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NAVAL POSTGRADUATE SCHOOL
MONTEREY, CALIFORNIA

THESIS

COUNTERPROLIFERATION OF BIOLOGICAL WEAPONS

by

Raymond P. Collins, Jr.

September 1995

Thesis Advisor: Patrick J. Parker

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Thesis
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When the Biological Weapons Convention opened for signature in 1972, the battle against infectious disease appeared to have been won and the biological warfare programs of the United States and Soviet Union seemed to be irrelevant in the global conflict dominated by strategic nuclear weapons. The end of the Cold War, the AIDS epidemic and the biotechnology revolution have shattered the paradigm of 1972. Offensive biological warfare may now be a viable threat. The first chapter evaluates the utility of biological warfare in a tactical battlefield scenario; a strategic scenario; and a special forces or terrorist scenario. The second chapter examines the stages in the development of an offensive program and how the biotechnology revolution has facilitated them. Chapter three examines the decision to use biological and chemical weapons and what can be done to deter that decision.

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Counterproliferation of Biological Weapons

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Submitted in partial fulfillment of the
requirements for the degree of

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ABSTRACT

When the Biological Weapons Convention opened for signature in 1972, the battle against infectious disease appeared to have been won and the biological warfare programs of the United States and Soviet Union seemed to be irrelevant in the global conflict dominated by strategic nuclear weapons. The end of the Cold War, the AIDS epidemic and the biotechnology revolution have shattered the paradigm of 1972. Offensive biological warfare may now be a viable threat. The first chapter evaluates the utility of biological warfare in a tactical battlefield scenario, a strategic scenario; and a special forces or terrorist scenario The second chapter examines the stages in the development of an offensive program and how the biotechnology revolution has facilitated them. Chapter three examines the decision to use biological and chemical weapons and what can be done to deter that decision.

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I. INTRODUCTION

> In the 21st century chemical and biological weapons may pose the kind of threat that nuclear weapons once did. An estimated 25 countries hostile to the United States are trying to build nuclear, chemical or biological weapons. R. James Woolsey DCI, Jan. 24, 1994. (Weiner p. A-25)

In November 1969, when President Nixon unilaterally renounced the use of biological weapons, the battle against infectious disease in the developed world appeared to have been won. The discovery of antibiotics and the development of vaccines had all but stopped mass epidemics. Smallpox, which had wiped out huge segments of indigenous populations as Europeans colonized the globe, was on the verge of eradication.[1]

Military biological warfare (BW) programs in the United States and Soviet Union begun during World War II seemed to be irrelevant in the global conflict dominated by strategic nuclear weapons. Based on the following military criteria for an ideal biological weapon, neither side had produced a weapon which would provide a decisive advantage on the battlefield.

[1]The last reported death from smallpox occurred in 1978. The virus samples at the CDC in Atlanta and the Research Institute for Viral Preparation in Moscow are believed to be the last in existence (There is no absolute way to guarantee the non-existence of any other samples) The WHO is debating the decision to destroy the remaining samples. (Wagner, p. WH-8)

Ideal Biological Warfare Agent

1. Highly virulent, consistently causing disease or death at low concentrations and infective through multiple routes, such as respiration, ingestion and skin contact.

2. Highly contagious--if possible, transmissible from specific animals to humans, but with limited general spillover that would create an uncontrollable epidemic among many species.

3. Short, predictable incubation period from exposure to onset of symptoms.

4. Robust in the environment under adverse conditions (eg. heat, light, desiccation and shear forces), but short lived, with predictable persistence if a target area is to be occupied by attacking troops.

5. Deniable--either endemic to the target region or causing symptoms that mimic those of endemic diseases.

6. Medical defense difficult--target population or army should have little or no natural or acquired immunity and little recourse to immediate, effective prophylaxis or medical treatment.

7. Countermeasures ultimately available such as antibiotics, vaccines and/or protective equipment, as well as decontamination methods, should be available to aggressor troops, civilians, and ultimately, target groups after occupation.

8. Suitable for economical mass production in militarily significant quantities from available raw materials.

9. Stable within munitions during storage and transportation, and amenable to dissemination by aerosol spraying, explosion, or living vectors (such as mosquitos or fleas).

10. Psychologically effective--the attack should produce terror or demoralization.

11. As host-specific as possible to reduce the risk of generalized damage to the biosphere. (Piller, pp. 93-94, Geissler, pp. 21-22, U.S. Congress, p. 77)

The Nixon biological weapons disarmament initiative which coincided with the ratification of the Nuclear Nonproliferation Treaty and strategic arms limitation negotiations (Naughton, "Nixon Renounces . . ." p.1) culminated in the 1972 Biological Weapons Convention (BWC).[2] The BWC was the first true disarmament convention. Unlike the 1925 Geneva Protocol which only outlawed the use of chemical and biological weapons in warfare, the BWC banned biological and toxic weapons development, production, stockpiling and mandated the destruction of any existing weapons. (BWC Art. I-III) The BWC is nondiscriminatory, imposing the same responsibilities on all states. (Piller, pp. 162-163) Due to the international political constraints of the time, the more contentious issue of chemical weapons disarmament was deferred to prevent delay of the BWC. The BWC did not create an international treaty oversight organization like the International Atomic Energy Agency (IAEA), so compliance was left to national, rather than international, means. Verification of compliance was recognized as an inherent weakness of the convention, but more comprehensive measures such as on site inspection and coordinated export controls were not politically viable in 1972. (Geissler, pp. 82-86 & 138-146)

[2]The United States destroyed its existing BW stock and converted its offensive BW program to a defensive one.(Piller, p. 64) The Soviet Union continued its offensive program at least until 1992 when Russian President Yeltsin admitted to the program and signed a decree ordering its end.(Barry, p.41) Recent reports indicate that the Russian military may be continuing the program without Yeltsin's knowledge.("Russian Military . . ." p. A-10)

The world has radically changed since 1972. The Cold War, which defined East West relations for fifty years, is over. The Soviet Union and its Eastern European empire imploded under its own weight. This new political reality allowed the completion of the long delayed chemical weapons disarmament negotiations. The Chemical Weapons Convention (CWC), which contains provisions for international on-site inspections to verify compliance opened for signature in January, 1993. (CWC, Art. IX)

The AIDS epidemic and the discovery of even more deadly pathogens such as Embola virus have shattered the illusion that man has conquered infectious disease. New strains of diseases, such as tuberculosis, that are resistant to treatment are now a grave concern of the medical community. (Krieger, p. A-14)

Science and technology have also radically changed what is possible in the field of molecular biology. Even as the BWC was being finalized some of the assumptions on which the treaty was based were being challenged by the first recombinant DNA (rDNA) experiments. For the first time the direct manipulation of the genetic code was possible. Genes could be transferred from one organism to another. As soon as the results of these first experiments were released, concerns were voiced that uncontrolled rDNA experimentation could result in the accidental release of a deadly pathogen created in the laboratory. Debate over the possible hazards led to the strict research guidelines recommended at the Asilomar Conference in February, 1975, one month before the BWC entered into effect. The

National Institutes of Health adopted the guidelines in early 1976. Genetic engineering research in the United States was hampered by these guidelines until 1979 when the guidelines were eased, allowing more freedom of experimentation. (Watson, pp. 1-90) Soon after the NIH eased its guidelines, the forefront of rDNA shifted to biotechnology industry. (Piller, p. 184) The first product produced by rDNA, human insulin, which is produced in E. coli bacteria began production. Application of rDNA has allowed the cost-effective production of synthetic organic products. (Watson, p. 465-527.)

With the change in the world situation brought on by the end of the Cold War and the innovations of the biotechnology revolution, is offensive BW now a viable threat? To answer this question chapter one will evaluate the utility of BW in three scenarios: a tactical battlefield scenario where BW use is similar to battlefield chemical warfare; a strategic scenario in which strategic delivery vehicles are used to attack rear areas; and a special forces or terrorist scenario in which a small unit clandestinely delivers the BW agent. The second chapter will examine each stage in the development of offensive BW programs for use in each of the same scenarios. Chapter three will examine the decision to use biological and chemical weapons and what can be done to deter that decision.

