minister of Health for purposes of clarification or amplification received remarkably poor replies, many to the effect that "it was to be considered confirmed that" such and such a situation had occurred (*Report of the ISC,* pp. 173–89). In at least one or two cases the Commission was informed that "... it could not now be considered demonstrable that these insects had been connected with bacteriological warfare" (p. 57), and an allegation was withdrawn.

15. The Korean Minister of Health ... stated that no plague had been recorded for five centuries in Korea, north or south, either under the Ri dynasty or the Japanese" (*Report of the ISC,* p. 303). He is substantiated in this insofar as Pollitzer's monograph on plague makes no mention of Korea in any context.

16. Affidavits are shown to state that

> ... there has been no case of anthrax among 3 942 autopsies since 1916 in the China Union Medical College [formerly Peking Union Medical College]. ... There has been no case of anthrax among 1 178 autopsies since 1928 in the Shanghai Medical College. (*Report of the ISC,* figures 23 and 24 following p. 416.)

General comments

The following comments are intended as an analysis of the material in the ISC report.

1. One must credit the detail represented in relation to the microbiological and entomological aspects of the Korean and Chinese allegations. Nevertheless, when the microbiological procedures are applied to human autopsy material, the extensive isolation, culturing, and fermentation studies only prove that patient X did have plague. They do not, of course, indicate where the infection came from, that is, its epidemiological context. The same holds for the isolation of the *Pasteurella pestis* from the voles or *Bacillus anthracis* from the beetles. But if finding these organisms

[51] *Ibid.* See also the *Report of the ISC,* p. 174 and the *Report of the Lawyers.*

in voles or beetles contradicts epidemiological evidence or expectations, then careful microbiological identification lends more support to the assessment that the organisms got there through BW attack rather than by natural means. Similarly one must credit the careful attempts at toxonomic keying of rodents, insects, etc., and the presentation of supporting evidence to show that a thesis presented is in fact feasible. For example, if one is going to allege that several thousand insects of a certain species and stage of development were artifically deposited, then it is pertinent to indicate that laboratory breeding of such species in such quantities is possible. The critics of the report claim that this is all beside the point.

2. The ISC makes a particular point of the massive collection of materials on which the allegations were founded.

> When confronted with bacteriological warfare, or even the suspicion of it, the peasant masses of China knew exactly what to do, and did it without the least confusion or panic. The Commission was able to visualize, through personal contact with a large number of witnesses from many parts of the Chinese countryside, the disciplined action of hundreds, indeed thousands, of ordinary folk, guided by instructions from the central and regional Ministries of Health, combing their fields and streets to collect and destroy everything which issued from containers arriving from the air. (*Report of the ISC*, p. 52.)

Without knowledge of the scale of earlier Chinese entomological collecting and surveying, one is entitled to begin to wonder at what may have been cause and what may have been effect. The thousands of ordinary folk may well have effected an unprecedented degree of entomological survey work, and they may have found and destroyed insects which did not issue from containers arriving from the air. It is not an unusual situation in ecology to be unaware of what is under one's feet, or at least under the rocks at one's feet, and to find the aphorism "seek and ye shall find" amply borne out. More endemic vectors might be found in an infected state than was imagined, and wider distribution patterns for them than was known. This also is not entirely surprising in view of the general ignorance in these matters.[52, 53] However, there is an upper limit to what can be explained away by the absence of thorough antecedent ecological knowledge. Barring specific local customs, it does not seem to be possible to explain in this way dead fish infected with cholera on an open hillside or clams wrapped in straw. According to the Korean Chief of the Epidemic Prevention Corps, "in Korea clams are not usually wrapped in straw for sale".

[52] P. Manson-Bahr, *Manson's Tropical Diseases*, 14th ed. (London, 1957).
[53] H. H. Mitchell, *Plague in the United States: an Assessment of its Significance as a Problem Following a Thermonuclear War* (RAND memorandum RM-4968-TAB, June 1966).

3. Because of their content and implications, a series of US statements in February, March and April 1952 are as important from the point of view of the analysis of allegations as are the clear and vociferous US denials of the use of BW. It has been pointed out that such denials were made by high US officials, by US representatives at the United Nations, and by the US field commander in Korea.

On 25 February 1952 a news report indicated that:

> Peking radio returned last night to its old untrue charge that the United States is using germ warfare in Korea, and renewed it at such length, and with so much violence of language, that it set United Nations officers wondering if epidemics have broken out in North Korea.[54]

It is this theme which is amplified with increasing information in the subsequent US statements. On 28 Feburary a declaration from General Ridgeway's headquarters stated that at no time had "germ warfare" been waged and that:

> Communist propagandists were making these allegations ... to conceal their own inadequacies in coping with seasonal epidemics. The allied broadcast said that the epidemics were made worse by infected bandages and decayed food.[55]

Details of the communist charges were said to "support the suspicion in UN headquarters that there is an outbreak of bubonic plague in North Korea."[56] A subsequent dispatch stated that:

> This supposition has now been confirmed by Peking radio which reports of an outbreak of "plague" in North Korea. ... Similar accusations [of bacteriological warfare] were made in the spring of 1951 when, as was later confirmed, the troops in North Korea were suffering a severe epidemic of typhus.[57]

Another statement read:

> Such diseases [cholera and typhus] are indeed endemic in Korea and spring is the season when they might most be expected. A typhus epidemic this time last year was followed a month later by similar charges. ...[58]

Finally, on 21 April 1952, some fifty-five days after the first statement, came the clearest and most detailed support for the entire series of US replies.

> In Washington yesterday evidence was published showing that the Chinese Communists had publicly acknowledged, two weeks before their propagandists began their allegations of germ warfare against the U.S., that epidemics were rife in parts of China due to natural causes. The first charge of germ warfare

[54] "U.S Officer's Account of Koje Riot", *Times* 25 February 1952: 5.
[55] "Charges of Germ Warfare", *Times* 28 February 1952: 3.
[56] *Ibid.*
[57] "Communist Delaying Tactics", *Times* 4 March 1952: 5.
[58] "Germ Warfare Charges Reiterated", *Times* 21 March 1952: 5.

was in a Peking broadcast on March 6. The charge was given official status by Chou En-Lai . . . on March 8.

But on February 21, the Peking newspaper *People's World* had stated at length that epidemics of diseases among humans and animals had been caused by unusually dry, warm weather during the winter, and by inadequate medical attention. Appealing for additional health precautions, the newspaper said: "Besides a great shortage of rain and snow last winter and this spring, and the dry and irregular weather, the fact that the leading health organizations and local health and medical organizations have not done their work intensely enough, and that they have either underestimated the seriousness of the epidemics or been ignorant of their seriousness, has also been a reason for the outbreak and spread of these epidemics."[59]

It seems rather odd that this material has appeared in no discussion of the Korean allegations that has come to our attention.

