Pathogens as Weapons: The International Security Implications of Biological Warfare

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M.P.P.
John F. Kennedy School of Government, Harvard University, 1999

B.A.
Brown University, 1996

SUBMITTED TO THE DEPARTMENT OF POLITICAL SCIENCE IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY IN POLITICAL SCIENCE
AT THE
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

JUNE 2004

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Submitted to the Department of Political Science on May 21, 2004 in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy in Political Science

ABSTRACT

This dissertation assesses the international security implications of biological weapons and the strategic consequences of their proliferation. It examines the impact of biological weapons on four key areas of concern for international security: proliferation, deterrence, civil-military relations, and threat assessment. The dissertation draws upon a range of theories from the field of security studies and a wealth of newly available information regarding the biological weapons programs of Iraq, the former Soviet Union, the United States, United Kingdom, and South Africa

My analysis yields four major findings. First, it is extremely difficult to prevent the spread of biological warfare capabilities to actors that want them and these actors tend to be motivated by a desire to challenge the status quo. Contrary to conventional wisdom, biological weapons have utility across the spectrum of conflict and are well suited to supporting asymmetric strategies against stronger opponents. Second, biological weapons do not confer the deterrent benefits associated with nuclear weapons and will undermine reliance on deterrence as a security strategy. Biological weapons are not suitable as strategic deterrents due to the uncertainty regarding their effects, the availability of defenses and the reliance of these weapons on secrecy and surprise for their effectiveness. The accessibility of these weapons to a diverse range of actors, including terrorists, and the ease of clandestine attacks undermines the effectiveness of deterrence as a security strategy.

Third, civilian oversight of biological warfare programs is hindered by the intense secrecy that shrouds these programs. This lack of supervision leads to abuse and corruption by program managers, impedes adherence to international agreements, and increases the risk of such programs becoming the source of materials for terrorists. Fourth, states tend to have flawed assessments of their opponent's biological warfare capabilities and intentions. The result of such flawed assessments may be worst-case planning and overreaction to a perceived threat or complacency and continued vulnerability to attack.

Biological weapons will continue to exert a destabilizing influence on international security until defenses against these weapons are improved, governments can reliably detect biological weapons activities, the proliferation of biological weapons materials and expertise is staunched, and the norms against their possession and use are strengthened.

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Acknowledgements

I would like to thank my thesis committee, Stephen Van Evera, Harvey Sapolsky, and Thomas Christensen, for their interest, advice, and constructive criticisms.

I would also like to thank Robert Art, Jeanne Guillemin, Kendall Hoyt, Milton Leitenberg, Julian Perry Robinson, Seth Stern, Jonathan B. Tucker, John Ellis van Courtland Moon, Margaret Sloane, and Seth Stern for carefully reading previous drafts and providing excellent feedback. A special thanks is due to Sean Lynn-Jones whose editorial comments not only helped me transform a portion of this dissertation into an article, but also dramatically improved the rest of the dissertation. I am also indebted to Matthew Meselson, John Moon, and Jack McGeorge for generously providing access to their archives.

I am also grateful for comments on earlier drafts from the participants in seminars at the Massachusetts Institute for Technology's Security Studies Program, Harvard University's Olin Institute for Strategic Studies, and the Fourth Annual New Faces Conference at the Triangle Institute for Security Studies. I would also like to acknowledge the support of the MacArthur Foundation, Carnegie Corporation, and the John Anson Kittredge Educational Fund.

Finally, I would like to thank my loving wife, Linda Fu, whose encouragement and support sustained me throughout the entire process.

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Chapter 1. Introduction

Biological weapons have become one of the most pressing security issues of the twenty-first century.[1] Three factors that first emerged in the 1990s have contributed to this phenomenon. First, revelations regarding the size, scope and sophistication of the Soviet and Iraqi biological warfare programs focused renewed attention on the proliferation of these weapons.[2] Second, the catastrophic terrorist attacks on September 11, 2001 and the anthrax letters sent to media outlets and Senate offices in the United States later that fall demonstrated terrorists' desire to cause massive casualties and heightened concern over their ability to employ biological weapons.[3] Third, significant advances in the life sciences have increased concerns about how the biotechnology revolution could be exploited to develop new or improved biological weapons.[4] These trends only intensify the urgent need to answer some fundamental questions about biological warfare: What is the nature of the biological weapons threat? What are the strategic consequences of the proliferation of biological weapons? How effective will traditional security strategies such as deterrence and arms control be in containing this threat? How do answers to these questions inform policies to reduce the danger of biological weapons?

A rich literature on the history and capabilities of biological weapons began to emerge in the 1960s.[5] The security studies community began paying closer attention to the threat posed by these weapons in the 1990s.[6] There have been few attempts, however, to apply theories from the

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[1] Portions of this dissertation were previously published in Gregory Koblentz, "Pathogens as Weapons: The International Security Implications of Biological Warfare," *International Security*, Vol. 28, No. 3 (Winter 2003/04), pp. 84-122.

[2] Ken Alibek with Stephen Handelman, *Biohazard: The Chilling True Story of the Largest Covert Biological Weapons Program in the World-Told From the Inside by the Man Who Ran It* (New York: Random House, 1999); and Raymond A. Zilinskas, "Iraq's Biological Weapons: The Past as Future?" in Joshua Lederberg, ed., *Biological Weapons: Limiting the Threat* (Cambridge, Mass.: MIT Press, 1999), pp. 137-158.

[3] The letters, containing spores of *B. anthracis* (the organism that causes anthrax), killed five and infected another seventeen. Elin Gursky, Thomas V. Inglesby, and Tara O'Toole, "Anthrax 2001: Observations on the Medical and Public Health Response," *Biosecurity and Bioterrorism*, Vol. 1, No. 2 (2003), pp. 97-110.

[4] On the potential for the misuse of the biotechnology revolution, see Matthew Meselson, "Averting the Hostile Exploitation of Biotechnology," *CBW Conventions Bulletin*, No. 48 (June 2000), pp. 16-19; and Claire M. Fraser and Malcolm R. Dando, "Genomics and Future Biological Weapons: The Need for Preventive Action by the Biomedical Community," *Nature Genetics*, No. 29 (November 2001), pp. 253-256.

[5] Prominent examples include United Nations Secretary General, *Chemical and Bacteriological (Biological) Weapons and the Effects of Their Possible Use* (Geneva: United Nations, 1969); World Health Organization (WHO), *Health Aspects of Chemical and Biological Weapons* (Geneva: WHO, 1970); Stockholm International Peace Research Institute (SIPRI), *The Problem of Chemical and Biological Warfare*, Vol. I-VI (New York: Humanities Press, 1971-1975); and Erhard Geissler and John Ellis van Courtland Moon, eds., *Biological and Toxin Weapons: Research, Development and Use From the Middle Ages to 1945*, SIPRI Chemical and Biological Warfare Study No. 18 (Oxford: Oxford University Press, 1999).

[6] For example, see Raymond A. Zilinskas, "Biological Warfare and the Third World," *Politics and the Life Sciences*, Vol. 9, No. 1, (August 1990), pp. 59-76; Susan Wright, ed., *Preventing a Biological Arms Race* (Cambridge, Mass.: MIT Press, 1990); Marie I. Chevrier, "Deliberate Disease: Biological Weapons, Threats, and Policy Responses," *Environment and Planning C: Government and Policy*, Vol. 11, No. 4 (1993), pp. 395-417; Malcolm Dando, *Biological Warfare in the 21st Century: Biotechnology and the Proliferation of Biological Weapons* (New York: Brassey's, 1994); Brad Roberts, "The Proliferation of Biological Weapons: Trends and Consequences," in Oliver Thranert, ed., *Enhancing the Biological Weapons Convention* (Bonn, Germany: Dietz, 1996), pp. 57-70; John D. Steinbruner, "Biological Weapons: A Plague upon All Houses," *Foreign Policy*, No. 109 (Winter 1997-1998), pp. 85-96; Richard K. Betts, "The New Threat of Mass Destruction," *Foreign Affairs*, Vol. 77, No. 1 (January/February

field of security studies to assess the broader international security implications of biological weapons or to test such theories against the empirical evidence.[7] As a result, the existing literature on biological weapons contains three major fallacies and two important lapses that contribute to a flawed understanding of these weapons and understate the adverse consequences of their proliferation.

The first fallacy minimizes the military utility of biological weapons based on the United States' experience with these weapons.[8] The United States began developing biological weapons during World War II, but decided to unilaterally abandon these weapons in 1969.[9] The government publicly justified this decision and its 1975 ratification of the Biological Weapons Convention (BWC) in large part on the basis of the unpredictable and uncontrollable consequences of these weapons as well as their lack of military utility.[10] It made these decisions at least in part, however, after concluding that the destructive power of these weapons and their relative accessibility posed a serious proliferation threat.[11] In addition, given its formidable nuclear and conventional forces, the United States did not believe that it needed biological weapons to cause massive civilian casualties or deter the use of biological weapons by other states. For the United States, the contribution of these weapons to achieving other missions was not worth the price of a heightened risk of proliferation.[12] It is a mistake to extrapolate from this

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1998), pp. 26-41; Christopher F. Chyba, "Toward Biological Security," *Foreign Affairs*, Vol. 81, No. 3 (May/June 2000), pp. 122-136; Lederberg, *Biological Weapons*; and Raymond Zilinskas, ed., *Biological Warfare: Modern Offense and Defense* (Boulder, Colo.: Lynne Reinner, 2000).

[7] Examples include George H. Quester, "Chemical and Biological Warfare," *American Political Science Review*, Vol. 68, No. 3 (September 1974), pp. 1285-1291; Marie Isabelle Chevrier, "Impediment to Proliferation? Analysing the Biological Weapons Convention," *Contemporary Security Policy*, Vol. 16, No. 2 (August 1995), pp. 72-102; Peter R. Lavoy, Scott D. Sagan, and James J. Wirtz, eds., *Planning the Unthinkable: How New Powers Will Use Nuclear, Biological, and Chemical Weapons* (Ithaca, N.Y.: Cornell University Press, 2000); and Susan Martin, "The Role of Biological Weapons in International Politics: The Real Military Revolution," *Journal of Strategic Studies*, Vol. 25, No. 1 (March 2002), pp. 63-98.

[8] Erring in this direction are Chevrier, "Impediment to Proliferation?" p. 84; and Richard Novick and Seth Shulman, "New Forms of Warfare?" in Wright, *Preventing a Biological Arms Race*, pp. 103-105.

[9] For the decision making process leading to the 1969 decision, see Jonathan B. Tucker, "A Farewell to Germs: The U.S. Renunciation of Biological and Toxin Warfare, 1969-70," *International Security*, Vol. 27, No. 1 (Summer 2002), pp. 107-148.

[10] "Remarks of the President on Announcing the Chemical and Biological Defense Policies and Programs," Office of the White House Press Secretary, The White House, November 25, 1969, Folder 5: Chemical, Biological Warfare (Toxins, etc.), Vol. 1, Box 310, National Security Council Subject Files, Nixon Presidential Materials, National Archives, College Park, Maryland [hereafter Nixon papers]; Senate Committee on Foreign Relations, *Prohibition of Chemical and Biological Weapons*, 93d Cong., 2d Ses., December 10, 1974, p. 10; Arms Control and Disarmament Agency (ACDA), *Verification: The Critical Element of Arms Control* (Washington, D.C.: United States Government Printing Office [U.S. GPO], 1976), pp. 7, 17-18; *Fiscal Year 1979 Arms Control Impact Statements: Statements submitted to the Congress by the President Pursuant to Section 36 of the Arms Control and Disarmament Act* (Washington, D.C.: U.S. GPO, 1978), p. 220.

[11] Matthew Meselson, "The Problem of Biological Weapons," undated, http://www.pugwash.org/reports/cbw/cbw5.htm; Julian P. Perry Robinson, "Some Political Aspects of the Control of Biological Weapons," *Science in Parliament*, Vol. 53, No. 3 (May/June 1996), pp. 6-11; Graham S. Pearson, "Biological Weapons: A Priority Concern," *Director's Series on Proliferation*, No. 4 (Livermore, Calif.: Lawrence Livermore National Laboratory, May 1994), p. 42; and Gradon Carter, "Biological Warfare and Biological Defence in the United Kingdom 1940-1979," *RUSI Journal*, Vol. 137, No. 6 (December 1992), p. 72.