II. IS THERE A BIOLOGICAL WARFARE THREAT ?

This chapter will evaluate the utility of BW in three scenarios: a tactical battlefield scenario where BW is similar to battlefield chemical warfare; a strategic scenario in which strategic delivery vehicles are used to attack rear areas; and a special forces or terrorist scenario in which a small unit clandestinely delivers the BW agent. Each of the use scenarios will examine the effect on the armed forces or population of a developed nation such as the United States and those of a less developed nation.

A. TACTICAL BATTLEFIELD SCENARIO

Under this scenario, BW would be used in a tactical battlefield application similar to tactical battlefield use of chemical warfare. This scenario will consider the direct effects of the pathogen on the troops as well as the loss of combat effectiveness caused by protective measures and increased logistics requirements for the defending forces.

1. Desert Storm

Historically, epidemics of infectious disease have claimed far more lives during wars than combat casualties. (Heggers, pp. 390-394) During Desert Storm Allied Forces faced the possibility that Saddam Hussein's forces would use

biological weapons against them. Despite crash programs to produce anthrax vaccine, not all troops were fully vaccinated.[3] Prophylactic vaccination requires the foreknowledge of which agent will be used. Some vaccines only provide immunity for a limited time period or require a period of time before full immunity is conferred. Through genetic engineering, the agent can be altered rendering standard vaccines useless. (Piller, pp. 97, 116, 120)

If Iraq had used biological weapons, Allied Forces would have been forced to don protective gear. The United States Army estimates that the donning of chemical biological warfare (CBW) protective gear would cause an immediate fifty percent loss in combat effectiveness to U.S. forces, with combat effectiveness continuing to rapidly decrease the longer the gear is worn. This effect is exacerbated by hot or humid weather. (Spiers, p. 67) Properly prepared forces could launch a BW attack without having to don protective gear and exploit the loss of combat effectiveness imposed on the opposing forces. (Spiers, p. 67) U.S. ground forces in Saudi Arabia carried a limited supply of gas mask filter canisters and had only a one day supply of sealed water. The need to decontaminate equipment and resupply units with protective gear and water would have seriously slowed the advance of Allied Forces. (Author's conversations with Gulf War ground force veterans.)

[3]Full immunity to anthrax requires three vaccine doses spread out over a 30 day period. None of the Gulf War ground force veterans interviewed by the author received the full course of vaccination.

B. STRATEGIC SCENARIO

This scenario will examine the use of strategic delivery of biological weapons against rear areas. Combat aircraft, ballistic or cruise missiles are not required for the strategic delivery of biological weapons. For a surprise attack prior to the outbreak of hostilities, time and the ability to penetrate defenses are not a factor. Strategic biological weapons could be delivered in militarily significant quantities by a civilian aircraft, ship, submarine or truck. (U.S. Congress pp. 197, 201) If the area attacked were a key transportation, command and control or logistics center, mobilization and resupply could be seriously disrupted and therefore affect the outcome on the battlefield. (Spires, pp. 131, DIA, 60-62)

This scenario will use the outbreak of disease during a large scale natural disaster as a model for the use of biological weapons during the disruption caused by an ongoing conflict. In a large country, natural disasters such as hurricanes, floods and earthquakes are confined to a small portion of the total area. Residents of small countries are not as lucky. In 1988 severe flooding submerged over two thirds of Bangladesh. (Kristof, "The Everyday . . ." p. A-1) In large nations, with developed infrastructure, emergency supplies and relief workers can quickly be brought from unaffected areas into the disaster zone. In developing nations with poor communication, a relatively minor illness may result in death because of the time required to reach medical treatment. (Brooke, p. IV-3)

1. Valley Fever in California

The January 1994 Northridge earthquake caused an outbreak of Valley Fever (Coccidioidomycosis), a flu-like illness caused by inhalation of a fungus (Coccidioides immitis) living in the soil. The earthquake and cleanup efforts created large clouds of dust which contained the fungus spores. One-third of those who inhale the spores contract Valley Fever. The infection is treatable with anti-fungal drugs. (Ayers, p. A-21) The disease has an incubation period of several weeks and a one percent mortality rate among victims who receive treatment and up to 50 percent for untreated cases. People of African descent are up to 10 times more susceptible to Valley Fever than are Caucasians. (Piller, pp. 100, 245) A 1992 outbreak affected 4,000 and killed 34 people in Kern County California. (Arax, p. A-1) Valley Fever was one of the pathogens investigated by the Naval Biological Laboratory at the University of California, Berkeley during the 1950's and 1960's. (Cookson, p. 82) The U.S. Navy conducted BW tests using a fungal simulant (Aspergillus fumigatus) for Valley Fever at the Mechanicsburg, Pennsylvania supply depot in 1951. The Mechanicsburg depot was chosen for the test because the incapacitation of the African American workers, who comprised a high percentage of the employees, would have caused a serious disruption of the Navy supply system. (Piller, p. 100)

2. Cholera in Bangladesh

Every year in Bangladesh 870,000 children under the age of five die. One-third of those deaths are caused by simple diarrhea. (Kristof, "In Bangladesh

. . ." p. A-1) The annual flooding season brings an outbreak of endemic Cholera. (Brooke, p. IV-3)

Cholera is water-borne disease caused by a bacteria (Vibrio comma). (Piller, p. 244). The symptoms, which can begin within a few hours of infection, are a high fever, vomiting and diarrhea resulting in critical dehydration. Cholera is treated by intravenous rehydration and antibiotics. (Brooke, p. IV-3) The mortality rate for untreated victims is as high as 80 percent. (Bailey "Doomsday Weapons . . ." p. 83) Cholera was one of the first pathogens considered for possible BW use. The Japanese are alleged to have used it to contaminate wells in Manchuria during World War II. (Piller, p. 35, Cookson, p. 56)

The cyclone which struck Bangladesh in 1991 killed 139,000 people. Cholera, spread by sewage contaminated water, killed thousands more in coastal areas where all of the homes were destroyed and half the people killed by the storm. The death toll would have been much higher if 8,000 U.S. troops had not been deployed to the area for disaster relief with water purification equipment. (Kristof, "The Every . . ." IV-3, "In Bangladesh's . . ." p. A-1)

3. Anthrax in Sverdlovsk

The anthrax bacteria (Bacillus anthracis) is considered by many to be the prototypical BW agent. The anthrax bacteria forms spores which can survive explosive dissemination. The spores remain viable in the environment under

adverse conditions for an indefinite period.[4] Anthrax can be contracted by skin contact with the spores (cutaneous anthrax), ingestion of contaminated food or water (gastric anthrax) or inhalation (pulmonary anthrax). (Piller, p. 170) Pulmonary anthrax has an incubation period of one to seven days and is 99 percent fatal if not treated. (Bailey, "Doomsday Weapons . . ." p.83) The anthrax bacteria produces a toxin that interferes with the transmission of nerve impulses resulting in respiratory failure and death. (Geissler, p. 162)

On the morning of April 3, 1979, five to ten kilograms of anthrax spores were released by an accident at the Microbiology and Virology Institute laboratory in Military Compound 19 located in the Chkalovskiy district of Sverdlovsk. The next day people who lived or worked down wind of Military Compound 19 began to fill local hospitals. Their symptoms included extremely high fever and breathing difficulty. Within a few hours of hospitalization, victims began to die. Soon after the accident Soviet military and KGB forces secured the area and took over cleanup and medical treatment. All medical records were seized and the victims bodies were not returned to families. The Soviets acknowledge 79 civilian casualties with 64 deaths. According to Western estimates, total casualties were as high as 1,000 dead. The population of the Chkalovskiy district were vaccinated for anthrax. An area of three to four square miles was sprayed with disinfectant by aircraft. The

[4]Anthrax spores from British BW experiments during World War II on Gruinard Island remained viable until the recent decontamination of the Island. The environmental persistence of anthrax may preclude it's use on territory that will eventually be occupied by friendly forces (Leitenberg, p.12 White)

area in the immediate vicinity of Compound 19 was decontaminated with hypochlorite and the top soil was partially removed. The extensive decontamination efforts inside Compound 19 lasted for five years and included the removal of plaster and equipment and the replacement of entire floors. The two month long Sverdlovsk human anthrax outbreak is the worst in Russian history. (Leitenberg, pp. 10-13, White)

When questioned by the Carter administration at the March, 1980 BWC review conference, the Soviets claimed it was an outbreak of intestinal anthrax caused by contaminated meat. A more elaborate version of the same story was presented at the BWC second review conference in 1986.