4. *If* one accepts all the allegations or observations of human and vector infection, apart from or without any of the causal analysis presented by the Koreans and Chinese and accepted by the ISC, (i.e., the voles were plague infected, the number of voles were found in the seaon indicated, the clams were cholera infected, anthrax and encephalitides did occur, etc.), then one is obliged to offer an alternative natural explanation. Could they all have been the result of abnormal population movements in Northeast China and in Korea in wartime? Perhaps. If so, would the particular grouping of diseases observed and their coincidence in time also be plausible? If natural causation supplies the answer for some fraction of the allegations, one can then implicate the Chinese and Koreans in those cases with overzealous entomological surveying for several insect species on what was perhaps a previously inadequate ecological data base. If anything this should have been expected. But if, after eliminating some such fraction of examples with plausible explanations other than BW, there remains a residue of cases, one has not removed the essential dilemma. Even if the finding of insects is explained away, the isolation of pathogens and the various anomalies and their combinations remain. It is more difficult to explain by natural processes some of the alleged vector anomalies, such as an accumulation of thousands of plague-infected human fleas in one delimited area.

5. It is also often argued that the methods alleged to have been used by the USA for BW agent dissemination were obsolescent and too crude, that if the USA had meant to initiate BW it would have used aerosol dissemination, not vectors. However, aerosol dissemination was new in 1952; it could have been used, but so equally could the older methods.

[59] "New Series of Korea Truce Meetings", *Times* 21 April 1952: 5.

One can think of reasons in favour of using the new or the old dissemination methods, including the desire to test or to mislead. Nothing can be proved or disproved in this way. Such considerations seem to offer more in the way of intellectual diversion than they offer as qualities of evidence for a tentative personal judgement.

6. It has often been stressed that the Chinese and Koreans refused to permit an investigation to be held under the auspices of the International Committee of the Red Cross or the World Health Organization. In reply, these nations indicated that they considered the ICRC to be dominated by the USA, the very nation they were accusing, and thus not an impartial body. The WHO was a United Nations specialized agency and "the war in Korea was being fought under the banner of the United Nations".[60]

> Dr Kuo declared that the governments of China and [North] Korea did not consider the International Red Cross Committee sufficiently free from political influence to be capable of instituting an unbiassed [*sic*] enquiry in the field. This objection was later extended to the World Health Organization, as a specialised agency of the United Nations. (*Report of the ISC*, p. 2.)

China is not a member of the United Nations, and its position outside the international system makes this reply not altogether surprising. If China's reply is explainable within such political contexts, its refusal to permit ICRC or WHO teams to enter the country could no longer be considered evidence on the validity of the allegations.

It is, however, interesting from the point of view of investigating CBW allegations to examine the role of the ICRC in the Korea-China case. Between 27 February and 6 March 1952, the Hungarian, Polish, Bulgarian and Romanian Red Cross organizations transmitted protests over the alleged US use of biological weapons in Korea to the ICRC.[61] The ICRC transmitted these protests to the US Red Cross organization.[62] The US reply came from the Department of State. It denied the charges and suggested that the ICRC conduct an investigation "to determine (1) the nature and extent of this epidemic and (2) the real cause of the epidemic". It stated that such an investigation would have to be conducted on both sides of the Korean battle line, and offered "free access to all sources of possible information behind United Nations lines bearing upon the investigation".[63] On 12 March the ICRC offered to set up a commission

[60] J. M. G. Stewart, "Germ Warfare" [letter to the editor], *New Statesman and Nation*, 5 December 1953.
[61] *Le Comité International de la Croix-Rouge et le Conflit de Corée, Recueil de Documents*, vol. II, 1 January – 30 June 1952, Geneva, 1952, pp. 84–86.
[62] *Ibid.*, pp. 87–88.
[63] *Ibid.*, p. 89.

under its direction, on two conditions: the offer was "subject to the agreement of both Parties", and "the Commission must be assured of the co-operation of the authorities on both sides of the front and of experts whom they will nominate".[64] This note was transmitted to the USA, China, North Korea, the UN Secretariat and to the UN forces.[65] The ICRC proposed to form a commission of two Swiss specialists and a Swiss technician, two Indian specialists (epidemiology and plague) and an Indian technician, and a Pakistani specialist (entomology).[66] On 28 and 31 March, the ICRC again contacted Chinese authorities[67] and on 10 April the ICRC reached Chinese and North Korean authorities for the last time, stating that if they had no reply by 20 April they would consider their proposal to have been rejected.[68] No reply was forthcoming and on 25 April the ICRC reported that the conditions it had stipulated for conducting an enquiry were still unfulfilled, and it was suspending its provisional preparations.[69] On 30 April it explicitly terminated the venture which had been in process since 7 March.[70]

7. The suggestion that all the evidence was found as described but was planted by the Chinese, Korean or Soviet authorities[71] must accommodate the corollary that these nations were willing to infect the human vector population of Korea and China with unknown and potentially long-term endemic implications.

8. The suggestion that the entire series of allegations are sheer fabrication, with or without real samples introduced at late stages for laboratory examinations, and so on, has no rebuttal. One thing can be said with absolute certainty: there is no "absolute proof" and none is given in the *Report of the ISC*.[72] The clearest statement by the ISC as to the nature of its "proof" of the allegations is made with reference to data on mortalities resulting from the alleged attacks:

> ... The information is not necessary for the proof of the case upon which the Commission was invited to express an expert opinion. All that is necessary is to know what the Commission confirmed, namely that many human fatalities

[64] *Ibid.*, p. 90.
[65] *Ibid.*, pp. 89–93.
[66] *Ibid.*, pp. 99–100.
[67] *Ibid.*, pp. 102–103.
[68] *Ibid.*, pp. 105–106.
[69] *Ibid.*, p. 107.
[70] *Ibid.*, p. 109.
[71] G. P. Thomson, "Germ Warfare" [letter to the editor], *New Statesman and Nation* 5 December 1953.
[72] Direct proof would consist of: (*a*) the direct observation and instrumental recording by the ISC itself of the BW agent delivery by the vehicle alleged, and the ability to track that vehicle to its source; (*b*) field collecting, sampling, laboratory culture, isolation and identification studies carried out by the ISC; (*c*) the absence of any suspicion of fabrication in such work carried out by the ISC itself.

have occurred in isolated foci and in epidemics, under highly abnormal circumstances in which the trail always leads back to American air activity. (*Report of the ISC*, p. 59.)

After reading through the entire volume every reader is left with the same choice, to accept one or another set of contentions as more or less plausible. These are that: BW was waged by the USA; BW was waged by US military personnel with or without authorization of higher command; there are natural explanations for the phenomena observed; or that fabricated evidence was involved.

One can also plausibly believe a mixture of these explanations. Thus Rosebury, reviewing the allegations, concluded:

> ... They might conceivably have been inventions; it is possible although highly unlikely, that they were all natural outbreaks of disease mistaken for BW; or some may have been one and some the other; or they may have been mixtures of the two.[73]

The individual reader is very likely to choose between Rosebury's three alternatives largely on the degrees of credibility he will accept for them *a priori*. There are definite gaps in the evidence. If the evidence is accepted, it is done so on some degree of faith.