[12] For an insider's account of the influence of these considerations in the U.S. decision to renounce biological weapons, see Han Swyter, "Political Considerations and Analysis of Military Requirements for Chemical and Biological Weapons," *Proceedings of the National Academy of Sciences*, Vol. 65, No. 1 (January 15, 1970), pp. 261-270.

decision that biological weapons are, in the words of Thomas Schelling, "ridiculous weapons that nobody is interested in having even if the other side is foolish enough to procure them."[13] Although biological weapons may have had marginal military utility for the United States in 1969, history has shown that this calculation is not universally applicable. Indeed, shortly after the U.S. decision to abandon these weapons, the Soviet Union decided to dramatically expand its own program and develop a new generation of biological weapons.[14] In addition, since 1972, the number of states suspected of developing these weapons has tripled from four to thirteen.[15] This proliferation suggests that the prevailing view of the disutility and unimportance of biological weapons needs to be revised. The utility of biological weapons across the spectrum of conflict is discussed in greater detail in chapter 2. This chapter also examines why biological warfare strongly favors the attacker, the properties of these weapons that make them attractive primarily to dissatisfied actors, including terrorists, and the erosion of the constraints on the development and use of these weapons.

The second fallacy is a byproduct of the first one. Those who assert that the utility and value of biological weapons is so low, overestimate the feasibility of verifying biological arms control.[16] Biological arms control advocates believe that even a low probability of detecting non-compliance would deter states from violating the treaty since the costs and risks of discovery would outweigh the minor benefits of possessing these weapons.[17] As discussed in chapter 2, if the potential benefits and advantages of biological weapons are properly taken into account, then some states would have a strong incentive to acquire them, even if it means violating treaty commitments. Thus, the standard for verification would have to be raised significantly for a treaty to have a restraining influence. Chapter 3 examines the challenges in verifying that biotechnology is not being used for hostile purposes in light of the difficulty in distinguishing between offensive, defensive, and civilian activities in the field of biology. The formulation of the BWC and the experience of United Nations Special Commission (UNSCOM) in Iraq are examined for insights into the nature and consequences of this indistinguishability.

The third fallacy is that biological and nuclear weapons have similar political effects and implications for international security.[18] This type of analysis takes too literally the comparison of biological weapons to "the poor man's atomic bomb" by focusing exclusively on lethality and ignoring other aspects of biological weapons that make them poor strategic deterrents. Although biological warfare strongly favors the attacker, the uncertain effects of biological weapons, the

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[13] Thomas C. Schelling, *Choice and Consequence* (Cambridge, Mass.: Harvard University Press, 1984), p. 253 as cited in Chevrier, "Impediment to Proliferation?" p. 84.

[14] Alibek, *Biohazard*; and Anthony Rimmington, "The Soviet Union's Offensive Program: The Implications for Contemporary Arms Control," in Susan Wright, ed., *Biological Warfare and Disarmament: New Problems/New Perspectives* (Lanham, Md.: Rowman and Littlefield Publishers, 2002), pp. 103-150.

[15] General Accounting Office (GAO), *Arms Control: Efforts to Strengthen the Biological Weapons Convention*, GAO-02-1038 (Washington, D.C.: GAO, September 2002), pp. 10-11.

[16] For examples of this fallacy, see ACDA, *Verification*, pp. 17-18; Chevrier, "Impediment to Proliferation?" p. 95; and Elisa Harris, "The Biological and Toxin Weapons Convention," in Albert Carnesale and Richard Haass, eds., *Superpower Arms Control: Setting the Record Straight* (Cambridge, Mass.: Ballinger, 1987), p. 205.

[17] Chevrier, "Impediment to Proliferation?" pp. 72-102; Raymond A. Zilinskas, "Verifying Compliance to the Biological and Toxin Weapons Convention," *Critical Reviews in Microbiology*, Vol. 24, No. 3 (September 1998), p. 211; Barbara Hatch Rosenberg, "U.S. Policy and the BWC Protocol," *CBW Conventions Bulletin*, No. 52 (June 2001), p. 2; and Elisa Harris, "Bioweapons Treaty Still A Good Idea," *Christian Science Monitor*, August 24, 2001.

[18] This view can be found in Martin, "The Role of Biological Weapons in International Politics," pp. 63-98; and Steve Fetter, "Ballistic Missiles and Weapons of Mass Destruction: What is the Threat? What Should Be Done?" *International Security*, Vol. 16, No. 1 (Summer 1991), pp. 22-26.

availability of defenses, and the need for secrecy and surprise greatly reduces the ability of biological weapons to confer the strategic deterrent benefits associated with nuclear weapons. Furthermore, the potential accessibility of these weapons and the prospect of anonymous use pose special difficulties for states seeking to deter the use of biological weapons. These issues are addressed in chapter 4.

In addition, the focus on lethality obscures other attributes of biological weapons that pose less obvious but more insidious dangers to international security. These destabilizing features of biological weapons are mutually reinforcing and make these weapons even more dangerous than suggested by assessments based solely on potential lethality. Chapter 5 examines how the intense secrecy that shrouds biological weapons programs impedes civilian control of these programs. This lack of effective oversight leads to flawed decision-making, violation of international obligations, corruption, and heightens the risk of proliferation to states and terrorists. Chapter 6 analyzes how secrecy and the multi-use nature of biotechnology leads states to have flawed assessments of the biological warfare capabilities and intentions of their adversaries. Poor intelligence complicates effort to develop and deploy defenses, engage in diplomacy, and conduct inspections. In addition, misleading intelligence can give rise to a security dilemma or provoke a state to take unnecessary military action. A common theme in all of these chapters is the role of secrecy as a hydra-headed cause of destabilizing effects: it impedes verification, undermines deterrence, hinders civilian oversight, and significantly complicates threat assessments.[19]

In the concluding chapter, I offer five policy prescriptions for countering the growing danger posed by biological weapons: strengthen defenses against biological weapons, increase the transparency of defensive and civilian biological activities, improve intelligence and verification capabilities, enhance cooperative nonproliferation programs, and reinforce the norm against the development and use of these weapons.

[19] On the broader security implications of secrecy, see Stephen Van Evera, *Causes of War: Power and the Roots of Conflict* (Ithaca, N.Y.: Cornell University Press, 2000), pp. 140-141.

Chapter 2. Pathogens as Weapons

As Thomas Schelling has observed, "The tendency in our planning is to confuse the unfamiliar with the improbable. The contingency we have not considered seriously looks strange; what looks strange is thought improbable; what is improbable need not be considered seriously."[20] The goal of this chapter is to familiarize the reader with the major characteristics of biological weapons and the nature of biological warfare. Four key characteristics of these weapons are highlighted. First, biological warfare strongly favors the attacker. Second, biological weapons have utility across the full spectrum of conflict from sabotage and terrorism to strategic warfare. Third, biological weapons are attractive primarily to dissatisfied actors. Fourth, the constraints on developing and using these weapons may be eroding.

BIOLOGICAL WARFARE FAVORS THE ATTACKER

Biological warfare is the use of micro-organisms, or toxins derived from such organisms, to deliberately cause the death or illness of humans, plants or animals. Biological weapons are unique among the instruments of warfare because they are composed of, or derived from, living organisms. This feature of biological weapons has several important implications for the nature of these weapons and their use in warfare. For example, biological weapons, like chemical weapons, affect only living things; they do not damage or destroy buildings, machinery, or other property. Pathogenic micro-organisms require a human, plant, or animal host in order to multiply and cause disease. Since toxins (like chemical weapons) are non-living molecules that do not replicate in the body, the initial exposure dose is what causes the illness.[21]

The offense-defense balance in biological warfare strongly favors the attacker because developing and using biological weapons to cause casualties is significantly easier and cheaper than developing and fielding defenses against them.[22] Whether the biotechnology revolution will strengthen the defender or allow attackers to maintain their edge in this competition is unknown.[23] The most common method of operationalizing the offense-defense balance is to construct a cost ratio of offense to defense: the more resources the attacker must invest to overcome the investment in defensive forces made by the defender, the greater the shift in the

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[20] Thomas Schelling, "Foreword," in Roberta Wohlstetter, *Pearl Harbor: Warning and Decision* (Stanford, Calif.: Stanford University Press, 1962), vii.

[21] However, toxins can be extraordinarily lethal. Botulinum toxin is more than 100,000 times more toxic than the nerve gas sarin. Erhard Geissler, "Introduction," in Erhard Geissler, ed., *Biological and Toxin Weapons Today* (Oxford: Oxford University Press, 1986), pp. 4-6.

[22] This feature of biological warfare has been recognized for more than fifty years. Theodor Rosebury, *Peace or Pestilence: Biological Warfare and How to Avoid It* (New York: Whittlesey, 1946), p. 135; SIPRI, *The Problem of Chemical and Biological Warfare,* Vol. 2*: CB Weapons Today* (New York: Humanities Press, 1973), p. 90; Edward Eitzen and Ernest Takafuji, "Historical Overview of Biological Warfare," in Frederick R. Sidell, Ernest T. Takafuji, and David R. Franz, eds., *Medical Aspects of Chemical and Biological Warfare* (Falls Church, V.A.: Office of the U.S. Army Surgeon General, 1997), p. 443; and Joshua Lederberg and George Whitesides, *Biological Defense: Report of the Defense Science Board/Threat Reduction Advisory Committee* (Washington, D.C.: Office of the Undersecretary of Defense for Acquisition, Technology and Logistics, June 2001), p. 2, released under the Freedom of Information Act (FOIA) [hereafter FOIA].

[23] Favoring the attacker are innovations that facilitate the production of traditional pathogens, the modification of microorganisms to enhance their lethality, and improved means for the dissemination of biological agents. Favoring the defender are breakthroughs that accelerate the development of improved vaccines and therapeutic agents and the deployment of new detection, identification, and diagnostic systems. For assessments of the impact of the biotechnology revolution on the offense-defense balance in biological warfare, see Raymond A. Zilinskas, "Conclusion," in Zilinskas, *Biological Warfare*, pp. 247-254; and Lederberg and Whitesides, *Biological Defense.*

balance toward defense.[24] In addition, qualitative factors that affect the ease of attack or defense are also important. Four factors help to determine the attacker's advantage in biological warfare: (1) the diversity of threat agents, (2) the potency of biological weapons, (3) the ease of surprise, and (4) the difficulty in defending against such an attack.

The Diversity of Biological Warfare Agents

Biological warfare agents vary widely in their infectivity (the number of organisms required to cause disease), virulence (the severity of the disease caused), transmissibility (ease of spreading from person-to-person), and incubation period (the time from exposure to a pathogen or toxin to the onset of illness). This diversity provides terrorists and military planners with a great deal of flexibility. Although there are hundreds of infectious diseases and toxins that can cause serious health effects in humans, the open literature discusses some biological agents as having the physical and biological characteristics needed for a mass casualty-producing biological weapon. Most national biological warfare programs have focused on ten to fifteen agents.[25] The Department of Defense has identified eighteen microorganisms and toxins that have been developed or produced as biological weapons and believes that at least ten of these agents pose direct threats to U.S. forces.[26] Even this short list of agents, however, offers a range of potential weapons from the lethal *B. anthracis* to incapacitating agents such as *Coxiella burnetii* (which causes Q fever) and Venezuelan Equine Encephalitis (VEE). Pathogens that cause contagious diseases that have been developed as biological weapons include variola (the virus that causes smallpox) and *Yersinia pestis* (the bacteria that causes plague). Table 2-1 provides a summary of the major characteristics of these pathogens.

This list of agents, however, reflects only known threats. Since biological terrorism is generally less sophisticated and demanding than military use of biological weapons, the range of possible agents for terrorists is even larger and more varied.[27] U.S. experts were surprised by some of the agents that Iraq and the former Soviet Union chose to produce and weaponize.[28] The application of molecular biology to the development of biological weapons could significantly increase the diversity of biological warfare agents, but efforts along these lines are not believed to have advanced beyond the research stage.[29] The difficulty in assessing threat agents in a timely manner results in defensive programs lagging behind offensive programs.[30]

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[24] Charles L. Glaser and Chaim Kaufmann, "What Is the Offense-Defense Balance and Can We Measure It?" *International Security*, Vol. 22, No. 4 (Spring 1998), pp. 50-51.