In 1988, three representatives of the Soviet and Russian Republic Ministries of Health gave public presentations of the contaminated meat story at the National Academy of Sciences and two other locations in the United States. One of the three, Vladimir N. Sergiyev, Chief Specialist in Infectious Diseases of the Russian Republic's Ministry of Health, indicated that he had participated in some of the Sverdlovsk autopsies. (Leitenberg, p. 11) Despite the contrary evidence presented by the United States, the international community largely accepted the Soviet account of the Sverdlovsk incident. (Piller, pp. 169-171, Barry, p. 40, Begley p. 25)

Starting in March of 1990, after Soviet President Gorbachev's policy of Glasnost allowed some freedom of the press, accounts of what actually happen in

Sverdlovsk began to appear in Soviet newspapers. The articles attributed the anthrax outbreak to an accident at the laboratory in Military Compound 19 and documented the cleanup efforts. Medical personnel who attended to the victims or preformed the autopsies stated that the outbreak was pulmonary anthrax. (Leitenberg, pp. 11-12) The diagnosis of pulmonary anthrax has been verified by a joint team of Russian and American pathologists. The team re-examined tissue samples from 42 of the Sverdlovsk victims and determined all had been infected with pulmonary anthrax. (Abramova, pp. 2291-2294)

The Sverdlovsk incident illustrates the effectiveness of a relatively small point source release of a BW agent and the level of effort required to decontaminate after such an attack. It also illustrates the difficulty of proving to the international community that a BW incident has occurred when the truth is being obfuscated by a concerted disinformation campaign.

C. SPECIAL FORCES/TERRORIST SCENARIO

In a special forces or terrorist scenario, a small unit or individual clandestinely delivers the BW agent. Biological weapons are particularly well suited for clandestine attack, because unlike radiological weapons, BW agents have no signature which can be detected by external inspection. The 30 kilograms of anthrax spores contained in a nominal ballistic missile biological weapons warhead would be much easier for a small special forces unit to carry than the 300 kilograms of sarin in a nominal CW warhead.(Fetter, p. 27) Getting a militarily significant

amount of BW agent through entry customs would be easier than importing narcotics. B77W agent could be spread over a large area target with mosquito abatement spraying equipment mounted on a light truck. A city's water supply could be contaminated with BW agent. The ventilation system for a large office building or sports complex could be used to disseminate the agent. More people were injured seriously enough to require hospitalization by the smoke from the resulting fires than by the bomb blast in the World Trade Center in 1993. If the bombers had used a BW agent instead of a bomb they could have killed or injured a far greater number of people with a lower probability of getting caught.

This scenario will use the accidental introduction of an exotic or unknown pathogen and subsequent epidemic as a model.

1. Legionnaire's Disease

During an American Legion convention in Philadelphia in July, 1976, 181 people were stricken with a pneumonia like illness. The outbreak claimed the lives of 39 people. (Schmeck, "Scientists Link . . ." p. A-1) After a crash research program, the Center for Disease Control (CDC) found the cause to be a previously unknown bacterium, Legionella pneumophila. Legionnaire's disease is spread by bacteria contaminated mist from air-conditioning system cooling towers. (Root-Bernstein, pp. 48-49) The bacteria was found to have been the cause of several previous outbreaks of mysterious pneumonia which had baffled medical experts. (Schmeck, "Experts Think . . ." p. A-1) The CDC estimates there are 10,000 to

50,000 cases of Legionnaire's disease in the United States each year. A September 1991 outbreak closed the Social Security Administration building in Richmond California, and the 1,200 employees who process benefits for 4.5 million people were placed on administrative leave. (Mathews, p. A-3)

2. Hanta Virus

In May, 1991 a mysterious aliment claimed the lives of 11 Navajo Indians on a reservation in the Four Corners region. CDC investigators isolated the cause as a previously unidentified strain of Hanta Virus. The Hanta Virus is one of a family of viruses which cause hemorrhagic fever. Korean Hemorrhagic fever is caused by a rodent-borne virus, which istransmitted by contaminated water and primarily affects the kidneys. During the Korean War thousands of U.S. servicemen were stricken with the illness. (Larson, p. A-1, Geissler, p. 22) Unlike previously identified Hanta Virus strains, the new infection is caused by inhalation of rodent droppings, dust contaminated with rodent urine or through direct contact with infected rodents. The virus was originally isolated in deer mice, but it has now been found in several species of rats and mice. Victims can only be treated for the symptoms; there is no cure or vaccination. ("Hanta Virus . . ." p. C-13) As of January, 1994 there have been a total of 53 confirmed cases of Hanta Virus in 15 states. The disease has a 60 percent mortality rate. The infection starts like the flu, then the lungs begin to fill with fluid from leaking capillaries and patient literally drowns. (Larson, p. A-1)

Fortunately, the virus is not transmittable from person to person and has a low rate of infection. The family of a woman in Kansas who contracted the disease from handling dead mice tested negative for Hanta Virus antibodies, proving that they had never been exposed. Health officials recommend that all wild rodents be considered to be infected with Hanta Virus. The original Four Corners outbreak and an October, 1993 case in South Florida have been attributed to unusual increases in the rodent population. The mild 1992-1993 winter in the southwest and the devastation wrought by Hurricane Andrew resulted in an explosion in the number of rodents. (Larson, p. A-1)

III. OFFENSIVE BIOLOGICAL WARFARE

The development and deployment of an offensive BW capability would follow the stages used for the development and deployment of any ordnance. (Geissler, pp. 87-88) The evaluation of each stage will include:

1. A description of the procedures
2. The type of facility required
3. The expertise required
4. How biotechnology has facilitated the stage
5. An approximation of the cost
6. An approximation of the time required
7. The comparable level of biotech infrastructure and capability
8. Applicability to each of the three types of programs evaluated

A. STAGES IN THE DEVELOPMENT OF A BW OFFENSIVE CAPABILITY

Offensive BW Decision

1. Policy review of pros and cons of an offensive BW effort and decision by government to proceed or continue
2. Preparation of detailed budgetary estimates for research and development

Research, Development, and Weaponization

3. Voting of R&D budgets

4. Recruitment of R&D personnel

5. Organization of research facilities

6. Selection of projects for research

7. Acquisition of microbial agent

8. Genetic manipulation of agent

9. Selection of research projects for development

10. Organization of development facilities

11. Development of agent manufacturing techniques

12. Vaccine development

13. Protective equipment development

14. Development of munitions, including test and evaluation

15. Standardization of weapons for possible procurement

Large Scale Production

16. Preparation of budgetary estimates for procurement and maintenance

17. Voting of procurement and maintenance budgets

18. Procurement of raw materials

19. Production of agents

20. Production of vaccines

21. Production/importation of protective equipment

22. Bulk transport of agents

23. Bulk storage of agents

24. Manufacture of munitions

25. Filling of munitions with agent (possibly included with item 19)

26. Storage of filled munitions

Deployment and War Plan Integration

27. Development and integration of employment doctrine

28. Training of troops in defense procedures

29. Training of individual troops in offensive techniques

30. Mass inoculation of troops/civilians

31. Deployment of matériel in forward areas

32. Troop maneuvers including agent exercises(Geissler, p. 88 U.S. Congress, pp. 83-84)

B. OFFENSIVE BW DECISION

The decision to acquire an offensive capability would not necessarily be the first step in the process. The BWC allows defensive BW programs. Intent is all that separates an offensive from a defensive program, particularly in the early stages. Many of the organisms considered as possible BW agents are endemic to the countries which present the highest proliferation concern. Knowledge gained in infectious disease medical research and vaccine development is directly applicable to offensive biological weapons development. This latent BW capability will only increase with the expansion of the biotechnology industry. (Geissler, pp. 66-73, U.S. Congress) Under the terms of the Biodiversity Convention, developing nations

are to be given preferential access to biotechnology in exchange for access to their biological natural resources. Transnational corporations are setting up biotechnology operations in developing countries to avoid the restrictive regulations imposed over genetic engineering in the United States and Europe. (Munson, pp. 503-505) A program which began as peaceful BW defense or medical research could quickly be diverted by a change in the government or national security situation.