The same degree of faith goes into accepting any of the four propositions noted above. These elements are explicitly brought out in some of the early discussions which followed the release of the *Report of the ISC*. The Swedish representative on the Commission

> ... told the Press in September, 1952, after returning from China: "The scientific foundation of the Commission's work consisted of the fact that the delegates implicitly believed the Chinese and North Korean accusations and evidence." Dr Needham himself was asked at a Press conference what proof he had that the samples of plague bacillus he was shown actually came, as the Chinese said, from an unusual swarm of voles, and he replied, as reported in the *Daily Herald:* "None. We accepted the word of the Chinese scientists. It is possible to maintain that the whole thing was a kind of patriotic conspiracy. I prefer to believe the Chinese were not acting parts. ..." One may believe, as I do, in a conspiracy without supposing that all the Chinese he met were *conscious* participants in it. ...
>
> Sir Henry Dale and Sir Robert Robinson pointed out, in a letter to the Press more than a year ago, that the really important questions before the so-called "International Scientific Commission" were not of a specially scientific nature. "They involved the scrutiny of evidence from all kinds of people, purporting to prove how and where the objects submitted for examination were discovered, and—the essential point—to show that they were deposited there in a particular manner." ...[74]

[73] Rosebury, *op. cit.*, p. 231.
[74] Thompson, *op. cit.*

It would seem that the considerations were also apparent at the time to a British National Committee of Science for Peace which concerned itself with the *Report of the ISC.*

When the Report of the Commission was published, it was scrutinised carefully by our Committee, and a critical review was prepared for the scientific press, but has not been published. This review pointed out a number of obvious defects and gaps in the evidence presented in the Report, and made many of the points which were later made in the pamphlet, *Germ Warfare, The Communist Secret Weapon,* by John Clews. The conclusion of our review was that complete scientific proof of the charges had not been given, and that from the circumstances and the nature of the charges scientific proof would be extremely difficult. It appears that Mr Clews accepted the reality of the observations discussed in the Report, but he dismisses them as evidence of germ warfare with the suggestion that they were "planted," probably by the Russians. We also accepted the reality of the observations, but were far from convinced that the evidence was fraudulent.[75]

It is necessary to repeat that the object of reciting this evidence has not been to try to reach a conclusion one way or the other, but to recount the history as carefully as possible and to illustrate the very difficult problems of verifying allegations of use. The allegations of BW in Korea and China, which commanded world-wide attention and were so hotly debated in 1952–53, are largely ignored in 1971. Discussions of them in Western literature are rare, and tend to dismiss the charges as fabrications.[76] References to the allegations seem simply to have disappeared from East European literature.

[75] F. G. Gregory, "Germ Warfare" [letter to the editor], *New Statesman and Nation* 5 December 1953.
[76] For example, J. Cookson, and J. Nottingham, *A Survey of Chemical and Biological Warfare* (London, 1969), pp. 57–63, 293–308.

Appendix 5. List of states which have signed, ratified, acceded or succeeded to the 1925 Geneva Protocol[1]

Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or other Gases, and of Bacteriological Methods of Warfare, signed at Geneva on 17 June 1925

The Undersigned Plenipotentiaries, in the name of their respective Governments:

Whereas the use in war of asphyxiating, poisonous or other gases, and of all analogous liquids, materials or devices, has been justly condemned by the general opinion of the civilized world; and

Whereas the prohibition of such use has been declared in Treaties to which the majority of Powers of the World are Parties; and

To the end that this prohibition shall be universally accepted as a part of International Law, binding alike the conscience and the practice of nations;

Declare:

That the High Contracting Parties, so far as they are not already Parties to Treaties prohibiting such use, accept this prohibition, agree to extend this prohibition to the use of bacteriological methods of warfare and agree to be bound as between themselves according to the terms of this declaration.

The High Contracting Parties will exert every effort to induce other States to accede to the present Protocol. Such accession will be notified to the Government of the French Republic, and by the latter to all signatory and acceding Powers, and will take effect on the date of the notification by the Government of the French Republic.

The present Protocol, of which the French and English texts are both authentic, shall be ratified as soon as possible. It shall bear to-day's date.

The ratifications of the present Protocol shall be addressed to the Government of the French Republic, which will at once notify the deposit of such ratification to each of the signatory and acceding Powers.

The instruments of ratification of and accession to the present Protocol will remain deposited in the archives of the Government of the French Republic.

[1] The criteria used in compiling this list are explained in Appendix 5 to Volume IV of this study. The list is complete as of July 1971.

The present Protocol will come into force for each signatory Power as from the date of deposit of its ratification, and, from that moment, each Power will be bound as regards other Powers which have already deposited their ratifications. In witness whereof the Plenipotentiaries have signed the present Protocol.

Done at Geneva in a single copy, the seventeenth day of June, One Thousand Nine Hundred and Twenty-Five.

A. List of signatories and ratifications[2]

Signatory	*Deposit of ratification*
Austria	9 May 1928
Belgium	4 Dec. 1938
Brazil	28 Aug. 1970
British Empire	9 April 1930
Bulgaria	7 March 1934
Canada	6 May 1930
Chile	2 July 1935
Czechoslovakia	16 Aug. 1938
Demark	5 May 1930
Egypt	6 Dec. 1928
El Salvador	
Estonia	28 Aug. 1931
Ethiopia	20 Sept. 1935
Finland	26 June 1929
France	10 May 1926
Germany	25 April 1929
Greece	30 May 1931
India	9 April 1930
Italy	3 April 1928
Japan	21 May 1970
Latvia	3 June 1931
Lithuania	15 June 1933
Luxembourg	1 Sept. 1936
Netherlands	31 Oct. 1930
Nicaragua	
Norway	27 July 1932
Poland	4 Feb. 1929

[2] Volume IV also lists the reservations and other declarations which accompanied the ratifications.

Portugal	1 July 1930
Romania	23 Aug. 1929
Serbs, Croats and Slovenes, Kingdom of the (Yugoslavia)	12 April 1929
Siam (Thailand)	6 June 1931
Spain	22 Aug. 1929
Sweden	25 April 1930
Switzerland	12 July 1932
Turkey	5 Oct. 1929
USA	
Uruguay	
Venezuela	8 Feb. 1928

B. List of accessions and successions

Country	*Notification*
Argentina	12 May 1969
Australia	24 May 1930
Central African Republic	31 July 1970
Ceylon	20 Jan. 1954
China	24 Aug. 1929
Cuba	24 June 1966
Cyprus	21 Nov. 1966
Dominican Republic	8 Dec. 1970
Ecuador	16 Sept. 1970
Gambia	11 Oct. 1966
Ghana	3 May 1967
Holy See	18 Oct. 1966
Hungary	11 Oct. 1952
Iceland	2 Nov. 1967
Indonesia	13 Jan. 1971
Iraq	8 Sept. 1931
Irish Free State (Ireland)	29 Aug. 1930
Israel	20 Feb. 1969
Ivory Coast	27 July 1970
Jamaica	28 July 1970
Kenya	6 July 1970
Lebanon	17 April 1969
Liberia	17 June 1927
Malagasy Republic	2 Aug. 1967

Malaysia	10 Dec. 1970
Malawi	14 Sept. 1970
Maldives	19 Dec. 1966
Malta	25 Sept. 1970
Mauritius	27 Nov. 1970
Mexico	28 May 1932
Monaco	6 Jan. 1967
Mongolia	6 Dec. 1968
Morocco	13 Oct. 1970
Nepal	9 May 1969
New Zealand	24 May 1930
Niger	18 March 1967
Nigeria	15 Oct. 1968
Pakistan	13 April 1960
Panama	4 Dec. 1970
Paraguay	22 Oct. 1933
Persia (Iran)	5 Nov. 1929
Rwanda	21 March 1964
Saudi Arabia	27 Jan. 1971
Sierra Leone	20 March 1967
South Africa	24 May 1930
Syria	17 Dec. 1968
Tanzania	22 April 1963
Togo	5 April 1971
Tonga	28 July 1971
Trinidad and Tobago	9 Oct. 1970
Tunisia	12 July 1967
Uganda	24 May 1965
Upper Volta	3 March 1971
USSR	15 April 1928
Yemen (Arab Republic of)	17 March 1971