[25] Richard O. Spertzel, Robert W. Wannemacher, and Carol D. Linden, *Global Proliferation: Dynamics, Acquisition Strategies, and Responses.* Vol. 4: *Biological Weapons Proliferation* (Washington, D.C.: Defense Nuclear Agency, September 1994), p. 11; and David R. Franz, "Medical Countermeasures to Biological Warfare Agents," in Alexander Kelle, Malcolm Dando, and Kathryn Nixdorff, eds., *The Role of Biotechnology in Countering BTW Agents* (Dordrecht, Netherlands: Kluwer, 2001), p. 228.

[26] Department of Defense (DOD), *Proliferation: Threat and Response* (Washington, D.C.: U.S. GPO, 2001), pp. 94, 113.

[27] This wider range of agents, however, may not be well suited to large-scale, outdoor aerosolization and would thus be limited to aerosol dissemination inside buildings or the contamination of food and water supplies.

[28] Chemical and Biological Arms Control Institute (CBACI), *Responding to the Biological Weapons Challenge: Developing an Integrated Strategy* (Alexandria, Va.: CBACI, 2000), p. 43.

[29] Lederberg and Whitesides, *Biological Defense*, p. 12. This assessment is apparently based on information regarding the former Soviet biological weapons program. It is not known, however, to what extent Russia has continued the work initiated during the Soviet era or what other nations have accomplished in this field.

[30] Eitzen and Takafuji, "Historical Overview of Biological Warfare," in Sidell, Takafuji, and Franz, *Medical Aspects of Chemical and Biological Warfare*, pp. 443-444.

Table 2-1. Properties of Biological Warfare Agents

Pathogen	Disease	Incubation Period	Lethality (% fatality if untreated)	Duration of Illness	Contagious?	Vaccine/ Treatment
Bacteria						
Bacillus anthracis	Anthrax	1-6 days (up to 60)*	High (>90)	3-5 days	No	Yes/Yes
Yersinia pestis	Plague	2-3 days	High (>90)	1-6 days	High	No/Yes
Francisella tularensis	Tularemia	2-10 days	Moderate (35)	>2 weeks	No	Yes/Yes
Brucella ssp.	Brucellosis	5-60 days	Low (5)	Weeks-months	No	No/Yes
Rickettsiae						
Coxiella burnetti	Q Fever	10-40 days	Low (5)	2-14 days	Rare	Yes/Yes
Viurses						
Variola	Smallpox	7-17 days	Moderate (30)	4 weeks	High	Yes/No
Venezuelan Equine Encephalitis	Viral Encephalitis	2-6 days	Low (1)	1-2 weeks	Low	Yes/No
Ebola	Viral Hemorrhagic Fever	4-21 days	Moderate to High (50-90)	7-16 days	Moderate	No/No
Toxins						
Clostridium botulinum	Botulinum	1-5 days	High (>90)	Weeks-months	No	Yes/No
	Ricin	18-24 hours	High	Hours	No	No/No
Staphylococcus aureus	Staphylococcal Enterotoxin	3-12 hours	Low (1)	2 weeks	No	No/No

SOURCES: David Franz, et al., "Clinical Recognition and Management of Patients Exposed to Biological Warfare Agents," *Journal of the American Medical Association*, August 7, 1997, pp. 400-401; Mark Kortepeter, et al., eds., *USAMRIID's Medical Management of Biological Casualties Handbook*, 4th edition (Frederick, M.D.: U.S. Army Medical Research Institute of Infectious Diseases, February 2001).

* Laboratory experiments and the 1979 outbreak of inhalation anthrax in Sverdlovsk, USSR demonstrated that anthrax spores in the lungs can remain dormant for several weeks before causing illness. Jeanne Guillemin, *Anthrax: Investigation of a Deadly Outbreak* (Berkeley, Calif.: University of California Press, 1999), pp. 189, 237.

The Potency of Biological Weapons

Biological weapons combine a relatively low cost of production with the capability for infecting large numbers of people over a wide area. The ability of biological weapons to cause mass casualties has been documented by the Stockholm International Peace Research Institute

(SIPRI), World Health Organization (WHO), and OTA.[31] Table 2-2 summarizes the results of some of these studies. The most significant result of these studies is that the potential of biological weapons to cover large areas and cause large numbers of casualties are comparable to nuclear weapons. The ramifications of this finding, however, have been widely misunderstood and are addressed in chapter 4.

Table 2-2. Potential Casualties From Biological Weapons[1]

Pathogen (Disease)	Delivery System[2]	Amount of Agent	Area Affected (km^2)	Population Exposed	Estimated Fatalities
B. anthracis (Anthrax)[3]	Point Source	30 kg. dry powder	10	50,000	25,000
B. anthracis (Anthrax)[3]	Line Source	100 kg. dry powder	140	560,000	280,000
B. anthracis (Anthrax)[4]	Line Source	50 kg dry powder	>40	200,000	40,000 (60,000 sick)
Brucella ssp. (Brucellosis)[5]	Line Source	50 kg. dry powder	20	100,000	200 (36,000 sick)
C. burnetti (Q Fever)[5]	Line Source	50 kg. dry powder	>40	200,000	85 (100,000 sick)
Y. pestis (Plague)[6]	Line Source	50 kg. dry powder	20	100,000	8,500 (25,500 sick)
F. tularensis (Tularemia)[6]	Line Source	50 kg. dry powder	>40	200,000	7,500 (92,500 sick)

SOURCES: WHO, *Health Aspects of Chemical and Biological Weapons* (Geneva: WHO, 1970); and OTA, *Proliferation of Weapons of Mass Destruction: Assessing the Risks* (Washington, D.C.: U.S. GPO, 1993).

NOTES:
1. These estimates are for attacks using high-quality dried agents disseminated with a high-efficiency device against a city with a population density of 5,000 people per square kilometer, equivalent to that of Boston.
2. Line source refers to the dissemination of a biological agent from a moving vehicle (ship, vehicle or aircraft) by means of a spraying device. This is a more efficient means of spreading an agent over a large area than a single, or point source, release created by a bomb, submunition, or stationary aerosol generator.
3. OTA, *Proliferation of Weapons of Mass Destruction*, pp. 53-54. Estimate is for an attack under moderate weather conditions and assumes that no medical treatment is provided to the victims.
4. WHO, *Health Aspects of Chemical and Biological Weapons*, p. 99. Estimate is for an attack under ideal weather conditions and assumes that victims receive medical treatment that reduces fatalities by 50%.
5. Ibid., pp. 96-99. Estimate is for an attack under ideal weather conditions and assumes that no medical treatment is provided to the victims.
6. Ibid., p. 99. Estimate is for an attack under ideal weather conditions and assumes that victims receive medical treatment that reduces fatalities by 70%.

Modern biological weapons are able to achieve these types of results by disseminating pathogens or toxins in an aerosol cloud of microscopic particles that can be readily inhaled and retained in the lungs of the exposed population.[32] These aerosols are most effective when

[31] For a summary of these and other studies, see Dando, *Biological Warfare in the 21st Century*, pp. 4-11.
[32] For technical background information on biological weapons, see Office of Technology Assessment (OTA), *Proliferation of Weapons of Mass Destruction: Assessing the Risks* (Washington, D.C.: U.S. GPO, 1993), pp. 71-

composed of particles ranging from one to ten microns in size that can stay airborne longer and cause more severe cases of disease.[33] Aerosols are also tasteless, odorless, and invisible, thus facilitating clandestine attacks. These aerosols can be generated by bomblets loaded into cluster bombs or missile warheads or by spraying devices mounted on aircraft, helicopters, cruise missiles, ships and vehicles, or carried by hand.[34] Biological weapon field tests conducted by the United States in the 1950s and 1960s demonstrated that line sources, such as those generated by spray tanks mounted on aircraft, could cover targets 8 to 30 kilometers downwind while point sources, such as bomblets and stationary aerosol generators, could cover 10 square kilometers.[35]

The key drawback to employing biological weapons in this manner is their sensitivity to environmental and meteorological conditions that could result in uncertain area coverage and effects.[36] For example, wind speed and direction, humidity, atmospheric stability, and the presence of sunlight can all significantly influence the performance of a biological weapon.[37] The careful selection of agents, delivery systems, targets and timing of an attack, however, could compensate for most of these limitations.[38] The timing of an attack can be adjusted to take advantage of the favorable atmospheric conditions typically found after dusk and before dawn and the lack of direct sunlight or ultraviolet radiation at these times. In order to minimize the influence of meteorological conditions, an attacker could employ bombs or missile warhead with dozens or hundreds of submunitions that would saturate the center of the impact area with aerosol cloud regardless of the wind speed or direction.

The creation of an offensive biological weapon capability is also relatively cheap, in comparison to other weapons of mass destruction and in comparison to the cost of developing defensive capabilities. According to the U.S. Office of Technology Assessment (OTA), a simple fermentation plant suitable for the production of biological warfare agents would cost $10 million.[39] In contrast, chemical plants that can produce nerve agents cost tens of millions of dollars while fissile material production facilities cost hundreds of millions of dollars.[40] The combination of low production costs and wide area coverage results in a highly cost-effective weapon. According to a 1969 United Nations study, the cost of causing one civilian casualty per square kilometer was about $2,000 with conventional weapons, $800 with nuclear weapons, $600 with chemical weapons, and only $1 with biological weapons.[41]

A comparison of the costs of modern state-sponsored offensive and defensive biological warfare programs is also illustrative. The cost of Iraq's pre-1991 Gulf War biological weapons program to produce and weaponized multiple biological warfare agents has been estimated at

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117; Spertzel, Wannemacher, and Linden, *Global Proliferation,* Vol. 4; and William C. Patrick III, "Biological Warfare: An Overview," *Director's Series on Proliferation*, No. 4 (Livermore, Calif.: Lawrence Livermore National Laboratory, May 1994), pp. 1-7.

[33] Leroy Fothergill, "The Biological Warfare Threat," in American Chemical Society, *Nonmilitary Defense: Chemical and Biological Defenses in Perspective*, Advances in Chemistry Series No. 26 (July 1960), p. 26.

[34] Spertzel, Wannemacher, and Linden, *Global Proliferation,* Vol. 4, pp. 28-30.

[35] Ibid., p. 17.

[36] SIPRI, *The Problem of Chemical and Biological Warfare,* Vol. 2, pp. 132-138.

[37] Patrick, "Biological Warfare," p. 5.

[38] Graham S. Pearson, "Prospects for Chemical and Biological Arms Control: The Web of Deterrence," *Washington Quarterly,* Vol. 16, No. 2 (Spring 1993), pp. 147-148; and Patrick, "Biological Warfare."

[39] OTA, *Technologies Underlying Weapons of Mass Destruction* (Washington, D.C.: U.S. GPO, 1993), p. 86.

[40] Total program costs for these weapons are also significantly higher. Ibid., pp. 27, 156-158.

[41] The methodology used to determine these figures is not known. United Nations Secretary General, *Chemical and Bacteriological (Biological) Weapons and the Effects of Their Possible Use*, p. 40.

roughly $200 million.[42] In comparison, the Department of Defense's program to vaccinate U.S. soldiers against *B. anthracis* has cost more than $250 million over the past six years and only a fraction of the force has been fully vaccinated.[43] In addition, developing a new biodefense vaccine costs $300-400 million and typically takes eight to ten years.[44] In contrast, former American and Soviet biological weapons scientists report that transforming a pathogen into a weapon takes only two to three years.[45]

Developing a terrorist capability would be even cheaper. In 1999, the U.S. Defense Threat Reduction Agency built a small facility that could be used to produce limited quantities of biological warfare agents for only $1.6 million.[46] The Federal Bureau of Investigation (FBI) has estimated that the small amount of high-quality *B. anthracis* spores sent to media and government officials in September and October 2001 cost only $2,500 to produce.[47]

A more refined, although still crude, analysis of the highly favorable cost ratio of offense to defense in biological warfare is also possible. Utilizing information from the former U.S. biological weapons program, unclassified studies of the effects of an attack utilizing *B. anthracis*, and public data on the cost of the anthrax vaccine, it is possible to calculate the cost ratio of defense-to-offense for the most commonly cited biological warfare scenarios (see Table 2-3). At the low end of the cost ratio, a defender would have to spend between six and nineteen times as much to protect a city as an attacker would have to spend to acquire the capability to kill the population of the city. At the high end of the cost ratio, a defender would have to spend between 24 and 81 times as much as an attacker. This cost ratio actually underestimates the costs to the defender since it assumes that the defender will know which city is going to be attacked and with which agent.