C. RESEARCH, DEVELOPMENT, AND WEAPONIZATION

BW is a perverse reversal of public health. The causal agents are highly pathogenic bacteria, virus, fungi and rickettsia. BW agents are able to reproduce themselves so only a small sample is needed to start a BW program. Samples of potential BW agents such as anthrax can be obtained by isolation from nature or through biological supply firms like the American Type Culture Collection or from the CDC. (Strum, p. 88)

Under current biosafety standards in the United States and Europe research and development projects using the human pathogens, considered the most likely BW agents, are conducted under strict BL3 or BL4 containment.[5] Research on

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[5]There are four levels of physical containment for biohazardous material. BL1 (P1) is the least stringent and only requires normal safe laboratory procedures to contain material not known to cause disease in healthy adult humans. BL4 (P4), the highest physical containment requires special practices, facilities and safety equipment (for example positive pressure personnel suits) to contain exotic organisms which pose a high risk of life threatening disease. Most potential BW agents require BL4 containment (U.S. Department of Health pp. 46279-46291 and Guidelines for. . pp. 5-17)

plant or animal specific pathogens can be safely conducted under less stringent BL1 or BL2 containment. (Geissler, p.96) These biosafety standards are not necessarily followed in less developed countries. If the researchers involved are willing to assume the additional risk, even the most deadly pathogens can be handled at lower levels of containment. When the United States dismantled its offensive BW program, the highest level of containment it was using at the time is only comparable to a BL2 containment facility of today. (Bailey, "Iraq Inspections . . ." p. 50) During the United Nations disarmament, it was discovered that Iraq was conducting research on foot and mouth disease under BL2 or BL3 containment. (Bailey, "Iraq Inspections . . ." p. 49) The NIH classifies the foot and mouth disease virus as a class five pathogen requiring the highest level of containment. Importation of class five pathogens into the United States is forbidden by law. (U.S. Department of Health, p. 46276))

Nations or subnational organizations with access to even modest microbiology research facilities are no longer limited to naturally occurring pathogens. Biotechnology has made it possible to create superior biological weapons. One of the main ways that BW agents are improved over nature is by increasing their resistance to standard medical treatments. Due to the misuse of antibiotics in medical treatment and livestock production, this process is occurring naturally. Drug-resistant pathogens now present a major threat to world health. Bacteria are

able to naturally pass antibiotic resistant genes to bacteria of other strains. Staphylococcus, the bacteria most commonly responsible for post-operative infections is now resistant to all but the "last-resort" antibiotic, vancomycin. Enterococcus, the third most common cause of post-operative infections is now resistant to all antibiotics. Enterococcus may pass its resistance to staphylococcus and other bacteria with deadly results. (Krieger, A-14) Rather than waiting for this process to occur naturally rDNA technology allows the direct and deliberate manipulation of genetic code. A small change in the DNA sequence which controls the production of a virus outer protein coat would render standard vaccines useless against the new manmade strain. (Piller, p. 97)

In an effort to reduce the cost and environmental impact of chemical pesticides, insect pathogens are being used on an experimental basis as biological pesticides. Thirty species of Bacillus thringiensis (Bt), a spore forming bacteria, which produces a protein that destroys insect stomachs, can be applied to crops in a powder or liquid form. Genetic engineering research is being conducted to shorten the time insect virus and fungi pathogens take to kill. (Howe, "All . . ." p. D-5)

All of the research and development associated with biological pesticides is directly applicable to a offensive BW. The research and development could also be used to obfuscate the existence of a BW program. The large scale testing of biological weapons to simulate use under battlefield conditions would require an

expansive controlled area such as the Dugway proving grounds. (Geissler, pp. 102-103) This activity could be disguised as a legitimate test of biological pesticide. (U.S. Congress p. 102)

D. LARGE SCALE PRODUCTION

The biotechnical revolution is greatly improving the efficiency of producing organic products. Production of a large quantity of product used to require large capacity fermentors producing single batches. The technology is now available to continuously produce the same amount of product in a laboratory facility. (U.S. Congress, p. 103) Using rDNA, the genes which produce a desired protein can be inserted into bacteria, yeast or animal cells and cultivated in large vats. Prior to rDNA technology, production of these proteins required the labor intensive extraction from large amounts of plant or animal tissue where it occurred naturally. Splicing the genes directly into embryonic plants and animals can produce the same proteins for-one half to one-tenth the cost of production in fermenting vats. Another production method which does not affect the heredity, and therefore bypasses the need for creating a new line of plants, uses the disarmed tobacco mosaic retrovirus to introduce new genes into tobacco plants. The protein gene is spliced into the virus and the virus is dusted or sprayed onto adult plants. The tobacco plant then begins to produce the protein in its leaves, from where it can be extracted. (Barnum, p. E-1)

The modern biomedical facilities used for this type of production are no longer unique structures. The biotechnology industry is now growing at a faster rate than the electronics industry did at a comparable stage of development. (Wolf, p. D-1) Due to health, safety and purity requirements, many new facilities for vaccine or pharmaceutical production are being constructed with the BL4 containment needed for the safe containment of the most deadly pathogens. (U.S. Congress, p. 92) Although most of the rapidly expanding biotechnology infrastructure is located in industrialized nations, the high cost of labor in Europe and North America is causing labor intensive portions of the biotechnology industry such as plant tissue-culture to relocate to developing nations like India. (McDonald, p. 44)

Modern production facilities and technology with possible BW application are not limited to just BW agent production. The same economic and environmental imparities which are driving biological pesticide resource and development have caused the raising of beneficial bugs to become big business. Billions of insect predators and parasites are being raised in breeding facilities as a substitute for chemical pesticides. The beneficial insect larva are mixed with rice hulls or vermiculite and can be sprayed on with a crop duster. (Howe, "Raising . . ." p. D-1) The technology used to breed these insect predators is the modern equivalent to that used by the Japanese BW program in China during World War II to produce human flea vectors for plague. (Cookson, p.302 White)

Large containment laboratories and modern equipment are not required for a biological weapons capability. BW agents can be produced in small flasks using manual methods. "The Iraqi BW program at Salman Pak employed only 10 people (according to Iraqi claims), utilized 7 or 8 rooms and had no sophisticated equipment." (Bailey, "Iraq Inspections . . ." pp. 50-51) The production of a biological agent for use in a terrorist attack is no more difficult than the production of heroin. (Stern, p. 402