Appendix 6. Major documents relating to CB disarmament

6.A. *Revised UK draft convention for the prohibition of biological methods of warfare and accompanying draft Security Council resolution, of 18 August 1970*[1]

The States concluding this Convention, hereinafter referred to as the "Parties to the Convention",

Recalling that many States have become Parties to the Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or other Gases, and of Bacteriological Methods of Warfare, signed at Geneva on 17 June 1925,

Recognizing the contribution that the said Protocol has already made, and continues to make, to mitigating the horrors of war,

Recalling further United Nations General Assembly Resolutions 2162B (XXI) of 5 December 1966, and 2454A (XXIII) of 20 December 1968, which called for strict observance by all States of the principles and objectives of the Geneva Protocol and invited all States to accede to it,

Believing that chemical and biological discoveries should be used only for the betterment of human life,

Recognizing nevertheless that the development of scientific knowledge throughout the world will increase the risk of eventual use of biological methods of warfare,

Convinced that such use would be repugnant to the conscience of mankind and that no effort should be spared to minimize this risk,

Desiring therefore to reinforce the Geneva Protocol by the conclusion of a Convention making special provision in this field,

Declaring their belief that, in particular, provision should be made for the prohibition of recourse to biological methods of warfare in any circumstances.

Have agreed as follows:

[1] Disarmament Conference document, CCD/225/Rev. 2.

ARTICLE I

Each of the Parties to the Convention undertakes, insofar as it may not already be committed in that respect under Treaties or other instruments in force prohibiting the use of chemical and biological methods of warfare, never in any circumstances, by making use for hostile purposes of microbial or other biological agents or toxins causing death, damage or disease to man, other animals, or crops, to engage in biological methods of warfare.

ARTICLE II

Each of the Parties to the Convention undertakes:

(a) not to produce or otherwise acquire, or assist in or permit the production or acquisition of:
   (i) microbial or other biological agents or toxins of types and in quantities that have no justification for prophylactic or other peaceful purposes;
   (ii) ancillary equipment or vectors the purpose of which is to facilitate the use of such agents or toxins for hostile purposes;
(b) not to conduct, assist or permit research aimed at production of the kind prohibited in sub-paragraph (a) of this Article; and
(c) to destroy, or divert to peaceful purposes, within three months after the Convention comes into force for that Party, any stocks in its possession of such agents or toxins or anciliary equipment or vectors as have been produced or otherwise acquired for hostile purposes.

ARTICLE III

1. Any Party to the Convention which believes that biological methods of warfare have been used against it may lodge a complaint with the Secretary-General of the United Nations, submitting all evidence at its disposal in support of the complaint, and request that the complaint be investigated and that a report on the result of the investigation be submitted to the Security Council.

2. Any Party to the Convention which believes that another Party is in breach of any of its undertakings under Articles I and II of the Convention, but which is not entitled to lodge a complaint under Paragraph 1 of this Article, may lodge a complaint with the Security Council, submitting all evidence at its disposal, and request that the complaint be investigated.

3. Each of the Parties to the Convention undertakes to co-operate fully with the Secretary-General and his authorized representatives in any investigation he may carry out, as a result of a complaint, in accordance with Security Council Resolution No ...

ARTICLE IV

Each of the Parties to the Convention affirms its intention to provide or support appropriate assistance, in accordance with the United Nations Charter, to any Party to the Convention, if the Security Council concludes that biological methods of warfare have been used against that Party.

ARTICLE V

Each of the Parties to the Convention undertakes to pursue negotiations in good faith on effective measures to strengthen the existing constraints on chemical methods of warfare.

ARTICLE VI

Nothing contained in the present Convention shall be construed as in any way limiting or derogating from obligations assumed by any State under the Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or other Gases, and of Bacteriological Methods of Warfare, signed at Geneva on 17 June 1925.

ARTICLE VII

[Provisions for amendments.]

ARTICLE VIII

[Provisions for Signature, Ratification, Entry into Force, etc.]

ARTICLE IX

1. This Convention shall be of unlimited duration.

2. Each Party shall in exercising its national sovereignty have the right to withdraw from the Convention, if it decides that extraordinary events, related to the subject matter of this Convention, have jeopardized the supreme interests of its country. It shall give notice of such withdrawal to all other Parties to the Convention and to the United Nations Security Council three months in advance. Such notice shall include a statement of the extraordinary events it regards as having jeopardized its supreme interests.

ARTICLE X

[Provisions on languages of texts, etc.]

Revised draft Security Council resolution

The Security Council,

Welcoming the desire of a large number of States to subscribe to the Convention for the Prohibition of Biological Methods of Warfare, and thereby

undertake never to engage in such methods of warfare; to prohibit the production and research aimed at the production of biological weapons, and to destroy, or divert to peaceful purposes, such weapons as may already be in their possession,

Noting that under Article III of the Convention, Parties will have the right to lodge complaints and to request that the complaints be investigated,

Recognizing the need, if confidence in the Convention is to be established, for appropriate arrangements to be made in advance for the investigation of any such complaints, and the particular need for urgency in the investigation of complaints of the use of biological methods of warfare,

Noting further the declared intention of Parties to the Convention to provide or support appropriate assistance, in accordance with the Charter, to any other Party to the Convention, if the Security Council concludes that biological methods of warfare have been used against that Party,

Reaffirming in particular the inherent right, recognized under Article 51 of the Charter, of individual and collective self-defence if an armed attack occurs against a Member of the United Nations, until the Security Council has taken measures necessary to maintain international peace and security.

1. Requests the Secretary-General
   (a) to take such measures as will enable him
      (i) to investigate without delay any complaints lodged with him in accordance with Article III.1 of the Convention;
      (ii) if so requested by the Security Council, to investigate any complaint made in accordance with Article III.2 of the Convention; and
   (b) to report to the Security Council on the result of any such investigation.
2. Declares its readiness to give urgent consideration
   (a) to any complaint that may be lodged with it under Article III.2 of the Convention; and
   (b) to any report that the Secretary-General may submit in accordance with operative paragraph I of this Resolution on the result of his investigation of a complaint; and if it concludes that the complaint is well-founded, to consider urgently what action it should take or recommend in accordance with the Charter.

3. Calls upon Member States and upon Specialized Agencies of the United Nations to co-operate as appropriate with the Secretary-General for the fulfilment of the purposes of this Resolution.