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[42] In 1991, the Defense Intelligence Agency (DIA) estimated the cost at $100-200 million. The agency also noted that a significant biological weapons capability without the redundancy of the pre-Gulf War program could be attained for less than $100 million. DIA, *Iraq's Chemical and Biological Warfare Capabilities: Surviving Assets and Lack of Use during the War,* Defense Intelligence Memorandum 88-91, March 1991, p. 3, FOIA.

A former UNSCOM biological inspector has estimated the cost of the program at $200-300 million. In comparison, the chemical program was estimated to cost several billion dollars. Rod Barton, "The Application of the UNSCOM Experience to International Biological Arms Control," *Critical Reviews in Microbiology*, Vol. 24, No. 3 (1998), p. 230.

[43] As of January 2003, only 83,000 of 2.4 million service members had completed the six-shot series. DOD, *Chemical and Biological Defense Program,* Vol. 1: *Annual Report to Congress* (Washington, D.C.: DOD, April 2003), p. 59, http://www.acq.osd.mil/cp/vol1-2003cbdpannualreport.pdf.

[44] DOD, *Report on Biological Warfare Defense Vaccine Research and Development Programs* (Fort Belvoir, Va.: Defense Technical Information Center, July 2001), p. 2, http://www.acq.osd.mil/cp/bwdvrdp-july01.pdf.

[45] William Broad and Judith Miller, "Once He Devised Germ Weapons; Now He Defends against Them," *New York Times*, November 3, 1998, p. D1; and Kenneth Alibek, "Research Considerations for Better Understanding of Biological Threats," in Institute of Medicine, *Biological Threats and Terrorism: Assessing the Science and Response Capabilities* (Washington, D.C.: National Academy Press, 2002), p. 64.

[46] Judith Miller, Stephen Engelberg, and William Broad, *Germs: Biological Weapons and America's Secret War* (New York: Simon and Schuster, 2001), pp. 297-298.

[47] David Rosenbaum and David Johnston, "Single Letter With Anthrax Is Discounted," *New York Times*, November 10, 2001, p. B1.

Table 2-3. Cost Ratio of Defense to Offense for Biological Attack with Anthrax

Biological Weapon	Production Cost ($)[3]	Estimated Fatalities	Cost per Casualty ($)	Cost of Vaccine ($)[4]	Cost Ratio of Defense to Offense
30 kg. of dry anthrax, missile warhead[1]	330,000	30,000-100,000	3.30-11.00	63.84	6-19:1
50 kg. of dry anthrax, spray tank[2]	550,000	100,000	5.50	63.84	11:1
100 kg. of dry anthrax, spray tank[1]	1,110,000	420,000-1,400,000	.78-2.62	63.84	24-81:1

NOTES:
1. The amount of agent, type of delivery system, and estimated fatalities are based on data from OTA, *Proliferation of Weapons of Mass Destruction*, pp. 53-54.
2. The amount of agent, type of delivery system, and estimated fatalities are based on data from WHO, *Health Aspects of Chemical and Biological Weapons*, pp. 98-99.
3. The estimated cost to produce and deliver a dry bacterial biological warfare agent is roughly $11,000 per kilogram. Bruce Grim and William H. Rose, *Biological Threat Vulnerability Assessment: The US East Coast* (Dugway, UT: U.S. Army Dugway Proving Ground, November 1983), p. 39.
4. Each dose of the anthrax vaccine costs $10.84 and the current vaccine regimen requires six doses to confer full immunity. Steven Lee Myers, "U.S. Doubles Payment to Sole Source of Anthrax Vaccine," *New York Times*, August 6, 1999, p. A16.

The Ease of Surprise

The ability to conceal the identity of an agent, the timing of an attack, and the planned target is crucial for an effective biological weapon attack. While surprise is a well-known force multiplier for conventional forces, biological weapons are especially dependent on this factor for their success. Moreover, the element of surprise necessary for a biological weapon attack is relatively easy to achieve. The small quantity of agent required for an attack, the ability to launch an attack with a spray system from several miles upwind from a target or to clandestinely deliver biological weapons, and the difficulty of detecting biological aerosols makes biological weapons well suited to surprise attacks.[48] The nonspecific nature of the early symptoms of most diseases of concern can mask the beginning of a man-made outbreak and enhance the likelihood that such an attack will catch an adversary unprepared. Numerous exercises and simulations have demonstrated current U.S. vulnerability to clandestine attacks with biological weapons.[49]

This reliance on surprise, however, exposes an Achilles' heel of biological weapons. Accurate intelligence on an adversary's biological warfare capabilities can substantially reduce

[48] Field tests conducted by the United States Army in the 1950s and 1960s demonstrated the ease of conducting covert attacks with biological weapons against buildings, subway systems, air bases, and cities. William C. Patrick III, "Biological Warfare Scenarios," in Scott P. Layne, Tony J. Beugelsdijk, and C. Kumar N. Patel, eds., *Firepower in the Lab: Automation in the Fight against Infectious Diseases and Bioterrorism* (Washington, D.C.: Joseph Henry Press, 2001), pp. 215-223.

[49] Judith Miller, "Exercise Finds U.S. Unable to Handle Germ War Threat," *New York Times*, April 26, 1998, p. A1; Thomas V. Inglesby, Rita Grossman, and Tara O'Toole, "A Plague on Your City: Observations from TOPOFF," *Clinical Infectious Diseases*, Vol. 32, No. 3 (February 2001), pp. 436-445; and Tara O'Toole, Michael Mair, and Thomas V. Inglesby, "Shining Light on Dark Winter: Lessons Learned," *Clinical Infectious Diseases*, Vol. 34, No. 7 (April 2002), pp. 972-983.

the effectiveness of a biological attack by providing the defender with sufficient information to organize public health and medical measures to mitigate the effects of an attack.

The Difficulty of Defense

Defensive biological warfare includes measures to prevent, mitigate, or treat the effects of a biological weapon attack. Biological defenses include vaccines and other pharmaceuticals, early warning systems, and physical protection. Given the range of available agents, the agent-specific nature of most defenses, the time lag required to develop new vaccines, and the ease with which an attacker can achieve surprise, defending a large population against a significant number of threat agents is a daunting task that would require a huge investment. Biological weapons, however, are in some ways more susceptible to countermeasures than high explosives, chemical weapons, or nuclear weapons. They are unique among weapon systems in that vaccines can protect soldiers and civilians before an actual attack[50] Although licensed vaccines are currently available for only two of the most dangerous biological warfare agents—*B. anthracis* and variola—experimental vaccines are available for *F. tularensis*, *C. burnetti*, botulinum toxin, Venezuelan Equine Encephalitis, Western Equine Encephalitis, and Eastern Equine Encephalitis and unlicensed antitoxins are also available for botulinum.[51] In addition, the U.S. Department of Defense (DOD) and National Institutes of Health (NIH) are developing more than twelve new biodefense vaccines.[52] Even though immunizing vulnerable populations against the full range of biological warfare threats is not feasible or desirable, the availability of sufficient stockpiles of appropriate vaccines is still valuable as a deterrent to potential attackers, as a defensive measure if warning of an attack is received, as a form of postexposure prophylaxis for anthrax and smallpox, and as a reassuring symbol of preparedness.

Given the limitations of vaccines, defenses against biological weapons rely more on early detection of a biological attack and postexposure prophylaxis with antimicrobial drugs. The incubation period following infection with a pathogen, typically several days, provides a window of opportunity for the detection and response to a biological attack.[53] Aerosol detection devices, laboratory or clinical diagnosis, and public health surveillance systems can provide the early warning necessary to launch a medical intervention to mitigate the consequences of a biological attack. Although current systems do not yet offer rapid, accurate, and broad-spectrum detection and identification capabilities, new systems are under development.[54] Administered promptly after infection or the onset of symptoms, antibiotics can significantly reduce the morbidity and

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[50] For vaccines to be effective, defenders must be able to meet the following conditions: identification of the target population, knowledge of the specific threat agent, availability of the appropriate vaccine, and time for the vaccine to be administered to the target population before an attack. David R. Franz, "Physical and Medical Countermeasures to Biological Weapons," *Director's Series on Proliferation*, No. 4 (Livermore, Calif.: Lawrence Livermore National Laboratory, May 1994), pp. 59-60.

[51] DOD, *Chemical and Biological Defense Program: Annual Report to Congress and Performance Plan* (Washington, D.C.: DOD, July 2001), p. D-11.

[52] DOD, *Chemical and Biological Defense Program,* Vol. 1, p. 62; and Tara Palmore, Greg Folkers, Carole Heilman, John R. La Montagne, and Anthony S. Fauci, "The NIAID Research Agenda on Biodefense," *ASM News*, Vol. 68, No. 8 (August 2002), pp. 376-377.

[53] Arnold Kaufmann, Martin I. Meltzer, and George Schmid, "The Economic Impact of a Bioterrorist Attack: Are Prevention and Postattack Intervention Programs Justifiable?" *Emerging Infectious Diseases*, Vol. 3, No. 2 (April-June 1997), pp. 83-94.

[54] Gregory Koblentz, "Biological Terrorism: Understanding the Threat and the Response," in Arnold Howitt and Robyn Pangi, eds., *Countering Terrorism: Dimensions of Preparedness* (Cambridge, Mass.: MIT Press, 2003), pp. 123-143.

mortality of most bacterial and rickettsial agents. In contrast, there are few effective medical treatments for viral infections. Quarantine and vaccination can reduce the impact of contagious diseases such as smallpox.[55]

Physical defenses prevent exposure to biological warfare agents by filtering the air to remove dangerous particles. Simple masks, such as those used to prevent the inhalation of dust as well as more harmful materials, have been touted as being able to provide relatively inexpensive protection to civilian populations and military forces.[56] To be effective against a surprise attack, the use of these masks would have to be triggered by real-time detection of an attack, a capability that does not yet exist. Alternatively, military and healthcare personnel and others could wear masks when the threat of a biological attack is heightened, such as during a crisis or conflict. The prolonged use of such masks, however, would be difficult for several reasons: growing discomfort, especially during intense physical activity; the erosion of mask integrity and fit with rugged use; interference with face-to-face and radio communication; and the need to unmask to eat and drink.[57] Finally, masks do not prevent exposure if not properly fitted or if the concentration of agent is high enough. Given the inability to detect a biological attack in real time, the most feasible type of physical defenses are buildings and vehicles equipped with filters and positive pressure systems that prevent the infiltration of biological aerosol clouds. Because of their expense, such systems are rare outside of the military. Nonetheless, they hold much promise for defending against biological attacks since they are not agent-specific and can function continuously.[58]

BIOLOGICAL WEAPONS HAVE UTILITY ACROSS THE SPECTRUM OF CONFLICT

As the authoritative SIPRI study of chemical and biological weapons noted thirty years ago: "Because CB weapons have rarely been used in modern warfare, conjecture can scarcely be avoided in discussing their present utility."[59] Although the actual use of biological weapons has been rare, additional information is now available from defectors, declassified documents, war games, inspections and investigations, and open sources that allows for a more informed discussion of the utility of biological weapons. This information makes it possible to assess the military utility of biological weapons based on the nature of biological warfare, the specific characteristics of weapons developed and fielded, and the doctrines adopted by different states. In the view of Graham Pearson, former head of Britain's chemical and biological defense program, biological weapons "have been proven to a greater extent than had nuclear weapons before they were used at Nagasaki and Hiroshima."[60] The diversity of agents available and the range of their effects could provide military planners with a flexible weapon system capable of

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[55] Martin I. Meltzer, Inger Damon, James W. LeDuc, and J. Donald Millar, "Modeling Potential Responses to Smallpox as a Bioterrorism Weapon," *Emerging Infectious Diseases*, Vol. 7, No. 6 (November-December 2001), pp. 959-969.

[56] Karl Lowe, Graham S. Pearson, and Victor Utgoff, "Potential Values of a Simple Biological Warfare Protective Mask," in Lederberg, *Biological Weapons*, pp. 263-281; and Stanley L. Weiner, "Strategies for the Prevention of a Successful Biological Warfare Aerosol Attack," *Military Medicine*, Vol. 161, No. 5 (May 1996), pp. 251-256.