E. DEPLOYMENT AND WAR PLAN INTEGRATION

To fully integrate biological weapons into a conventional battlefield force would require the same effort it would take to integrate CW. As an example, the North Korean Army (KPA) is the world's most prepared to fight in a CBW environment. The KPA uses weakened chemical agents for major training exercises. Unlike western NBC training exercises which last, at most, a few hours, KPA units spend up to ten days in protective gear. Units down to squad level receive extensive offensive CBW training. North Korea (DPRK) produces it's own CBW warheads for large caliber mortars, rockets, and Frog and Scud variant missiles. The DPRK has independently developed and tested an offensive biological weapons capability. The DPRK has also developed self-sufficiency in NBC protective equipment production. KPA doctrine includes first use of CW in plans for the liberation of the Korean peninsula. (Bermudez, pp. 226-228) KPA

missiles armed with CBW warheads can hit targets in all of South Korea and now threaten parts of Japan, Russia and China. (Ertman, pp. 612-617)

IV. WEAPONS OF MASS DESTRUCTION DETERRING A RATIONAL CHOICE

> The purpose of nuclear forces is to deter the use of weapons of mass destruction and to serve as a hedge against the emergence of an overwhelming conventional threat. The need for nuclear deterrence is a continuing one whether the nation is at peace or our troops are responding to a contingency in some region of the world. (National Military . . . p. 13)

A. WEAPONS OF MASS DESTRUCTION: A RATIONAL CHOICE ?

Nuclear, chemical and biological weapons, when considered as a group, are referred to as weapons of mass destruction. Nuclear weapons, which are possessed by only a relatively few countries, have only been used in warfare twice by one country. Chemical and biological weapons are possessed and have been used by a larger and ever increasing number of countries. The inherent dual-use nature of CBW technology and materials, along with their relatively modest cost, does not present the barrier to acquisition that obtaining fissile material and other specialized nuclear technology does. All countries with even a rudimentary biomedical or chemical industry infrastructure have a latent indigenous ability to produce CBW agents. The ease of production and modest cost of CBW agents doom international counterproliferation efforts to stop a determined proliferator.

With no reliable way to prevent the acquisition of CBW weapons, it is incumbent upon the United States and the international community to deter their first use. The first step in deterring the use of CBW is understanding why states choose to break international law and employ banned weapons. Once the

dynamics of the use decision are understood, deterrent strategies can be developed to influence that decision.

1. International Agreements

The codification of the laws of war into binding international agreements began in the second half of the nineteenth century. Since that time there have been numerous attempts to outlaw specific weapons on humanitarian grounds. Most of these efforts failed to reach the international consensus required for their incorporation into a binding regime. All of the international agreements which have been reached have ultimately failed.

a. Explosive Projectiles

The 1868 St. Petersburg Declaration was the first modern attempt to ban the use of a specific weapon in warfare. The Declaration banned the use in war of explosive or incendiary projectiles weighing less than 400 grams (14 oz). Although the Declaration only applied to war between the states party to the Declaration, it established the international legal precedent that weapons which cause needless suffering are against the laws of humanity. (A. Roberts, pp. 30-31) Technically, the Declaration still remains in effect. In practice, the Declaration, along with most other pre-1914 agreements, did not survive World War I.

World War I was the first time that hand grenades were used extensively. The trend in grenade development has been to reduce size and

weight. The smaller grenades allow the soldier to carry more and throw farther.[6] Most thrown or rifle projected grenades weigh less than 400 g. (Lumsden, pp. 126-135, 212, 220)

b. Dumdum Bullets

The use of dumdum bullets in war was outlawed by the 1899 Hague Declaration which was the first codification of the laws of land warfare. The dumdum bullet, which is a semi-jacketed bullet with a 1 mm soft point, gets it's name from the British Dumdum Arsenal near Calcutta, India where it was first produced. Dumdum bullets expand or flatten in the human body causing a larger wound than a similar fully jacketed bullet. (Lumsden, pp. 213-214) The British argued that the increased stopping power of the dumdum was needed when fighting against savage races such as the tribesman of Northwest India. (Best, p. 162) The United States objected to the declaration on the grounds that, although its specific language outlawed one type of bullet, there were other methods by which a bullet could be made that had identical effects. (Lumsden pp. 214-215) Although the prohibition against non-full metal jacket ammunition remains in force,[7] the spirit of the declaration has been overtaken by technology as predicted in the American objection. Modern military rifles use small, high velocity spritzer (pointed) bullets

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[6]Effective throw distance for a 400 g grenade is 30 meters. A 250 g grenade can be thrown approximately 40 meters with only a slightly reduced kill radius.

[7]United States armed forces law of armed conflict training specifically prohibits altering ammunition to make dumdum bullets. (Naval . . p. 19)

which tend to tumble after entering the human body producing an effect similar to the dumdum. Moreover, the use of smaller bullets allows the individual soldier to carry more rounds. (Lumsden, pp. 55-56)

c. Chemical and Biological Weapons

The first international agreement to codify the customary prohibition against using poison in warfare was the 1899 Hague Declaration II. The Declaration banned the use of poison gas projectiles. (Best, p. 160) The specific prohibition against poison gas projectiles was broadened in the 1907 Hague Convention IV Annex Regulations Respecting the Laws and Customs of War on Land. Article 22 states that "The right of belligerent to adopt means of injuring the enemy is not unlimited." Article 23 states, in part, that "in addition to the prohibitions provided by special Conventions, it is especially forbidden (a) To employ poison or poisoned weapons; (b) To kill or wound treacherously individuals belonging to the hostile nation or army; (e) To employ arms, projectiles or material calculated to cause unnecessary suffering." (A. Roberts, p. 52) The 1907 Hague Convention IV was recognized as a declaration of customary international law by the International Military Tribunal at Nuremberg and, as such, they remain in effect. (A. Roberts, P. 44)

(1) World War I. Contrary to the predictions of a quick victory by most military planners, the western front of World War I degenerated into inconclusive trench warfare. To break the stalemate, both sides began

experimenting with poison gas. The French were the first to use gas in combat. They used tear gas in small quantities in 1914 without effect. The first major gas attack was on April 22, 1915 at Ypres. The Germans used 6000 cylinders containing 165 tons of chlorine along a front of six to seven kilometers. German tactical mistakes and lack of ready reserves prevented them from a major exploitation of the surprise attack. (Spiers, pp. 69-74)

The millions of tons of chemical agent used in World War I did not break the stalemate. The use of gas resulted in over one million casualties and over 90 thousand deaths. These numbers seem large except when compared with the total carnage which the war brought about. Only 5.7% of the total casualties and 1.4% of the combat deaths were the result of chemical warfare. (Cookson, pp. 283-286)

(2) 1925 Geneva Protocol. The failure of the Hague Agreements and the massive use of chemical weapons led to the 1925 Geneva Protocol. The Protocol banned the use in war of asphyxiating, poisonous or other gases, all analogous liquids and bacteriological methods of warfare. (A. Roberts, pp. 137-145) The prohibition was not violated by the parties to the Protocol during World War II[8] and has only been violated on a relatively few occasions given the several hundred international conflicts which have occurred since it came into force. (Elisa Harris, "Flaws in the Proposed ICWA" in Jensen, p. 28) Why all other international

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[8]Japan, which used both biological and chemical weapons during World War II, signed the Protocol in 1925 but did not become a party until 1970.

agreements outlawing specific weapons have failed and violations of the 1925 Geneva Protocol remain exceptional is the subject of much intellectual debate. The explanatory arguments can be broken down into six categories. The categories are international law, domestic political, horrors of war, retaliation in kind, military utility and rational choice.