6.B. *Revised draft convention on the prohibition of the development, production and stockpiling of chemical and bacteriological (biological) weapons and on the destruction of such weapons, submitted by Bulgaria, Byelorussian SSR, Czechoslovakia, Hungary, Mongolia, Poland, Romania, Ukrainian SSR and the USSR to the UN General Assembly on 23 October 1970*[2]

The States Parties to this Convention,

Convinced of the immense importance and urgent necessity of eliminating from the arsenals of States such dangerous weapons of mass destruction as chemical and bacteriological (biological) weapons,

Guided by the desire to facilitate progress in the achievement of the objectives of general and complete disarmament,

Desiring to contribute to the strengthening of confidence between peoples and the general improvement of the international atmosphere,

Believing that scientific discoveries in the field of chemistry and bacteriology (biology) must in the interests of all mankind be used solely for peaceful purposes,

Recognizing nevertheless that the development of scientific knowledge throughout the world will increase the risk of the use of chemical and bacteriological (biological) methods of warfare,

Convinced that such use would be repugnant to the conscience of mankind and that no effort should be spared to minimize this risk,

Recognizing the important significance of the Geneva Protocol of 17 June 1925 for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare, an instrument which embodies generally recognized rules of international law and conscious also of the contribution which the said Protocol has already made, and continues to make, to mitigating the horrors of war,

Reaffirming their adherence to the purposes and principles of that Protocol and calling upon all States to comply strictly with them,

Recalling United Nations General Assembly resolutions 2162B (XXI) of 5 December 1966 and 2454A (XXIII) of 20 December 1968 which condemned all actions contrary to the Geneva Protocol of 17 June 1925, and also resolutions 2603A and B (XXIV) of 16 December 1969 which, *inter alia,* confirmed once again the generally recognized character of the

[2] UN document, A/8136.

rules of international law embodied in the Geneva Protocol of 17 June 1925,

Noting the conclusions contained in the report submitted to the United Nations General Assembly and the Disarmament Committee on the grave consequences for mankind that might result from the use of chemical and bacteriological (biological) weapons,

Expressing their desire to contribute to the implementation of the Purposes and Principles of the Charter of the United Nations,

Have agreed as follows:

ARTICLE I

Each State Party to this Convention undertakes not to develop, produce, stockpile or otherwise acquire chemical and bacteriological (biological) weapons, or equipment or vectors specially designed for the use of chemical and bacteriological (biological) weapons as means of warfare.

ARTICLE II

Each State Party to this Convention undertakes to destroy within a period of . . .—observing all the necessary precautions—or to divert to peaceful uses all previously accumulated chemical and bacteriological (biological) weapons in its possession, as well as equipment and vectors specially designed for the use of chemical and bacteriological (biological) weapons as means of warfare.

ARTICLE III

Each State Party to the Convention undertakes not to assist, encourage or induce any individual State, group of States or international organizations to develop, produce or otherwise acquire and stockpile chemical and bacteriological (biological) weapons.

ARTICLE IV

Each State Party to the Convention shall be internationally responsible for compliance with its provisions by legal and physical persons exercising their activities in its territory, and also by its legal and physical persons outside its territory.

ARTICLE V

Each State Party to the Convention undertakes to take as soon as possible, in accordance with its institutional procedures, the necessary legislative and administrative measures to prohibit the development, production and stock-

piling of chemical and bacteriological (biological) weapons and to destroy such weapons.

ARTICLE VI

The States Parties to the Convention undertake to consult one another and to co-operate in solving any problems which may arise in the application of the provisions of this Convention.

ARTICLE VII

1. Each State Party to the Convention which finds that actions of any other State Party constitute a breach of the obligations assumed under articles I and II of the Convention may lodge a complaint with the Security Council of the United Nations. Such a complaint should include all possible evidence confirming its validity, as well as a request for its consideration by the Security Council. The Security Council shall inform the States Parties to the Convention of the result of the investigation.

2. Each State Party to the Convention undertakes to co-operate in carrying out any investigations which the Security Council may undertake, in accordance with the provisions of the United Nations Charter, on the basis of the complaint received by the Council.

ARTICLE VIII

1. The States Parties to the Convention undertake to facilitate, and have the right to participate in, the fullest possible exchange of equipment, materials and scientific and technological information for the peaceful uses of chemical and bacteriological (biological) agents.

2. This Convention shall be implemented in a manner designed to avoid hampering the economic or technological development of States Parties to the Convention or international co-operation in the field of peaceful chemical and bacteriological (biological) activities, including the international exchange of chemical and bacteriological (biological) agents and equipment for the processing, use or production of chemical and bacteriologial (biological) agents for peaceful purposes in accordance with the provisions of this Convention.

ARTICLE IX

Any State Party may propose amendments to this Convention. Amendments shall enter into force for each State Party accepting the amendments upon their acceptance by a majority of the States Parties to the Convention and thereafter for each remaining State Party on the date of acceptance by it.

ARTICLE X

Five years after the entry into force of this Convention, a conference of States Parties to the Convention shall be held at Geneva, Switzerland, in order to review the operation of this Convention with a view to assuring that the purposes of the preamble and the provisions of the Convention are being realized. Such review shall take into account any new scientific and technological developments relevant to this Convention.

ARTICLE XI

1. This Convention shall be open to all States for signature. Any State which does not sign the Convention before its entry into force in accordance with paragraph 3 of this article may accede to it at any time.

2. This Convention shall be subject to ratification by signatory States. Instruments of ratification and instruments of accession shall be deposited with the Governments of ... which are hereby designated the Depositary Governments.

3. This Convention shall enter into force after the deposit of the ... instrument of ratification by Governments, including the instruments of ratification of the Governments of States which are permanent members of the United Nations Security Council and of other Governments designated as Depositaries of the Convention.

4. For States whose instruments of ratification or accession are deposited subsequent to the entry into force of this Convention, it shall enter into force on the date of the deposit of their instruments of ratification or accession.

5. The Depositary Governments shall promptly inform all signatory and acceding States of the date of each signature, the date of deposit of each instrument of ratification or of accession and the date of the entry into force of this Convention and shall transmit other notices to them.

6. This Convention shall be registered by the Depositary Governments pursuant to Article 102 of the Charter of the United Nations.

ARTICLE XII

This Convention, of which the Chinese, English, French, Russian and Spanish texts are equally authentic, shall be deposited in the archives of the Depositary Governments. Duly certified copies of this Convention shall be transmitted by the Depositary Governments to the Governments of the signatory and acceding States.

In witness whereof the undersigned, duly authorized, have signed this Convention.

DONE in ..., copies at ..., this ... day of ....., ...