[57] See John Martyny, Craig S. Glazer, and Lee S. Newman, "Respiratory Protection," *New England Journal of Medicine*, September 12, 2002, p. 827.

[58] Lester L. Yuan, "Sheltering Effects of Buildings from Biological Weapons," *Science and Global Society*, Vol. 8, No. 3 (2000), pp. 287-313; and Richard L. Garwin, Ralph E. Gomory, and Matthew S. Meselson, "How to Fight Bioterrorism," *Washington Post*, May 14, 2002, p. A21.

[59] SIPRI, *The Problem of Chemical and Biological Warfare*, Vol. 2, p. 116.

[60] Graham Pearson, "The Essentials of Biological Threat Assessment," in Zilinskas, *Biological Warfare*, p. 69.

carrying out a range of missions against a broad selection of targets.[61] This section analyzes the utility of biological weapons for unconventional operations as well as traditional military operations at the tactical, operational and strategic levels of warfare.[62]

Unconventional

Biological weapons can be used in a range of unconventional operations such as assassination, sabotage, terrorism, and counterinsurgency. These operations may be conducted by states against other states, by states against sub-national groups, and by non-state actors such as terrorist groups against states. Regardless of the perpetrator, target or objective, these operations all share a common feature: "that the weapon is delivered against its target in a manner that cannot readily be distinguished from normal background traffic and activity."[63] In these types of operations, anonymity and surprise are highly valued. Biological and toxin agents hold a number of advantages for these types of activities. The small amount of agent required to kill or incapacitate and the ease of disseminating such agents secretly facilitates their use in covert unconventional operations. Furthermore, the incubation period for biological weapons is well suited to sabotage and terrorist operations since the delay provides the perpetrators with time to escape and cover their tracks. This feature also complicates the ability of victims to determine the source of an outbreak. In addition, due to the potency of these weapons, special operations forces could also achieve operational or strategic effects by the judicious employment of biological weapons behind enemy lines. Finally, since the political and psychological value of such operations usually outweighs their military or material significance, the uncertainty of the consequences is not as serious of a drawback. Jessica Stern observes that although one cannot predict ahead of time the scope of a biological attack, "what we can predict is that the radius of psychological damage would exceed that of injury and death."[64]

The suitability of biological weapons for use in unconventional operations is evidenced by the interest of intelligence agencies and special forces in these weapons. Virtually all biological warfare programs have been closely associated with intelligence agencies and other organizations interested in clandestine means of assassination and sabotage. Japan's employment of biological weapons against Chinese forces was primarily by unconventional means for the purpose of sabotage or counterinsurgency.[65] The Iraqi biological weapon program was initiated in the 1970s by the intelligence service for the development of dirty tricks to use against internal enemies.[66] South Africa's biological warfare program was conducted on behalf of the military's

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[61] Brad Roberts, "Between Panic and Complacency: Calibrating the Chemical and Biological Warfare Problem," in Stuart E. Johnson, ed., *The Niche Threat: Deterring the Use of Chemical and Biological Weapons* (Washington, D.C.: National Defense University Press, 1997), pp. 9-41.

[62] These types of operations are meant to be illustrative and are not mutually exclusive. For example, unconventional operations can have a strategic impact if they successfully spread fear and panic among civilians who pressure their government to make concessions.

[63] Richard A. Falkenrath, Robert D. Newman, and Bradley A. Thayer, *America's Achilles Heel: Nuclear, Biological and Chemical Terrorism and Covert Attack* (Cambridge, Mass.: MIT Press, 1998), p. 1.

[64] Jessica Stern, *The Ultimate Terrorists* (Cambridge, Mass.: Harvard University Press, 1999), p. 30.

[65] Sheldon Harris, *Factories of Death: Japanese Biological Warfare 1932-1945 and the American Cover Up* (London: Routledge, 1994).

[66] United Nations Security Council, *Letter Dated 8 April 1998 From the Executive Chairman of the Special Commission Established by the Secretary-General Pursuant to Paragraph 9 (b) (i) of Security Council Resolution 687 (1991) Addressed to the President of the Security Council*, S/1998/308, April 8, 1998, pp. 4-5; and Richard Spertzel, "Iraq's Biological Warfare Program: Past, Present and Future Challenges," *Policywatch*, No. 299

special forces with a focus on developing novel means of assassination.[67] The Soviet biological weapons program was initially administered by the internal security services and they retained an enduring interest in developing biological and toxin agents for assassination purposes.[68] The Central Intelligence Agency (CIA) was also sponsor and customer of American biological weapons research.[69] In addition, most of the biological munitions stockpiled by the United States in 1969 were designed for use by the Army's special forces behind enemy lines.[70] Terrorist interest in biological weapons is discussed later in this chapter.

Tactical

At the tactical level of combat, the delayed effects of biological agents and the susceptibility of aerosol clouds to vagaries in meteorological and environmental conditions limit their utility to static battles of attrition. The ability of aerosol clouds to penetrate fortifications and buildings could provide an attacker with a means of "softening up" a hardened enemy position before an assault.[71] The risk of infecting one's own troops can be minimized by vaccinating troops ahead of time, employing biological weapons far from friendly forces, or using only non-contagious or short-lived agents. States lacking precision-guided munitions and cluster bombs may find the cost effectiveness of these weapons attractive.

There is limited evidence of states developing biological weapons for tactical use on the battlefield. The United States did not develop biological weapons for this purpose. Japan reportedly used artillery shells filled with bacterial agents against Soviet forces during the Nomonhan Incident in 1939.[72] During World War II, the Soviet military reportedly halted the development of biological weapons for tactical missions after a biological attack against German troops besieging Stalingrad in 1942 caused a massive outbreak of tularemia among Soviet civilians.[73] Although Iraq experimented with biological warheads for short-range artillery rockets

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(Washington, D.C.: Washington Institute for Near East Policy, February 6, 1998), http://www.washingtoninstitute.org/watch/Policywatch/policywatch1998/299.htm.

[67] Chandré Gould and Peter Folb, "The South African Chemical and Biological Warfare Program: An Overview," *Nonproliferation Review*, Vol. 7, No. 3 (Fall-Winter 2000), pp. 10-23.

[68] The KGB had its own laboratory to develop biological and toxin weapons and sponsored research on new agents by the Ministry of Health under Project Flute. Alibek, *Biohazard*, pp. 37, 93, 171-174; and Rimmington, "The Soviet Union's Offensive Program," pp. 116-117.

[69] Senate Select Committee to Study Governmental Operations with Respect to Intelligence Activities, *Volume 1: Unauthorized Storage of Toxic Agents* (Washington, D.C.: U.S. GPO, 1976).

[70] Interview with former Fort Detrick official, Frederick, Maryland, July 24, 2002; and *Demilitarization Plan for Biological Stockpiles: Summary Report* (Frederick, M.D.: Fort Detrick, January 28, 1970), NSC, H-Files, Policy Papers, NSDMs, NSDM-35 [4 of 4], Box H-213, Nixon papers. This document kindly provided by John Moon.

[71] U.S. Army, *Employment of Chemical and Biological Agents*, Army Field Manual No. 3-10 (Washington, D.C.: Department of the Army, March 31, 1966), p. 47.

[72] Although there were outbreaks of plague, cholera and dysentery subsequent to these attacks, it is unknown whether the origins of these outbreaks were natural or man-made. Japan subsequently abandoned the development of bacteria-filled artillery shells. Harris, *Factories of Death*, pp. 60, 76.

[73] Prepared Statement of Ken Alibek Before Joint Economic Committee, *Hearing on Terrorism and Intelligence Operations: Potential Impact on the U.S. Economy*, May 20, 1998; Alibek, *Biohazard*, pp. 29-31. However, Alibek's claim that the 1942-1943 tularemia outbreak around Stalingrad was intentionally caused by the Soviet military has been challenged. Eric Croddy and Sarka Krcalova, "Tularemia, Biological Warfare, and the Battle for Stalingrad (1942-1943)," *Military Medicine*, Vol. 166, No. 10 (October 2001), pp. 837-838.

during the final stages of its war of attrition with Iran (1980-1988), none of these weapons were deployed.[74]

Operational

Biological weapons may have their greatest military utility at the operational, or theater, level of warfare.[75] The goal of attacks on logistical networks, reinforcements, and command and control facilities is to "to induce operational paralysis, which reduces the enemy's ability to move and coordinate forces in the theater."[76] The United States, Soviet Union, and Iraq have developed biological weapons and doctrine for their use at the operational level of warfare.[77] Targets in the enemy's rear area could be selected so that the effects of the biological attack are at their height when friendly forces plan on attacking the objective. The use of incapacitating instead of lethal agents for this type of warfare has several advantages.[78] The ability of some biological agents to sicken victims for weeks or months could outweigh the delayed time of onset for such agents. Incapacitating agents would have the additional benefit of burdening the defender with large numbers of wounded soldiers, who typically absorb more resources than fatalities. These types of biological weapons could also be perceived as being more useful in areas with heavy concentrations of civilians. In addition, the use of incapacitating agents instead of lethal ones might allow an aggressor to seize its objectives without provoking regime-threatening retaliation from a nuclear-armed opponent. Power projection forces that rely on a small number of large facilities with primarily civilian workforces are particularly vulnerable to such disruptive attacks.[79] As a result, the employment of biological weapons against theater targets could serve

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[74] Tim Trevan, *Saddam's Secrets: The Hunt for Iraq's Hidden Weapons* (London: HarperCollins, 1999), p. 341; and International Institute for Strategic Studies, *Strategic Survey, 1996/1997* (Oxford: Oxford University Press, 1997), p. 38.

[75] This potential, however, has been ignored in many analyses of these weapons. See, for example, Zilinskas, "Biological Warfare and the Third World"; and Novick and Shulman, "New Forms of Biological Warfare?" pp. 105-106. An exception to this view is W. Seth Carus, *The Poor Man's Atomic Bomb? Biological Weapons in the Middle East*, Policy Paper No. 23 (Washington, D.C.: Washington Institute for Near East Policy, 1991), pp. 36-37.

[76] Robert Pape, *Bombing to Win: Air Power and Coercion in War* (Ithaca, N.Y.: Cornell University Press, 1996), p. 72.

[77] See, respectively, U.S. Army, *Employment of Chemical and Biological Agents*; Jonathan B. Tucker, "Biological Weapons in the Former Soviet Union: An Interview with Dr. Kenneth Alibek," *Nonproliferation Review*, Vol. 6, No. 3 (Spring-Summer 1999), p. 2; and Timothy McCarthy and Jonathan Tucker, "Saddam's Toxic Arsenal: Chemical and Biological Weapons in the Gulf Wars," in Lavoy, Sagan, and Wirtz, *Planning the Unthinkable*, p. 62.

[78] According to Alibek, the Soviet Union selected incapacitating agents such as *Burkholderia mallei* (the bacteria that causes glanders), B*rucella* ssp. (the bacteria that causes brucellosis), and Venezuelan Equine Encephalitis (VEE) for operational missions. Tucker, "Biological Weapons in the Former Soviet Union," *The Nonproliferation Review*, p. 2.

The United States also favored incapacitating agents such as *Coxiella burnetii* (the rickettsia that causes Q fever) and VEE and these agents composed the vast majority of the biological agent stockpile when the program was terminated in 1969. The U.S. stockpile at this time consisted of 10,089 gallons of liquid incapacitating agent and 405 pounds of dry incapacitating agent versus 1,037 pounds of lethal dry agent. Department of Defense, *Environmental Impact Statement for Disposal of Biological Agents and Weapons*, September 17, 1970, Tab A, Inclosure 10. Folder Chemical, Biological Warfare (Toxins, etc.) Volume III, Box 311, National Security Council: Subject Files, Nixon papers.