2. International Law

The international law theory holds that states have been constrained from using CBW by the Geneva Protocol and the international consequences for violating an accepted norm of state behavior. This theory fails as an explanation on two accounts. First, on the three occasions when undisputed use of chemical weapons came to the attention of the international community while the violation was ongoing, the transgressor was a party to the Protocol. During the 1935-36 Italo-Ethiopian War, Haile Selassie, Emperor of Ethiopia, described the Italian use of mustard gas in his speech before the League of Nations. His was the only appearance before the Assembly of the League of Nations by a head of state. The League took no action against Italy for violating the Protocol. Soon after the Emperor's appearance the ineffective sanctions placed on Italy after the invasion were canceled, granting defacto recognition of Italian domination of Ethiopia. (Barker, pp. 294-297) The lack of action by the international community is not unique to the League of Nations. The United Nations took no action against Egypt for using Soviet supplied chemical weapons against Yemen in the 1960's (Cookson,

pp. 6-14), or against Iraq for chemical attacks on Iran. (Spiers, *pp.* 121-125). Secondly, the Soviet or their clients use of chemical or toxic weapons in Southeast Asia and Afghanistan was never considered by the Security Council due to the Cold War stalemate in the UN. (Spiers, pp. 113-117 and White)

As the conflict in Bosnia shows, the international community is even less potent in mitigating non-international conflict. The United Nations Charter prevents it from interfering in the internal affairs of sovereign nations. (UN Charter Article 2, 7)

3. Domestic Political

The domestic political theory holds that a state is constrained from using CBW by it's population's aversion to using CBW. This theory does not account for the non-use of CBW by nations whose governments have little no accountability to their population. In the case of Italy's use of mustard gas in Ethiopia, a pamphlet proclaiming the intention to use chemical warfare was distributed to the troops and their families to overcome the apprehension caused by memories of futile attacks during World War I. (Barker, p. 124)

By the summer of 1945, with the war in Europe over and the possibility of a protracted bloody conflict dragging on in the Pacific, America was rethinking it's position on CBW. The mounting casualties of the Island Campaigns prompted some newspapers to call for the use of gas against the Japanese. Public opinion was shifting in favor of using gas to save American lives. Had the atomic bomb not

been dropped and the war ended, the American public's aversion to CBW may have evaporated. (van Courtland Moon, "Project SPHINX: . . . pp. 303-307)

During the Vietnam War, the United States and South Vietnam used large amounts of riot control agents (CS) and herbicides. The use of CS gas and Agent Orange caused considerable domestic controversy, but that did not prevent their use. "As early as 1964 the Federation of American Scientists condemned the use of herbicides in Vietnam as exercises in field-testing for chemical and biological warfare" (Spiers, p. 111) The United States took the minority position that non-lethal riot control agents and herbicides were not covered by the Geneva Protocol and continued use until late in the war.[9] (Lumsden, p. 259 Naughton, "Nixon Widens . . ." p. 1)

Subnational organizations must have the support of their constituency just as a state needs the support of its citizens. Some organization's actions are tightly constrained while others are relatively autonomous. The acceptable level of violence in any given intrastate conflict is a complex dependant variable based on the interaction of the government, society and the subnational organization. (Leites, pp. 48-70) An allegation like the one that the DEA is responsible for the outbreak of cocoa fungus in Peru's Upper Huallaga Valley (Schmidt-Lynch, p. A-8)

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[9]The United States did not become party to the 1925 Geneva Protocol until 1975 and so was not legally bound by it. (Geissler, p. 151) The 1993 Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons And on Their Destruction (CWC) forbids the use of riot control agents as a method of warfare (CWC, Article I, 5) President Nixon, bowing to domestic political pressure, ended the use of Agent Orange in 1971. (Spiers, p. 109)

or Iraq's gassing of its Kurdish minority may raise the acceptable level of violence to include CBW. (Leites, pp.90-132 Stern, p. 403)

4. Horrors of War

The horrors of war theory holds that CBW weapons cause such horrible effects that institutions and decision makers have an aversion to their use. Proponents of this theory most often point to the non-use of CBW during the European portion of World War II. The theory fails to account for the British use of chemical weapons against the Red Army during the Allied intervention in the Russian Civil War or the Italian use in Ethiopia after they had experienced it's horrors on the World War I western front. (Spiers, 83-84)

The World War I chemical experience that shaped western perceptions of CBW has not been shared by most of the rest of the world. Cultural differences cause differences in attitude towards CBW. (Charles C. Flowerree "Current Chemical Weapons Proliferation" in Findlay pp. 13-14) European powers had no qualms about inflicting mass casualties on indigenous populations with conventional arms during the colonial wars. At the Battle of Omdurman during the British subjugation of the Sudan, there were over 11,000 Dervish killed compared to only 48 British casualties. The "victory" was ascribed to British spirit and the superiority of the white man, not the six Maxim guns that did the killing. (Ellis, p. 85-87) "It is not unreasonable to suppose that many people of the Third World see dying by chemical weapons as more or less preferable than perishing by bullets or

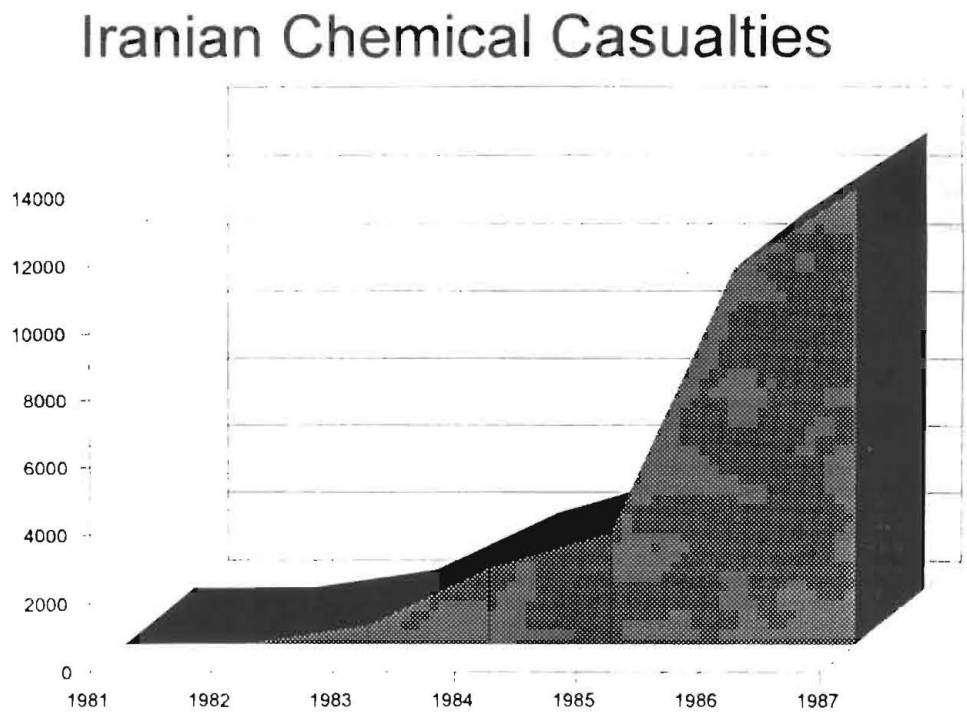
flame." (Charles C. Flowerree "Current Chemical Weapons Proliferation" in Findlay pp. 14-15)

5. Retaliation in Kind

The retaliation in kind theory holds that states will not employ CBW against an enemy which also has a CBW capability. This theory, while explaining the non-use of CBW in Europe and the Japanese use only against the Chinese during World War II,(Spires, pp. 88-94, White) does not account for Iraq's continued use of chemical weapons after Iran acquired its own chemical capability. The majority of the chemical casualties occurred in 1986-87, by which time the

Iranians were also using chemical weapons extensively. (Elisa Harris in Jensen, p. 31, Waters, p. 61, White)

The theory also does not hold for a non-state attacker. A subnational or transnational organization may not control any territory which can be the target of



a CBW retaliation. The organization may or may not have a state sponsor who can provide the weapon. A hostile state could carry out a CBW attack through a subnational organization without being implicated and subject to retaliation. (Arquilla, p.19)

6. Military Utility

The military utility theory holds that the use of CBW is limited to a narrow set of circumstances by its limited effectiveness and difficulty of use.

a. Battlefield Utility

Since World War I, CBW has not been used against troops who were fully prepared. CBW is most effective against poorly equipped and trained troops or unprotected targets such as civilian populations. (Julian P. Robinson "Chemical Weapons Proliferation: The Problem in Perspective" in Findlay, p. 28) The Italians effectively used mustard gas as a force multiplier against the barefoot Ethiopians. The spraying of mountainsides compensated for the lack of Italian mountain training and sealed of the flanks of advancing Italian columns. (Baker, p. 242) The use of gas as a terror weapon hastened the dissolution of the highly motivated but poorly equipped Ethiopian forces. (Dugan, p. 247) In the Iran/Iraq War, Iraq used chemical weapons to blunt the human wave attacks by the highly motivated but poorly equipped Iranian "martyrs". Iraqi conventional forces were able to repel the attacks in the open desert but needed chemical weapons in the marshlands and mountains.