6.C. *Draft convention on the prohibition of the development, production and stockpiling of bacteriological (biological) weapons and toxins and on their destruction, submitted by Bulgaria, Byelorussian SSR, Czechoslovakia, Hungary, Mongolia, Poland, Romania, Ukrainian SSR, and the USSR on 15 April 1971*[1]

The States Parties to this Convention,

Determined to act with a view to achieving effective progress towards general and complete disarmament and, above all, with a view to prohibiting and eliminating nuclear, chemical, bacteriological (biological) and all other types of weapons of mass destruction,

Convinced that the prohibition of the development, production and stockpiling of bacteriological (biological) weapons and toxins and their elimination will facilitate the achievement of general and complete disarmament,

Convinced of the immense importance and urgent necessity of eliminating from the arsenals of States such dangerous weapons of mass destruction as weapons using bacteriological (biological) agents and toxins,

Desiring to contribute to the strengthening of confidence between peoples and the general improvement of the international atmosphere,

Believing that scientific discoveries in the field of bacteriology (biology) must in the interests of all mankind be used solely for peaceful purposes,

Recognizing nevertheless that in the absence of appropriate prohibitions the development of scientific knowledge throughout the world would increase the risk of the use of bacteriological (biological) methods of warfare,

Convinced that such use would be repugnant to the conscience of mankind and that no effort should be spared to minimize this risk,

Recognizing the important significance of the Geneva Protocol of 17 June 1925 for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare, and conscious also of the contribution which the said Protocol has already made, and continues to make, to mitigating the horrors of war,

Reaffirming their adherence to the purposes and principles of that Protocol and calling upon all States to comply strictly with them,

Guided by the resolutions of the United Nations General Assembly,

[1] Disarmament Conference document CCD/325/Rev. 1.

which has condemned all actions contrary to the Geneva Protocol of 17 June 1925 as well as the use in international armed conflicts of any chemical and any biological means of warfare,

Noting the conclusions contained in the report submitted to the United Nations General Assembly and the Disarmament Committee on the grave consequences for mankind that might result from the use of chemical and bacteriological (biological) weapons,

Convinced that an agreement on bacteriological (biological) weapons will facilitate progress towards the achievement of agreement on effective measures for the complete prohibition of chemical weapons, on which negotiations will be continued,

Anxious to contribute to the realization of the purposes and principles of the Charter of the United Nations,

Have agreed as follows:

ARTICLE I

Each State Party to this Convention undertakes not to develop, produce, stockpile or otherwise acquire:

(1) microbiological or other biological agents or toxins of such types and in such quantities as are not designed for the prevention of disease or for other peaceful purposes;

(2) auxiliary equipment or means of delivery designed to facilitate the use of such agents or toxins for hostile purposes.

ARTICLE II

Each State Party to this Convention undertakes to destroy within a period of three months after the entry into force of the Convention—observing all the necessary precautions—or to divert to peaceful uses all previously accumulated weapons in its possession as well as the equipment and means of delivery mentioned in article I of the Convention.

ARTICLE III

Each State Party to the Convention undertakes not to assist, encourage or induce any particular State, group of States or international organizations to take action contrary to the provisions of this Convention.

ARTICLE IV

Each State Party to the Convention shall be internationally responsible for compliance with its provisions by legal or physical persons of that State.

ARTICLE V

Each State Party to the Convention undertakes to take as soon as possible, in accordance with its constitutional procedures, the necessary legislative and administrative measures for prohibiting the development, production and stockpiling of the weapons, equipment and means of delivery mentioned in article I of the Convention, and for destroying them.

ARTICLE VI

The States Parties to the Convention undertake to consult one another and to co-operate in solving any problems which may arise in the application of the provisions of this Convention.

ARTICLE VII

1. Each State Party to the Convention which finds that actions of any other State Party constitute a breach of the obligations assumed under the provisions of this Convention may lodge a complaint with the Security Council of the United Nations. Such a complaint should include all possible evidence confirming its validity, as well as a request for its consideration by the Security Council. The Council shall inform the States Parties to the Convention of the result of the investigation.

2. Each State party to the Convention undertakes to co-operate in carrying out any investigations which the Security Council may undertake, in accordance with the provisions of the United Nations Charter, on the basis of the complaint received by the Council.

ARTICLE VIII

Nothing in this Convention shall be interpreted as in any way limiting or detracting from the obligations assumed by any State under the Geneva Protocol of 17 June 1925 on the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare, an instrument which embodies generally recognized rules of international law.

ARTICLE IX

Each State Party to this Convention undertakes to conduct negotiations in good faith on effective measures for prohibiting the development, production and stockpiling of chemical weapons and for their destruction, and on appropriate measures concerning equipment and means of delivery specifically designed for the production or use of chemical weapons as means of warfare.

ARTICLE X

1. The States Parties to the Convention undertake to facilitate, and have the right to participate in, the fullest possible exchange of equipment, materials and scientific and technological information for the use of bacteriological (biological) agents and toxins for peaceful purposes.

2. This Convention shall be implemented in a manner designed to avoid hampering the economic or technological development of States Parties to the Convention or international co-operation in the field of peaceful bacteriological (biological) activities, including the international exchange of bacteriological (biological) agents and toxins and equipment for the processing, use or production of bacteriological (biological) agents and toxins for peaceful purposes in accordance with the provisions of this Convention.

ARTICLE XI

Any State Party may propose amendments to this Convention. Amendments shall enter into force for each State Party accepting the amendments upon their acceptance by a majority of the States Parties to the Convention and thereafter for each remaining State Party on the date of acceptance by it.

ARTICLE XII

1. This Convention shall be of unlimited duration.

2. Five years after the entry into force of this Convention, a conference of States Parties to the Convention shall be held at Geneva, Switzerland, to review the operation of this Convention, so as to be sure that the purposes of the preamble and the provisions of the Convention, including the provisions concerning negotiations on chemical weapons, are being realized. Such review shall take into account any new scientific and technological developments relevant to this Convention.

ARTICLE XIII

1. This Convention shall be open to all States for signature. Any State which does not sign the Convention before its entry into force in accordance with paragraph 3 of this article may accede to it at any time.

2. This Convention shall be subject to ratification by signatory States. Instruments of ratification and instruments of accession shall be deposited with the Governments of ... which are hereby designated the Depositary Governments.

3. This Convention shall enter into force after the deposit of the instruments of ratification by ... Governments, including the Governments designated as Depositaries of the Convention.

4. For States whose instruments of ratification or accession are deposited subsequent to the entry into force of this Convention, it shall enter into force on the date of the deposit of their instruments of ratification or accession.

5. The Depositary Governments shall promptly inform all signatory and acceding States of the date of each signature, the date of deposit of each instrument of ratification or of accession and the date of the entry into force of this Convention, and shall transmit other notices to them.

6. This Convention shall be registered by the Depositary Governments pursuant to Article 102 of the Charter of the United Nations.

ARTICLE XIV

This Convention, of which the Chinese, English, French, Russian and Spanish texts are equally authentic, shall be deposited in the archives of the Depositary Governments. Duly certified copies of this Convention shall be transmitted by the Depositary Governments to the Governments of the signatory and acceding States.

In witness whereof the undersigned, duly authorized, have signed this Convention.

DONE in . . . copies at . . ., this . . .
day of . . ., . . .

6.D. *Statement by the US President, 25 November 1969*[3]

Soon after taking office I directed a comprehensive study of our chemical and biological defense policies and programs. There had been no such review in over fifteen years. As a result, objectives and policies in this field were unclear and programs lacked definition and direction.

Under the auspices of the National Security Council, the Departments of State and Defense, the Arms Control and Disarmament Agency, the Office of Science and Technology, the Intelligence Community and other agencies worked closely together on this study for over six months. These government efforts were aided by contributions from the scientific community through the President's Scientific Advisory Committee.

This study has now been completed and its findings carefully considered by the National Security Council. I am now reporting the decisions taken on the basis of this review.

[3] Press release, Office of the White House Press Secretary.

Chemical Warfare Program

As to our chemical warfare program, the United States:

—Reaffirms its oft-repeated renunciation of the first use of lethal chemical weapons.

—Extends this renunciation to the first use of incapacitating chemicals.