[79] Robert J. Larsen and Robert P. Kadlec, *Biological Warfare: A Post Cold War Threat to America's Strategic Mobility Forces*, Ridgway Viewpoint 95-3 (Pittsburgh, Penn.: Matthew B. Ridgway Center for Strategic Studies, 1995), pp. 12-15.

as a potent force multiplier for a conventional military operation.[80] For this reason, the use of biological weapons as part of an asymmetric strategy to deter, prevent, or disrupt the intervention of U.S. forces in the Middle East and Northeast Asia is a major concern for American defense planners.[81]

Incapacitating biological weapons may be particularly useful for states that seek to occupy major cities without engaging in the long, bloody, and destructive battles that have historically characterized urban warfare.[82] John Steinbruner has speculated that Soviet military planners "might have calculated that with judicious selection of the agents and timing of their delivery, the urban populations of Western Europe might be sufficiently weakened to allow an occupying army to accomplish an otherwise impossible task."[83] This scenario was deemed credible in a 1976 U.S. Army study of possible Soviet biological warfare operations against members of the North Atlantic Treaty Organization (NATO). The assessment found that the covert use of an incapacitating agent against West Berlin "represents perhaps the most interesting and potentially profitable employment of biological agents in conjunction with offensive actions in NATO Europe."[84]

Strategic

At the strategic level of warfare, the goal of military action is to reduce the willingness or ability of the enemy to continue to prosecute a war. States can achieve this objective through attacks aimed at civilians with the goal of increasing pressure on the government to yield to the attacker or attacks aimed at damaging the enemy's economy enough to prevent effective resistance.[85] Biological warfare can target civilians directly with anti-personnel agents or indirectly with anti-livestock and anti-crop agents that could be used against agricultural targets to reduce an enemy's food supply. The ability of biological warfare agents to be disseminated over large areas and for agents such as variola virus and *Y. pestis* to cause epidemics makes them well suited for strategic attacks.[86] The delayed effects of biological weapons and uncertainties surrounding the downwind travel of aerosol clouds are less important for strategic attacks which do not require precision or immediate results. In addition, biological weapons possess a number of properties that evoke disproportionate levels of fear: exposure to these weapons would be invisible and involuntary while the effects would be delayed, uncontrollable, indiscriminate,

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[80] *Assessment of the Impact of Chemical and Biological Weapons on Joint Operations in 2010: A Summary Report* (McLean, Va.: Booz, Allen and Hamilton, November 1997).

[81] DOD, *Report of the Quadrennial Defense Review* (Washington, D.C.: U.S. GPO, May 1997), p. 13; and George W. Bush, *National Security Strategy of the United States of America* (Washington, D.C.: White House, September 2002), pp. 13-16.

[82] On the nature of urban combat, see Michael C. Desch, ed., *Soldiers in Cities: Military Operations on Urban Terrain* (Carlisle, Penn.: Strategic Studies Institute, October 2001), http://www.carlisle.army.mil/ssi/pubs/2001/cities/cities.pdf

[83] Steinbruner, "Biological Weapons," p. 90.

[84] Don T. Parker, Ronald D. Stricklett, William H. Rose, and Bruce S. Grim, *Biological Vulnerability Assessment: NATO Central Front*, Vol. 2 (Dugway, UT: U.S. Army Dugway Proving Ground, June 1976), p. 87.

[85] Pape, *Bombing to Win*, pp. 42-47.

[86] There are also a number of viral agents and fungal agents that can cause epidemics among livestock and crops, respectively. See Simon M. Whitby, *Biological Warfare Against Crops* (New York: Palgrave, 2002); and Terrance M. Wilson, Linda Logan-Henfrey, Richard Weller, and Barry Kellman, "Agroterrorism, Biological Crimes, and Biological Warfare Targeting Animal Agriculture," in Corrie Brown and Carole Bolin, eds., *Emerging Diseases of Animals* (Washington, D.C.: ASM Press, 2000), pp. 23-57.

poorly understood, and gruesome.[87] As a result, the "dreaded" nature of these weapons could amplify the psychological impact of even a small-scale biological attack.[88] The limitations of biological weapons as strategic deterrents are addressed in chapter 4.

During their offensive programs, the United States, the Soviet Union, and Iraq developed a range of aircraft and missile-delivered biological weapons and doctrine for use against urban populations and agricultural targets. The Soviet Union developed an extensive strategic biological warfare capability. According to Ken Alibek, the Soviets sought the most lethal and contagious agents for use as strategic weapons.[89] The Soviets kept tens of tons of variola, *Y. pestis*, and *B. anthracis* stockpiled for use against targets in the United States and remote parts of the European theatre. The Soviets developed cluster bombs and spray tanks for medium-range bombers as well as biological submunitions for single- and multiple-warhead intercontinental ballistic missiles.[90] The Soviet Union also developed biological weapons based on anti-livestock and anti-plant agents.[91] According to Jonathan Tucker, "Soviet military doctrine for strategic biological warfare called for delivering massive quantities of contagious agents against urban targets to cause panic and social disruption, overwhelm the enemy's medical system, and spawn widespread epidemics that would be impossible to control."[92] These objectives are consistent with the Soviet military's nuclear war-fighting strategy, which included impeding the post-war recovery of the United States.[93]

The Anglo-American biological warfare program during World War II was focused on developing strategic biological weapons. Until an anti-personnel weapon based on *B. anthracis* loaded into cluster bombs could be mass-produced in the United States, Great Britain stockpiled five million cattle cakes laced with the organism. The cattle cakes would have been spread across German farms by bombers with the goal of decimating the German cattle industry.[94] During the 1950s, the United States developed anti-plant and anti-personnel biological weapons for use in strategic warfare.[95] These agents were loaded into cluster bombs for use by strategic bombers against targets such as industrial facilities and the wheat fields in the Soviet Union.[96] Unlike the

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[87] Jessica Stern, "Dreaded Risks and the Control of Biological Weapons," *International Security*, Vol. 27, No. 3 (Winter 2002/2003), pp. 102-106.

[88] Stern, *The Ultimate Terrorists,* p. 30.

[89] Prepared Statement of Ken Alibek Before House Armed Services Committee, Special Oversight Panel on Terrorism, *Hearing on Terrorist Threats to the United States*, May 23, 2000.

[90] Alibek, *Biohazard*, pp. 5-7; and Tom Mangold and Jeff Goldberg, *Plague Wars: The Terrifying Reality of Biological Warfare* (New York: St. Martin's Press, 1999), pp. 84-85.

[91] Kenneth Alibek, "The Soviet Union's Anti-Agricultural Biological Weapons," *Annals of New York Academy of Sciences,* Volume 894 (1999), pp. 18-19; and Rimmington, "The Soviet Union's Offensive Program," p. 113-115.

[92] Jonathan B. Tucker, *Scourge: The Once and Future Threat of Smallpox* (New York: Atlantic Monthly Press, 2001), p. 143.

[93] Stephen M. Meyer, "Soviet Nuclear Operations," in Ashton Carter, John Steinbruner, and Charles Zraket, eds., *Managing Nuclear Operations* (Washington, D.C.: Brookings, 1987), p. 531; and Aleksander G. Savel'yev, and Nikolay N. Detinov, *The Big Five: Arms Control Decisionmaking in the Soviet Union* (Westport, Conn.: Praeger, 1995), pp. 1-5.

[94] See Gradon B. Carter and Graham S. Pearson, "British Biological Warfare and Biological Defence, 1925-1945," in Geissler and Moon, *Biological and Toxin Weapons*, pp. 168-189.

[95] Ed Regis, *The Biology of Doom: The History of America's Secret Germ Warfare Project* (New York: Henry Holt, 1999), pp. 138-157; and Whitby, *Biological Warfare Against Crops*, pp. 94-117.

[96] Jeffrey K. Smart, "History of Chemical and Biological Warfare: An American Perspective," in Sidell, Takafuji, and Franz, *Medical Aspects of Chemical and Biological Warfare*, pp. 51-52; Julian Perry Robinson, "Some Characteristics of Chemical and Biological Weapons," in *War and Environment* (Stockholm, Sweden: Ministry of Agriculture, 1981), pp. 97-100; Simon Whitby and Paul Rogers, "Anti-Crop Biological Warfare: Implications of the Iraqi and US Programs," *Defense Analysis*, Vol. 35, No. 3 (1997), pp. 303-318.

Soviet Union, the United States did not weaponize any contagious agents because of the higher risk during research and development, the increased uncertainty of effects, and the need to protect one's own troops.[97]

Iraq also developed and deployed biological weapons for strategic purposes. Beginning in 1988, Iraq began developing the forces necessary for the so-called Thunderstrike option, a massive attack on Israeli cities with chemical and biological-armed missiles.[98] Although Iraq claimed these weapons were developed for use in retaliation in order to deter an Israeli first-strike, they could also have been employed as part of an offensive strategy. According to UNSCOM, "Certain documentation supports the contention that Iraq was actively planning and had actually deployed its chemical weapons in a pattern corresponding to strategic and offensive use through surprise attack against perceived enemies."[99] By the time of the 1991 Gulf War, Iraq had deployed crude biological warheads for its extended-range Scud missiles and gravity bombs for delivery by aircraft and was developing spray tanks for use by piloted and unmanned aircraft in strikes against enemy cities.[100] Iraq also produced a large quantity of wheat cover smut, an anti-crop agent, which could have been employed against Iran as a form of economic warfare.[101]

ATTRACTIONS OF BIOLOGICAL WEAPONS TO DISSATISFIED ACTORS

The motivation to acquire biological weapons is the result of a complex interaction of strategic, economic, political, bureaucratic, and normative factors.[102] These motivations are difficult to study directly due to the secrecy that shrouds biological weapons programs and the lack of reliable information regarding decisions to pursue such programs.[103] An examination of the characteristics of biological weapons, however, strongly suggests that these weapons are attractive primarily to dissatisfied actors, both states and terrorists, who seek a means of challenging the status quo. This does not mean that there will be widespread proliferation of these weapons. Most states are satisfied with their security and position in the international system. However, deeply dissatisfied states that are willing to use violence to achieve their goals are likely to view biological weapons as a desirable force multiplier.[104] Similarly, among terrorist

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[97] Spertzel, Wannemacher, and Linden, *Global Proliferation,* Vol. 4, p. 12.

[98] The forces for this option were not completely in place by the time of the 1991 Persian Gulf War. McCarthy and Tucker, "Saddam's Toxic Arsenal," pp. 47-78.

[99] United Nations Security Council, *Report of the Secretary-General on the Status of the Implementation of the Special Commission's Plan for the Ongoing Monitoring and Verification of Iraq's Compliance with Relevant Parts of Section C of Security Council Resolution 687 (1991)*, S/1995/864 (New York: United Nations, October 11, 1995), p. 11.

[100] See Zilinskas, "Iraq's Biological Weapons: The Past as Future?" p. 141.

[101] Wheat is Iran's main crop. Whitby, *Biological Warfare Against Crops*, pp. 19-21.

[102] See Chevrier, "Deliberate Disease," pp. 395-417; Jonathan B. Tucker, "Motivations for and Against Proliferation: The Case of the Middle East," in Zilinskas, *Biological Warfare*, pp. 27-52; and W. Seth Carus, "The Proliferation of Biological Weapons," in Brad Roberts, ed., *Biological Weapons: Weapons of the Future?* (Washington, D.C.: Center for Strategic and International Studies, 1993), pp. 19-27.

[103] States also have an incentive to misrepresent their programs as being provoked by others or for the purpose of deterrence. In 1995, Iraq claimed that it developed strategic chemical and biological weapons as part of a deterrent strategy, but the United Nations Special Commission (UNSCOM) uncovered evidence that Iraq also planned on using these weapons for surprise attacks. United Nations Security Council, *Report of the Secretary-General on the Status of the Implementation of the Special Commission's Plan for the Ongoing Monitoring and Verification of Iraq's Compliance with Relevant Parts of Section C of Security Council Resolution 687 (1991)*, S/1995/864 (New York: United Nations, October 11, 1995), p. 11.

[104] For a discussion of the role of revisionist states in international politics, see Randall L. Schweller, "Bandwagoning for Profit: Bringing the Revisionist State Back In," *International Security*, Vol. 19, No. 1 (Summer

groups, only a limited number have the radical religious philosophy or apocalyptic worldview that could justify the use of these weapons. This section describes the properties of biological weapons that would appeal primarily to dissatisfied states and discusses the characteristics of terrorist groups interested in these weapons.