If military utility were the only consideration, all CBW capable forces who were being overwhelmed by masses of poorly equipped light forces in difficult terrain would use CBW to blunt the attack. American forces in Korea faced this situation when the Chinese entered the Korean war. The Peoples Liberation Army

(PLA) axis of attack was down the Korean central mountain range. Contrary to popular belief, the PLA did not mass attack American forces on a wide front, human wave tactics were used by a succession of platoon or company sized units to attack key tactical positions. (George, PP. 1-5) American forces could have used CBW with devastating effects and ended the Chinese advance well north of the thirty-eighth parallel.

b. Strategic Utility

Numerous developing countries possess or are acquiring first generation ballistic missiles. These missiles, based on the World War II German V-2, typically have a payload of 500 to 1000 kg, a range of less than 1000 km and a CEP of 1000 meters. These missiles, armed with conventional high explosive warheads, are not a significant military threat unless they are used in large numbers. The 2000 V-2 fired at Britain during World War II only caused 1,500 deaths. (U.S. Congress pp. 203-222) These same missiles equipped with CBW warheads can have a much greater effect.

Saddam Hussein's threat to use chemical warfare against Israel during the Gulf War resulted in a massive civil defense effort. Gas masks and nerve gas antidotes were distributed, families were instructed to create sealed rooms and stockpile food and water. During the 18 actual scud missile attacks and several false alarms, the entire Israeli population was ordered into the sealed rooms and to don their gas masks. Although none of the scuds carried a chemical

warhead and caused no appreciable material damage, the disruption of normal activity resulted in billions of dollars of economic loss. The stress from the scud attacks and protective measures also resulted in numerous heart attacks and other short and long-term psychological casualties. (Steinberg, pp. 90-95)

The effectiveness of a CBW warhead is dependant upon the size of disiminated particles, weather conditions, defensive measures, leathalty and population density. (Spiers, pp. 9-11, 145-146)

The larger the particle size, the faster they will fall out of the air. Large particles will result in a heavy concentration over a small area. This would be useful for contaminating an area target such as an air field using a persistent agent. Particles smaller than 5 microns remain airborne longer and are more readily absorbed by the respatory system. (Cookson, p. 267)

The disimination and lethality of CBW agents are affected by temperature, humidity, sunlight, and wind speed. Temperature, humidity and intensity of ultraviolet light all affect the rate of CBW agent decomposition. High wind speeds will spread the agent too quickly. Optimum conditions for a CBW attack are a calm clear night. (Cookson, p. 268)

The lethal effects of CBW agents are dependant on the amount of agent absorbed. Relatively high concentrations of chemical agents are required to cause death or incapacitationn. (Cookson, p. 199, Spiers, p. 9) A single microorganism can cause infection leading to death. Larger amounts are required

to overcome partial immunity and decrease the time between exposure and effect. A lethal dose of bacillus anthracis is 1000 times smaller than that for a nerve agent. (Fetter, p. 24)

Civil defense measures like those used by Israel will not be 100% effective. According to U.S. Army estimates, casualties among fully trained combat troops will still be four to eight percent of unprotected troop casualties due to delayed or improper masking, missing or defective equipment, and early unmasking. Casualty rates among civilians will be at least 10 percent. (Fetter, p. 26-27) Large-scale vaccination programs against BW require defenders to know which BW agent would be used in a attack well in advance of hostilities. The vaccine needs to be developed, manufactured, distributed and administered in sufficient time to confer immunity on the population. This amount of warning would not normally be available. In the event of attack, the high number of victims would overwhelm the capacity of the medical system. (Piller, pp. 102-103)

A comparison of casualties produced by conventional, chemical, biological and nuclear ballistic missile warheads in an attack on a western city.[10] (Fetter, p.27)				
Type of Warhead	Without Civil Defenses		With Civil Defenses	
	Dead	Injured	Dead	Injured
Conventional[11]	5	13	2	6
Chemical[12]	200-3,000	200-3,000	20-30	20-300
Biological[13]	20-80,000		20-80,000	
Nuclear[14]	40,000	40,000	20,000	20,000

The population density of cities in the developing world is 10 to 30 times higher than that of developed nations. A ballistic missile attack on Cairo would claim 10 times the casualties as an attack on a western city. (Fetter, pp. 22, 27) A 20 kiloton nuclear warhead would cause approximately 10,000 times the amount of death and injury as a 1000 kg HE warhead, 10 to 100 times as much as a chemical warhead and the same number of casualties as a biological warhead against an unprotected population under the optimum conditions. (Fetter, p. 27)

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[10]Assumes a missile with a 1,000 kg throw weight aimed at a large city with an average density of 30 per hectare. Assumes civil defense reduces casualties from conventional and nuclear by a factor of two and casualties from CBW by a factor of ten.

[11]1,000 kilograms high explosive

[12]300 kilograms of sarin

[13]30 kilograms of anthrax spores

[14]20 kilotons

c. Covert Utility

CBW offers greater military utility to a subnational organization or special forces unit than it does to the conventional military. Special forces units could conduct clandestine attacks using CBW against key targets before or during a conflict. These attacks could impede mobilization and reinforcement, and disrupt operations at airfields. (Spires, p. 130) A CBW attack in an enclosed area such as a sports stadium or large office building would not be as affected by environmental factors as an open air attack. (Root-Bernstein, p. 48) The mere threat of CBW use can have devastating effects. A reported poisoning of Chilean grapes resulted in the loss of $333 million dollars. A leftwing organization claimed to have poisoned the fruit, but only two grapes were found with a nonlethal trace of cyanide. (Stern, pp. 395-396) A CBW attack could be as simple as contaminating a water supply with fecal matter. (Root-Bernstein, p. 48)

7. Rational Choice

The rational choice theory holds that the decision on use of CBW is based on an analysis of all the cost and benefits. The American non-use of CBW in Korea is the best example of this theory. CBW would have been highly effective against the PLA, but the domestic and international cost of use outweighed the military utility.

The rational choice model accounts for cultural and perceptual differences. If use of CBW would have adverse domestic political consequences, those must be taken into account by the decision maker.

Since World War I no military forces well equipped with protective gear have been subject to chemical attack. This precedent may not hold in a possible future conflict in Korea. The North Korean Army (KPA) is the world's most prepared to fight in a CBW environment. CBW could be used to exploit the forward-deployed position of ROK and U.S. forces. Nonpersistent agents could be used in ground force breakthroughs of defensive positions and to blunt counterattacks. Persistent agents could be used against fixed strategic targets such as command and control centers, logistic depots and airfields. (DIA, pp. 60-62) The early coordinated and judicious use of CBW has a high probability of shifting the tactical balance of forces in Korea in the North's favor, allowing the KPA to make substantial gains before U.S. reinforcements could arrive. If the current crisis in Korea results in conflict, it would be rational for North Korea to use CBW as a force multiplier to aid in overwhelming the ROK and deployed U.S. forces. (Arquilla, pp. 17-20)

B. DETERRING THE RATIONAL CHOICE

> What makes atomic weapons different is a powerful tradition that they are different. The reason we do not ban bows and arrows on the grounds that they too, like nuclear weapons, kill and maim people, is that there is a tradition for the use of bows and arrows, a jointly recognized expectation that they will be used if it is expedient to use them. There is no such tradition for the use of atomic weapons. there is instead a tradition for their nonuse. (Schelling, p. 260)

Unfortunately, as discussed in the above, there is no tradition of nonuse of CBW. They have been used whenever it has appeared that the benefits of their

use outweighed the cost. The deterrence of future first use of CBW will require international and national action to readjust the cost/benefit equation and establish a tradition of nonuse. There are two ways this can be done: deterrence by denial and deterrence by punishment.