Consonant with these decisions, the Administration will submit to the Senate, for its advice and consent to ratification, The Geneva Protocol of 1925 which prohibits the first use in war of "asphyxiating, poisonous or other Gases and of Bacteriological Methods of Warfare". The United States has long supported the principles and objectives of this Protocol. We take this step toward formal ratification to reinforce our continuing advocacy of international constraints on the use of these weapons.

Biological Research Program

Biological weapons have massive, unpredictable and potentially uncontrollable consequences. They may produce global epidemics and impair the health of future generations. I have therefore decided that:

—The U.S. shall renounce the use of lethal biological agents and weapons, and all other methods of biological warfare.

—The U.S. will confine its biological research to defensive measures such as immunization and safety measures.

—The DOD has been asked to make recommendations as to the disposal of existing stocks of bacteriological weapons.

In the spirit of these decisions, the United States associates itself with the principles and objectives of the United Kingdom Draft Convention which would ban the use of Biological methods of warfare. We will seek, however, to clarify specific provisions of the draft to assure that necessary safeguards are included.

Neither our association with the Convention nor the limiting of our program to research will leave us vulnerable to surprise by an enemy who does not observe these rational restraints. Our intelligence community will continue to watch carefully the nature and extent of the biological programs of others.

These important decisions, which have been announced today, have been taken as an initiative toward peace. Mankind already carries in its own hands too many of the seeds of its own destruction. By the examples we set today, we hope to contribute to an atmosphere of peace and understanding between nations and among men.

6.E. *Press release, the White House, 14 February 1970*

On November 25, 1969, the President renounced all offensive preparations for and any use by the United States of biological or bacteriological agents and weapons in war. Since that decision, at the direction of the President, a comprehensive review of United States policy and military programs concerning toxins has been in progress.

Toxins are chemical substances, not living organisms, and are so regarded by the U.N. Secretary General and the World Health Organization. Although the effects of some toxins are commonly described as disease, they are not capable of reproducing themselves and are not transmissible from one person to another.

However, the production of toxins in any significant quality would require facilities similar to those needed for the production of biological agents. If the United States continued to operate such facilities, it would be difficult for others to know whether they were being used to produce only toxins but not biological agents. Moreover, though toxins of the type useful for military purposes could conceivably be produced by chemical synthesis in the future, the end products would be the same and their effects would be indistinguishable from toxins produced by bacteriological or other biological processes. Accordingly, the President has decided that:

The United States renounces offensive preparations for and the use of toxins as a method of warfare;

The United States will confine its military programs for toxins, whether produced by bacteriological or any other biological method or by chemical synthesis, to research for defensive purposes only, such as to improve techniques of immunization and medical therapy.

The President has further directed the destruction of all existing toxin weapons and of all existing stocks which are not required for a research program for defensive purposes only.

The United States will have no need to operate any facilities capable of producing toxins either bacteriologically or biologically in large quantities and therefore also capable of producing biological agents.

These decisions have been taken with full confidence that they are in accord with the overall security requirements of the United States. These decisions also underline the United States support for the principles and objectives of the United Kingdom Draft Convention for the Prohibition of Biological Methods of Warfare.

The United States hopes that other nations will follow our example with respect to both biological and toxin weapons.

The renunciation of toxin weapons is another significant step, which we are willing to take unilaterally, to bring about arms control and to increase the prospects of peace.

6.F. *Resolution adopted by a General Assembly of the International Association of Microbiological Societies, August 1970*

The microbiologists taking part in the conference on biological warfare at the 10th International Congress for Microbiology in Mexico, 1–14 August, 1970, have studied and discussed in detail much material including:

1. Report of the UN Secretary-General (1969), *Chemical and Bacteriological (Biological) Weapons and the Effects of their Possible Use.*

2. Report of a WHO Group of Consultants (1970), *Health Aspects of Chemical and Biological Weapons.*

3. Stockholm International Peace Research Institute (SIPRI) (1970), *The Problem of Chemical and Biological Warfare,* Provisional Edition, Parts I, III and IV.

Therefore they are cognizant of the great potential dangers of human, animal, and plant infections to the welfare of mankind;

Know what grave consequences could result from the use of harmful microorganisms (bacteria, fungi and viruses) or their products as instruments of warfare;

Declare that microbiological methods of warfare should not be employed, even in retaliation;

Believe also that no country should produce, sell or acquire microbial agents in quantity, except for peaceful purposes or to improve the health and wellbeing of Mankind;

Convinced also that: 1. the search for truth in science is enhanced by nonsecret research, and that secret research tends to increase mistrust and international tension; 2. the results of scientific investigation should be published and widely disseminated; and 3. the free movement of scientists from one laboratory or one country to another is an important aspect of science;

Realizing that the pursuit of these aims is shared by the vast majority of Mankind as indicated by:

a. the fact that a majority of UN member states have already signed and ratified The Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and Bacteriological Methods of Warfare (Geneva, 17 June, 1925);

b. the scope of the United Nations General Assembly Resolutions 2162 (XXI) of 5 December, 1966, and 2454 (XXIII) of 20 December, 1968, which called for strict observance by all states of the principles and objectives of the Geneva Protocol;

c. the trend among nations to go beyond the provision of the Geneva Protocol, for instance by unilateral renunciation of use under any circumstances of biological weapons and of any further research and development of such weapons;

d. the fact that several nations have by treaty renounced the use of weapons of mass destruction;

e. the resolutions passed by many professional societies and congresses;

Affirm, support and welcome further positive activities of the same kind, and particularly *We urge that:*

a. all countries that have not signed or ratified the Geneva Protocol should do so, and

b. all installations (laboratories, academies, institutes, etc.) where established microbiological programmes have been carried out expressly for offensive or defensive biological warfare purposes be converted to peaceful uses, if possible with international participation, and that no new installations should be commissioned.

c. all stockpiles of biological weapons should be destroyed as soon as possible.

We believe that existing installations for military microbiology could usefully be converted to any of the following uses:

Applied environmental microbiology
Biogeochemical transformations
Conservation of soils
Crop productivity and biological nitrogen fixation
Production of proteins and other food substances
Production of enzymes and hormones
Purification and recycling of sewage for drinking water
Rapid diagnosis of infectious diseases
Improved means of mass-vaccination
Problems of viral carcinogenesis
Problems of molecular biology
Microbiological pest control, etc.

Although microbiology is our field of competence, we feel that similar principles could usefully be applied as well to chemical, atomic, and other means of mass destruction.

We recommend the use of arbitration in the solution of problems connected with matters related to this resolution.