There are three reasons that biological weapons are more attractive to dissatisfied states than status quo states. First, pathogens and poisons have long been stigmatized and the subject of international opprobrium.[105] In the case of biological weapons, it truly is the case that "when guns are outlawed, only the outlaws have guns." The 1925 Geneva Protocol bans the use of chemical and biological weapons and the 1972 BWC prohibits the development and possession of biological weapons.[106] As a result, states that are satisfied with the status quo and the international legal framework that underpins it are unlikely to pursue these weapons. Indeed, by 1972, all of the Western nations that had pursued biological weapons—Canada, France, the United States, and United Kingdom—had abandoned these weapons. In contrast, the Soviet Union decided at this time to dramatically expand its own offensive program. Not only are status quo states much less likely to develop these weapons during peacetime, they are also unlikely to use them during wartime. Status quo states that seek primarily to defend themselves are unlikely to develop a weapon to repulse an aggressor that also risks undermining their status as a victim and alienating the international community or key allies.[107] On the other hand, states that plan on using violence to challenge the status quo would not likely demonstrate similar respect for international treaties. The history of chemical warfare supports this proposition. During the twentieth century, the state that initiated hostilities was always the first to use lethal chemical weapons.[108]

Second, biological weapons rely on surprise for much of their effectiveness. In general, attackers, not defenders, rely on surprise to achieve their objectives. As John Mearsheimer notes, "One important advantage held by the offense is the ability to choose the main point of attack for the initial battles, to move forces there surreptitiously, and to surprise the defender."[109] As discussed above, biological weapons can serve as a potent force multiplier for conventional military operations. Although biological weapons have no direct effect on the defender's tanks

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1994), pp. 72-107; and Alastair Iain Johnston, "Is China a Status Quo Power?" *International Security*, Vol. 27, No. 4 (Spring 2003), pp. 8-11.

[105] John Ellis van Courtland Moon, "Controlling Chemical and Biological Weapons Through World War II," in Richard Burns, ed., *Encyclopedia of Arms Control and Disarmament,* Vol. 2 (New York: Charles Scribner's Sons, 1993), pp. 657-674.

[106] Ironically, the development of biological weapons by revisionist states such as the Soviet Union and Imperial Japan may have been partly inspired by these agreements. On Japanese interest in chemical and biological weapons due to the Geneva Protocol, see Peter Williams and David Wallace, *Unit 731: Japan's Secret Biological Warfare in World War II* (New York: Free Press, 1989), pp. 7-8. The Soviet Union launched new efforts on biological weapons in the 1920s and 1970s following the creation of the Geneva Protocol and Biological Weapons Convention, respectively. See Valentin Bojtzov and Erhard Geissler, "Military Biology in the USSR, 1920-1945," in Geissler and Moon, *Biological and Toxin Weapons,* pp. 156-157; and Rimmington, "The Soviet Union's Offensive Program," pp. 105-106.

[107] States that do not expect external support in the event of an attack may not feel limited in their means of self-defense.

[108] Confirmed cases of the use of chemical weapons initiated by the aggressor include Germany during World War I, the Allies during their intervention into the Russian civil war from 1919 to 1921, Italy against Ethiopia from 1935 to 1936, Japan against China between 1937 and 1945, Egypt against Royalist forces in Yemen between 1963 and 1967, and Iraq against Iran during the 1980s. SIPRI, *The Problem of Chemical and Biological Warfare,* Vol. 1: *The Rise of CB Weapons* (New York: Humanities Press, 1971), pp. 125-161.

[109] John J. Mearsheimer, *Conventional Deterrence* (Ithaca, N.Y.: Cornell University Press, 1983), p. 26.

and aircraft, they can render these weapons useless by sickening or killing the crews. Aggressors are better prepared not only to employ biological weapons, but also to defend against them because they can anticipate enemy retaliation and prepare accordingly.[110] Finally, the need for surprise reduces the utility of these weapons for other strategies such as blackmail or deterrence. According to Robert Pape, "Military strategies that depend on surprise for their effectiveness have no coercive value because they cannot be used to *threaten* the target with defeat."[111] Robert Jervis uses a nineteenth century newspaper commentary to illustrate the implications of a weapon that relies on surprise: "As a measure of defense, knives, dirks, and sword canes are entirely useless. They are fit only for attack, and all such attacks are of murderous character. Whoever carries such a weapon has prepared himself for homicide."[112]

Third, biological weapons do not damage or destroy property. By degrading enemy capabilities while preserving transportation infrastructure, biological weapons could be used to facilitate the advance of a *blitzkrieg*-style armored attack. Such weapons could also offer an expansionist state the means of seizing valuable resources such as cities and industrial facilities without risking their destruction. To reduce the risk of contaminating the desired assets, biological agents with a high decay rate that degrade rapidly upon release could be selected and attacks could be timed to take place shortly before sunrise to minimize the agent's half-life.[113]

Terrorist Motivation to Acquire Biological Weapons

Terrorism experts have identified extremist religious groups, particularly those with an apocalyptic worldview, as the most likely terrorists to seek nuclear, biological, and chemical weapons for the purpose of causing mass casualties.[114] Traditional terrorists with ethnic, nationalist, or ideological grievances typically have political objectives that would be harmed by using illegitimate weapons to kill large numbers of civilians. Extremist religious terrorist groups such as al-Qaeda and Aum Shinrikyo, on the other hand, have shown a proclivity for highly lethal attacks. These groups do not have broad constituencies that they risk alienating by using biological weapons and their beliefs permit the indiscriminant mass murder of nonbelievers. Their radical ideologies encourage them to seek destructive means commensurate with the ambitious goals they are pursuing. The association of disease and pestilence in sacred texts as forms of divine wrath and the dreaded nature of these weapons may add to their appeal for such groups. In addition, since the main purpose of terrorism is to instill fear rather than cause a specified level of casualties or damage, terrorists can generally tolerate a much greater range of uncertainty in the effects of their attacks than military organizations. Finally, some extremist

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[110] According to a 1958 U.S. Army Chemical Corps study, "Definite advantage will accrue to the nation which initiates BW. Maximum surprise effect will be achieved by that nation. Conversely, if BW is used in retaliation, the impact will fall on troops and civilians who have presumably already taken all possible defensive measure to protect against it." Chemical Corps Board, *Concepts for Employment of Antipersonnel Biological Warfare*, Information Report No. 1 (Edgewood, Md.: Chemical Corps, April 1, 1958), p. 12.

[111] Pape, *Bombing to Win*, p. 14 (emphasis in original).

[112] Quoted in Robert Jervis, "Cooperation under the Security Dilemma," *World Politics*, Vol. 30, No. 2 (January 1978), pp. 205-206.

[113] On the limited risk of serious contamination with agents beside *B. anthracis*, see Patrick, "Biological Warfare," p. 6; and Pearson, "The Essentials of Biological Threat Assessment," p. 71.

[114] Bruce Hoffman, "Terrorists and WMD: Some Preliminary Hypotheses," *Nonproliferation Review*, Vol. 4, No. 3 (Spring/Summer 1997), pp. 45-53; Jessica Stern, "Terrorist Motivations and Unconventional Weapons," in Lavoy, Sagan, and Wirtz, *Planning the Unthinkable*, pp. 202-229; and Jerrold M. Post, "Psychological and Motivational Factors in Terrorist Decision-Making: Implications for CBW Terrorism," in Jonathan B. Tucker, ed., *Toxic Terror: Assessing Terrorist Use of Chemical and Biological Weapons* (Cambridge, Mass.: MIT Press, 2000), pp. 271-289.

groups may actually welcome severe government retaliation triggered by a biological attack as part of their plan to provoke an apocalyptic confrontation between the forces of good and evil.[115] To date, the very small number of terrorist groups that have had the motivation to use biological weapons on a large-scale have been unable to develop the capability to do so.[116] Aum Shinrikyo, despite its wealth and sophistication in other arenas, was unable to perfect an aerosolized biological weapon due to organizational problems and lack of skilled personnel.[117] Like Aum, al-Qaeda has demonstrated an interest in the full range of weapons of mass destruction as well as a willingness and capability to cause mass casualties. A terrorist group that is able to combine the capability and motivation to use biological weapons will pose the novel threat of a non-state actor capable of inflicting catastrophic damage against a nation.

ACCOUNTING FOR THE RARE USE OF BIOLOGICAL WEAPONS

Despite the major advances in biological warfare since the 1940s and the potential utility of these weapons for a wide range of operations, there is no evidence that modern biological weapons based on aerosol dissemination technology have been successfully employed by states or terrorists. On the rare occasions when states and terrorists have resorted to the use of biological weapons, they used less sophisticated means of dissemination.[118] Accounting for the rare use of these weapons in modern times is important to determine the likelihood that the conditions that led to this tradition will continue to remain strong. There are three probable reasons for the rare use of biological weapons in modern times.

First, there is a normative barrier to the use of these weapons. Scholars have identified, but not fully explained, a long-held taboo against the use of poison or disease in war.[119] This sense of revulsion at using poison or disease as an instrument of war has been codified in national legal prohibitions for centuries and in international law in the twentieth century.[120]

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[115] Stern, "Terrorist Motivations and Unconventional Weapons," pp. 214-216.

[116] Case studies of terrorist groups interested in biological weapons can be found in Tucker, *Toxic Terror*; and W. Seth Carus, *Bioterrorism and Biocrimes: The Illicit Use of Biological Agents in the 20th Century* (Washington, D.C.: National Defense University, April 2001).

[117] The Japanese cult Aum Shinrikyo tried and failed to aerosolize *B. anthracis* and botulinum toxin on a dozen separate occasions in the early 1990s. William Rosenau, "Aum Shinrikyo's Biological Weapons Program: Why Did It Fail?" *Studies in Conflict and Terrorism*, Vol. 24, No. 4 (2001), pp. 289-301.

[118] During the 1930s and 1940s, Japan used vectors infected with contagious diseases and the contamination of food and waters supplies to support sabotage, counterinsurgency, and strategic attacks in China. During the 1980s, South Africa employed biological agents for sabotage and counterinsurgency operations. The white-ruled government of Rhodesia, now Zimbabwe, has also been implicated in similar activities during the late 1970s. On Japan, see Harris, *Factories of Death*. On Rhodesia and South Africa, see Chandré Gould and Peter Folb, *Project Coast: Apartheid's Chemical and Biological Warfare Programme* (Geneva: United Nations Publications, 2002), pp. 24-30, 159-167; and Marléne Burger and Chandré Gould, *Secrets and Lies: Wouter Basson and South Africa's Chemical and Biological Warfare Programme* (Cape Town, South Africa: Zebra Press, 2002), pp. 15-16, 32-39.

In addition, nonstate actors have successfully used biological weapons at least twice in the past twenty years. In 1984 the Rajneeshee cult in Oregon sickened 750 with *Salmonella typhimurium*, and in 2001 an unidentified perpetrator caused twenty-two casualties and disrupted the operations of the U.S. Postal Service and U.S. Senate with five letters containing spores of *B. anthracis*. Ronald M. Atlas, "Bioterrorism Before and After September 11," *Critical Reviews in Microbiology*, Vol. 27, No. 4 (January 2002), pp. 359-361.

[119] Until the discovery of micro-organisms in the 19th century, poison and disease were viewed as the same phenomenon. For a review of the debate over the sources of this taboo, see Leonard Cole, "The Poison Weapons Taboo: Biology, Culture, and Policy," *Politics and the Life Sciences*, Vol. 17, No. 2 (September 1998), pp. 119-132.

[120] Moon, "Controlling Chemical and Biological Weapons Through World War II," pp. 657-674; and Charles C. Floweree, "Chemical and Biological Weapons and Arms Control," in Burns, *Encyclopedia of Arms Control and Disarmament* Vol. 2, pp. 999-1020.

Second, military organizations have also had practical reasons for not assimilating these weapons into their war plans.[121] Safely storing and handling these weapons presented logistical difficulties and employing them in combat posed significant operational problems. Early generations of biological weapons had limited effectiveness and uncertain results due to their reliance on vectors, such as insects or rats, and contamination of food or water to disseminate pathogens. Modern biological weapons based on aerosol dissemination are susceptible to vagaries in atmospheric conditions. This creates uncertainty for military planners and poses the risk of accidentally infecting friendly troops due to a change in wind direction. Terrorist groups so far have been unable to develop a biological weapon based on aerosol dissemination. A third reason for the rare use of these weapons is political and strategic. The use of these weapons may have been limited by the fear of retaliation or escalating a conflict. The domestic or international reaction to the use of these illegitimate weapons, rather than the prohibition itself, may have also had a restraining influence.