1. Deterrence By Denial

Under deterrence by denial, a potential user of CBW would be forewarned that no advantage could be achieved through use. (Levine, p. 9) At the international level a collective security consensus must be reached that explicitly guarantees that a multilateral force will come to the aid of a victim of a CBW attack. (Bailey, Noncompliance . . . p. 14) This consensus would reverse the precedent of international inaction. On the national level, increased battlefield and civil defense programs would lower the marginal utility of CBW use. (Fetter, p. 37-40)

2. Deterrence By Punishment

Deterrence by punishment requires an explicit threat that the use of CBW would incite a retaliatory response which would outweigh the potential benefits. The United States unilaterally gave up the option of retaliation in kind to biological and toxic weapons in 1969 and 1970 respectively. (Naughton, "Nixon Widens . . ." p. 1) The CWC, which the United States signed when it opened for signature in January 1993, outlaws the development, production, possession, transfer and use of chemical weapons under any circumstances. The convention also mandates the destruction of any existing weapons within ten years. (CWC, Art.

l) Having given up the right to retaliate to CBW in kind, the policy of the United States, as stated in the National Military Doctrine is to deter the use of nuclear, biological and chemical weapons with nuclear weapons. This position has been made more untenable by the withdrawal of tactical nuclear weapons. Deterrence of all use of weapons of mass distruction (WMD) is now based on the strategic nuclear forces, which are ill suited for the mission.

The United States has three options to deter the use of CBW against its interests: the current policy based on the threat of retaliation with strategic nuclear weapons; withdrawal of U.S. forces, ignoring the use of CBW; and, the development of a balanced, coherent, general extended deterrence policy based on robust conventional and nuclear capability. (Cropsey, p. 14)

Once the Soviet Union reached nuclear parity with the United States, deterrence was based ultimately on the threat of assured destruction. Now that the threat of nuclear Armageddon has been eased, the United states should not return to the policy of massive nuclear retaliation. The Clinton Administration has listed Cuba, North Korea, Iran and Iraq as recalcitrant outlaw "backlash" states. (Lake, p. 45)

> These backlash states have some common characteristics. Ruled by cliques that control power through coercion, they suppress basic human rights and promote radical ideologies. While their political systems vary, their leaders share a common antipathy toward popular participation that might undermine the existing regimes. These nations exhibit a chronic inability to engage constructively with the outside world, and they do not function effectively in alliances--even with those like-minded. They are often on the

> defensive, increasingly criticized and targeted with sanctions in international forums.
>
> Finally, they share a siege mentality. Accordingly, they are embarked on ambitious and costly military programs--especially in weapons of mass destruction (WMD) and missile delivery systems--in a misguided quest for a great equalizer to protect their regimes or advance their purposes abroad. (Lake, p. 46)

Strategic nuclear weapons are a poor deterrent of the regimes which are now acquiring WMD capability for three reasons. (Cropsey, p. 15) First, is the United State's unwillingness to use nuclear weapons under the most likely of WMD use scenarios. The current deterrence policy of unilaterally assured destruction does not differentiate between a strategic, tactical or non-conventional WMD use. A CBW attack on U.S. troops or interests would necessitate a retaliatory response using high yield strategic nuclear weapons. Even if the response was limited to one or two weapons, it would result in the mass casualities among the civilian population. (Dowler, pp. 35-36) This policy is particularly unjustifiable in light of the fact that the leaders of the most worrisome proliferant states are not controlled by their population. Secondly, the leaders of proliferant states may have a different cost benefit analysis and not be deterred by the holding of civilian population at risk. Thirdly, United States nuclear retaliation for a CBW attack would undermine nuclear prohibition and subvert anti-nuclear goals. (Cropsey, p. 15)

The United States faces the nuclear deterrence dilemma that nuclear weapons are only a deterrence if they are never used. If the nuclear weapons will never be used, they are not a credible deterrent. (Guertner, p. 147)

These weaknesses of the current policy can be overcome with a balanced, coherent, general, extended deterrence policy based on a robust nuclear and conventional capability. During Desert Storm the United States demonstrated that technological improvements in conventional weapons range, accuracy, survivability and lethality allow them to be used against strategic targets. Conventional weapons can be used against counterforce, economic, and non-hardened command and control targets which could previously only be targeted with nuclear weapons. (Guertner, pp. 142-143)

A credible conventional threat to supporting infrastructure like that attacked during Desert Storm, backed up by a strategic nuclear force, may be more of a deterrent than a dubious threat of strategic nuclear attack on a population. Use of CBW will result in guaranteed U.S. conventional response which inflicts more pain than any possible benefits. (Cropsey, p. 15) This attack could be carried out by conventional advanced cruise missiles with little risk to US forces. (Cropsey, p. 19)

V. CONCLUSION

With the end of the Cold War, the most likely scenarios for conflict do not include the clash of mass tank armies on the central European plain. The end of the bipolar competition has released the pressures of ethnic and religious rivalry. As demonstrated by the World Trade Center bombing, the United States is not immune to the consequences of these new conflicts. The biotechnical revolution is simplifying some of the problems which were considered insurmountable in 1969 when the U.S. gave up offensive biological warfare. As biotechnology disseminates through the world, a nation or subnational organization may use biological weapons as "the poor man's atom bomb."

The international agreements to outlaw such weapons on humanitarian grounds have been honored mostly in their breach because the benefits of violation outweighed the consequences. In the case of CBW agents, their limited use has not been the result of any single factor. Close examination of the facts reveals that CBW has been used when a rational analysis determined that the benefits outweighed the costs. This cost/benefits analysis is not a universal ledger. Each decision maker has a unique set of factors to evaluate. The current United States WMD deterrent policy is based on the threat of retaliation with strategic nuclear weapons. This policy fails to address the limitations on the use of nuclear weapons imposed by internal and external constraints. The policy also does not address the

use of CBW by subnational or transnational organizations. The United States should adopt a policy which will both raise the cost and lower any benefits of CBW use. To shift the cost/benefit analysis against use of CBW in all cases requires a coordinated international and national program of deterrence through denial and deterrence by punishment.

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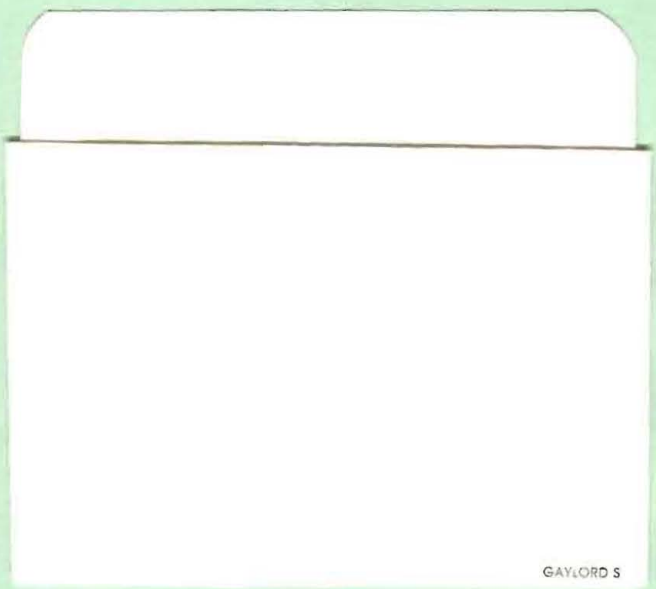

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