6.G. *Revised draft convention on the prohibition of the development, production and stockpiling of bacteriological (biological) and toxin weapons and on their destruction, submitted by Bulgaria, Byelorussian SSR, Czechoslovakia, Hungary, Mongolia, Poland, Romania, Ukrainian SSR, and the USSR on 5 August 1971*[1] *(A parallel and identical text was submitted by the USA.*[2]*)*

The States Parties to this Convention,

Determined to act with a view to achieving effective progress towards general and complete disarmament including the prohibition and elimination of all types of weapons of mass destruction, and convinced that the prohibition of the development, production and stockpiling of bacteriological (biological) weapons and toxins intended for use as weapons and their elimination will facilitate the achievement of general and complete disarmament under strict and effective international control,

Desiring thereby, for the sake of all mankind, to exclude completely the possibility of bacteriological (biological) agents and toxins being used as weapons,

Convinced of the immense importance and urgent necessity of eliminating from the arsenals of states such dangerous weapons of mass destruction as weapons using bacteriological (biological) agents and toxins,

Desiring to contribute to the strengthening of confidence between peoples and the general improvement of the international atmosphere,

Believing that scientific discoveries in the field of bacteriology (biology) must in the interests of all mankind be used solely for peaceful purposes,

Recognizing nevertheless that in the absence of appropriate prohibitions the development of scientific knowledge throughout the world would increase the risk of the use of bacteriological (biological) methods of warfare,

Convinced that such use would be repugnant to the conscience of mankind and that no effort should be spared to minimize this risk,

Recognizing the important significance of the Geneva Protocol of 17 June 1925 for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare, and conscious also of the contribution which the said Protocol has already made, and continues to make, to mitigating the horrors of war,

[1] Disarmament Conference document CCD/337.
[2] Disarmament Conference document CCD/338.

Reaffirming their adherence to the purposes and principles of that Protocol and calling upon all States to comply strictly with them,

Recalling resolutions of the United Nations General Assembly, which has condemned all actions contrary to the principles and purposes of the Geneva Protocol of 17 June 1925,

Convinced that an agreement on the prohibition of bacteriological (biological) and toxin weapons will facilitate progress towards the achievement of agreement on effective measures to prohibit the development, production and stockpiling of chemical weapons, on which negotiations will be continued,

Anxious to contribute to the realization of the purposes and principles of the Charter of the United Nations,

Have agreed as follows:

ARTICLE I

Each State Party to this Convention undertakes not to develop, produce, stockpile or otherwise acquire or retain:

(1) Microbial or other biological agents or toxins of types and in quantities that have no justification for prophylactic or other peaceful purposes;

(2) Weapons, equipment or means of delivery designed to use such agents or toxins for hostile purposes or in armed conflict.

ARTICLE II

Each State Party to this Convention undertakes to destroy, or to divert to peaceful purposes, as soon as possible but not later than . . . months after the entry into force of the Convention all agents, toxins, weapons, equipment and means of delivery specified in Article I of the Convention, which are in its possession or under its jurisdiction or control. In implementing the provisions of this Article all necessary safety precautions shall be observed to protect the population and the environment.

ARTICLE III

Each State Party to this Convention undertakes not to transfer to any recipient whatsoever, directly, or indirectly, and not in any way to assist, encourage, or induce any State, group of States or international organizations to manufacture or otherwise acquire any agent, toxin, weapon, equipment or means of delivery specified in Article I of the Convention.

ARTICLE IV

Each State Party to this Convention shall, in accordance with its constitutional processes, take any necessary measures to prohibit and prevent

development, production, stockpiling, acquisition or retention of the agents, toxins, weapons, equipment and means of delivery specified in Article I of the Convention, within the territory of such State, under its jurisdiction or under its control anywhere.

ARTICLE V

The States Parties to the Convention undertake to consult one another and to co-operate in solving any problems which may arise in the application of the provisions of this Convention.

ARTICLE VI

(1) Each State Party to the Convention which finds that actions of any other State Party constitute a breach of the obligations assumed under the provisions of this Convention may lodge a complaint with the Security Council of the United Nations. Such a complaint should include all possible evidence confirming its validity, as well as a request for its consideration by the Security Council. The Security Council shall inform the States Parties to the Convention of the result of the investigation.

(2) Each State Party to the Convention undertakes to co-operate in carrying out any investigations which the Security Council may undertake, in accordance with the provisions of the United Nations Charter, on the basis of the complaint received by the Council.

ARTICLE VII

Nothing in this Convention shall be interpreted as in any way limiting or detracting from the obligations assumed by any State under the Geneva Protocol of 17 June 1925 for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare.

ARTICLE VIII

Each State Party to this Convention undertakes to conduct negotiations in good faith on effective measures for prohibiting the development, production and stockpiling of chemical weapons and for their destruction and on appropriate measures concerning the equipment and means of delivery specifically designed for the production or use of chemical weapons for warfare.

ARTICLE IX

(1) The States Parties to the Convention undertake to facilitate, and have the right to participate in, the fullest possible exchange of equipment,

materials and scientific and technological information for the use of bacteriological (biological) agents and toxins for peaceful purposes.

(2) This Convention shall be implemented in a manner designed to avoid hampering the economic or technological development of States Parties to the Convention or international co-operation in the field of peaceful bacteriological (biological) activities, including the international exchange of bacteriological (biological) agents and toxins and equipment for the processing, use or production of bacteriological (biological) agents and toxins for peaceful purposes in accordance with the provisions of this Convention.

ARTICLE X

Any State Party may propose amendments to this Convention. Amendments shall enter into force for each State Party accepting the amendments upon their acceptance by a majority of the States Parties to the Convention and thereafter for each remaining State Party on the date of acceptance by it.

ARTICLE XI

Five years after the entry into force of this Convention, or earlier if it is requested by a majority of Parties to the Convention by submitting a proposal to this effect to the Depositary Governments, a conference of States Parties to the Convention shall be held at Geneva, Switzerland, to review the operation of this Convention, with a view to assuring that the purposes of the preamble and the provisions of the Convention, including the provisions concerning negotiations on chemical weapons, are being realized. Such review shall take into account any new scientific and technological developments relevant to this Convention.

ARTICLE XII

(1) This Convention shall be of unlimited duration.

(2) Each State Party to this Convention shall in exercising its national sovereignty have the right to withdraw from the Convention if it decides that extraordinary events, related to the subject matter of this Convention, have jeopardized the supreme interests of its country. It shall give notice of such withdrawal to all other States Parties to the Convention and to the United Nations Security Council three months in advance. Such notice shall include a statement of the extraordinary events it regards as having jeopardized its supreme interests.

ARTICLE XIII

(1) This Convention shall be open to all States for signature. Any State which does not sign the Convention before its entry into force in accordance with paragraph 3 of this Article may accede to it at any time.

(2) This Convention shall be subject to ratification by signatory States. Instruments of ratification and instruments of accession shall be deposited with the Governments of . . . . . which are hereby designated the Depositary Governments.

(3) This Convention shall enter into force after the deposit of the instruments of ratification by . . . . Governments, including the Governments designated as Depositaries of the Convention.

(4) For States whose instruments of ratification or accession are deposited subsequent to the entry into force of this Convention, it shall enter into force on the date of the deposit of their instruments of ratification or accession.

(5) The Depositary Governments shall promptly inform all signatory and acceding States of the date of each signature, the date of deposit of each instrument of ratification or of accession and the date of the entry into force of this Convention, and of other notices.

(6) This Convention shall be registered by the Depositary Governments pursuant to Article 102 of the Charter of the United Nations.

ARTICLE XIV

This Convention, the Chinese, English, French, Russian and Spanish texts of which are equally authentic, shall be deposited in the archives of the Depositary Governments. Duly certified copies of this Convention shall be transmitted by the Depositary Governments to the Governments of the signatory and acceding States.

In witness whereof the undersigned, duly authorized, have signed this Convention.

Done in . . . . copies at . . . . . ., this . . . . day of . . . ., ...

Index