Unfortunately, there is cause for concern that all three of these constraints on the use of biological weapons have been eroding. The continued proliferation of biological weapons may reflect the diminishing normative power of the BWC. The number of states pursuing biological weapons has tripled since the BWC was opened for signature in 1972—from four to thirteen.[122] Significantly, most of these countries are parties to the treaty.[123] Although the secretive nature with which these states pursue these weapons is a demonstration of the normative power of the BWC, the purpose of the treaty was to prevent this activity, not just drive it underground. As Cohen and Frankel have observed in the context of opaque nuclear proliferation, "beyond a certain point the aggregate weight of an on-going practice overwhelms the rules."[124] The restraining influence of norms has also been weakened by the rise of religious extremist and millenarian terrorist groups such as Aum Shinrikyo and al-Qaeda. As discussed above, these groups are not bound by norms shared by the rest of society or even traditional terrorist groups. Furthermore, the 2001 anthrax letter attacks, the first overt use of biological weapons, weakened the taboo against the use of disease as a weapon. The second constraint, posed by operational and logistical problems, may be less daunting now due to the availability of advanced biotechnologies that make these weapons easier and safer to produce and store, and more effective when employed.[125] These improvements may make it easier for states to assimilate these weapons into their arsenals and military planning. Finally, the conventional superiority of

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[121] Military organizations are well-known for resisting innovation in the absence of operational experience with a new technology. Samuel Huntington, *The Soldier and the State: The Theory and Politics of Civil-Military Relations* (Cambridge, Mass.: Belknap Press, 1957), p. 64; and Barry Posen, *The Sources of Military Doctrine: France, Britain, and Germany Between the World Wars* (Ithaca, N.Y.: Cornell University Press, 1984), p. 55.

[122] GAO, *Arms Control: Efforts to Strengthen the Biological Weapons Convention,* pp. 9-11.

[123] In 2002, the U.S. Department of State listed eight nations that were suspected of not being in compliance with the BWC: China, Cuba, Iran, Iraq, Libya, North Korea, Russia, and Syria. Department of State, *Adherence To and Compliance With Arms Control and Nonproliferation Agreements and Commitments* (Washington, D.C.: Department of State, 2002), http://www.state.gov/documents/organization/22466.pdf.

[124] Avner Cohen and Benjamin Frankel, "Opaque Proliferation," *Journal of Strategic Studies*, Vol. 13, No. 3 (September 1990), p. 30.

[125] Jonathan B. Tucker, "The Future of Biological Warfare," in W. Thomas Wander and Eric H. Arnett, eds., *The Proliferation of Advanced Weaponry* (Washington, D.C.: American Association for the Advancement of Science [AAAS], 1992), pp. 61-71; Steven M. Block, "Living Nightmares: Biological Threats Enabled by Molecular Biology," in Sidney D. Drell, Abraham D. Sofaer, and George D. Wilson, eds., *The New Terror: Facing the Threat of Biological and Chemical Weapons* (Stanford, Calif.: Hoover Institution Press, 1999), pp. 39-75; and Robert P. Kadlec and Alan P. Zelicoff, "Implications of the Biotechnology Revolution for Weapons Development and Arms Control," in Zilinskas, *Biological Warfare*, pp. 11-26.

Western nations and their allies may provide dissatisfied actors with a strong incentive to employ biological weapons as part of an asymmetric strategy that outweighs the political and strategic hazards of using these weapons. Such actors may calculate that they can use their biological weapons as force multipliers to accomplish a fait accompli, tailor their use of these weapons to avoid provoking regime-threatening retaliation, or conduct anonymous attacks and avoid retaliation entirely. As with nuclear weapons, the lack of large-scale use of biological weapons since 1945 is a cause for celebration, but not grounds for complacency.

CONCLUSION

This chapter has discussed the major characteristics of biological weapons and highlighted three four findings. First, biological warfare strongly favors the attacker. Second, biological weapons have utility across the spectrum of conflict from sabotage and terrorism to strategic warfare. Third, biological weapons are attractive primarily to dissatisfied actors seeking a potent means of challenging the status quo. Fourth, the constraints on the development and use of these weapons may be eroding. The implications of these findings as well as related issues are explored in the next four chapters on proliferation, deterrence, civil-military relations, and threat assessment.

Chapter 3. Proliferation of Biological Weapons

Preventing the spread of biological weapons is perhaps the most difficult proliferation challenge facing the international community. This does not mean that traditional arms control and nonproliferation tools should be abandoned, but policy makers must recognize that such measures will be less effective at halting the spread of biological weapons than other weapons. Verification, the ability to confirm whether a nation is complying with its obligations, is the foundation of effective arms control and disarmament.[126] Fortunately, during the Cold War, the most threatening military forces, strategic nuclear weapons, and the means to produce them were either visible to overhead reconnaissance systems or had distinct signatures that could be detected at long range.[127] Even chemical weapons require industrial-scale production facilities and large stockpiles of munitions to pose a significant military threat.[128]

The core problem in verifying compliance with biological arms control and disarmament is that the capabilities for conducting the research, development, production, and testing of biological weapons are virtually identical to those employed by defensive programs and in legitimate civilian enterprises.[129] Biotechnology-related capabilities and activities that cannot be justified as having a civilian purpose—such as working with dangerous pathogens or experimenting with aerosols of biological agents—can be legitimate activities for a biological defense program. There are few aspects of a biological weapons program that are unique to offensive applications and are readily detectable by outsiders. Advanced biotechnologies make it unnecessary to maintain large dedicated production plants, stockpiles of bulk agents, or filled munitions that would provide intelligence agencies or inspectors with a "smoking gun."

The first section of this chapter argues that the multi-use nature of biotechnology, the overlap between offensive and defensive activities, the need for secrecy, and the lack of signatures of offensive programs make it difficult to distinguish between offensive and defensive or civilian activities. This indistinguishability of offensive and defensive capabilities is the key variable that makes the security dilemma possible. When offensive and defensive activities cannot be differentiated, cooperation and arms control under the security dilemma becomes extremely difficult. This is especially true when the military capabilities in question favor the attacker, as was shown to be the case in chapter 2 with regards to biological warfare.[130]

The second section of this chapter argues that the history of the negotiation of the 1972 Biological Weapons Convention (BWC) illustrates the limitation of arms control under the security dilemma. The BWC prohibits the development, production, stockpiling, acquisition, and retention of biological weapons. The treaty does not, however, ban research on biological and

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[126] ACDA, *Verification*; and Allan S. Krass, *Verification: How Much Is Enough?* (London: Taylor and Francis, 1985).

[127] On the "reconnaissance revolution", see John Lewis Gaddis, "The Long Peace: Elements of Stability in the Postwar International System," *International Security*, Vol. 10, No. 4 (Spring 1986), pp. 123-125.

[128] Gordon M. Burck, "Chemical Weapons Production Technology and the Conversion of Civilian Production," *Arms Control*, Vol. 11, No. 12 (September 1990), pp. 122-163; and Susan Berger, "The Challenges of Chemical and Biological Weapon Arms Control Treaty Verification," in Elizabeth J. Kirk, W. Thomas Wander, and Brian D. Smith, eds., *Trends and Implications for Arms Control, Proliferation, and International Security in the Changing Global Environment* (Washington, DC: AAAS, 1993), pp. 175-189.

[129] OTA, *Technologies Underlying Weapons of Mass Destruction*, pp. 84-87; Zilinskas, "Verifying Compliance to the Biological and Toxin Weapons Convention," pp. 198-199; and Berger, "The Challenges of Chemical and Biological Weapon Arms Control Treaty Verification," pp. 175-189.

[130] On the influence of the offense-defense balance on the security dilemma, see Jervis, "Cooperation Under the Security Dilemma," pp. 167-214; and Van Evera, *Causes of War*, pp. 135-137.

toxin agents and prohibit their development and production for protective, prophylactic or other peaceful purposes. The convention, however, does not define what activities constitute research or are considered protective, prophylactic, or peaceful.[131] As a result of these ambiguities and the multi-use nature of biotechnology, it was recognized that intrusive methods aimed at uncovering evidence of the development of biological weapons would inevitably require inspections of facilities engaged in defensive and civilian activities. However, the inability to distinguish between offensive and defensive activities and the desire to shield commercial and security information imposed strict limits on the effectiveness of these measures. These considerations strongly contributed to the lack of verification measures in the BWC in 1972 and continue to remain important factors impeding progress in the development of a protocol to strengthen verification of the treaty.

The third section examines the investigation of Iraq's biological weapons program by the United Nations Special Commission (UNSCOM) from 1991 to 1998. The UNSCOM experience represents the most important effort by the international community to verify biological arms control and disarmament. UNSCOM was the most intrusive arms control regime ever devised and had access to an unprecedented range of inspection techniques and technologies. Although UNSCOM was successful in uncovering aspects of Iraq's past biological weapons activities, a comprehensive account of Iraq's biological agent research, production, and weaponization only emerged following a high-level defection in August 1995. Furthermore, the conditions required for UNSCOM's success cast serious doubt on the ability of an international organization to achieve similar results in the context of a multilateral biological verification treaty. This case demonstrates how indistinguishability greatly complicates verification and the extraordinary measures that were required to overcome a dedicated state's attempts to retain an offensive capability based on multi-use technologies.

CHALLENGES TO VERIFICATION OF BIOLOGICAL ARMS CONTROL

The difficulty in verifying that a state is complying with its commitment to use biotechnology for peaceful purposes is due to four reasons: (1) the multi-use nature of biotechnology, (2) the overlap between offensive and defensive activities, (3) the need for secrecy to protect commercial and national security information, and (4) the lack of signatures of an offensive program. These characteristics make biological arms control and disarmament agreements dramatically harder to verify than similar arrangements regarding nuclear and chemical weapons.[132]

The Multi-Use Nature of Biotechnology

Biotechnology is multi-use in the sense that it can be applied to civilian endeavors as well as defensive and offensive military programs.[133] The overlap between offensive and defensive programs is discussed in the next subsection. Although chemical warfare technology is commonly characterized by a high degree of multi-use, there are in fact a range of materials,

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[131] Barend ter Haar, *The Future of Biological Weapons* (New York: Praeger, 1991), pp. 16, 62.

[132] On the difficulty in making definitive judgments regarding a state's compliance with biological arms control agreements, see Jonathan B. Tucker, "Strengthening the Biological Weapons Convention," *Arms Control Today*, April 1995, p. 11; and Berger, "The Challenges of Chemical and Biological Weapons Arms Control Treaty Verification," p. 185.

[133] Most analyses of biotechnology refer to it as dual-use since it has both civilian and military applications. I use the term "multi-use" to highlight the distinct but overlapping applications of this technology in civilian, defensive, and offensive domains.

equipment, production processes, and facilities that have no civilian application.[134] In contrast, most of the raw materials and equipment required for the research, development, production and weaponization of biological weapons is used in civilian industries.[135]

In some cases, the agents themselves are multi-use. Botulinum toxin, 10,000 more times lethal than the nerve gas VX, is used under the name Botox to treat spasmic eye muscle disorders and migraine headaches and to smooth facial wrinkles.[136] The number of multi-use agents is likely to become more pronounced as the use of toxins in medical research and therapy continues to grow.[137] Even innocuous agents with civilian applications can be used as part of an offensive biological warfare program. The use of non-pathogenic organisms, such as *B. subtilis* and *B. thuringensis,* as simulants for the closely related *B. anthracis* was integral to the Iraqi biological weapons program. These simulants were used at every stage of its biological weapons program: determining the best growth media to use, testing production equipment, scaling up production, developing spray drying techniques, studying conditions suitable for storing organisms, assessing the viability of these organisms in an aerosol, testing munitions to determine dispersion and dissemination patterns and efficiency, and training personnel.[138]

Research conducted for scientific or commercial purposes could also potentially also be used for military purposes. Many of the biological warfare threat agents are naturally occurring diseases that are endemic in certain parts of the world and periodically cause epidemics in people and animals. Thus, the medical and public health authorities in many countries have legitimate reasons for conducting research on the virulence, pathogenicity, immune response-avoidance, and antibiotic-resistance of dangerous pathogens. This research is being facilitated by the sequencing of the genomes of more than seventy major pathogens, including *Y. pestis* and *B. anthracis*, with the results being posted on the Internet.[139] This information will allow researchers to develop better drugs and improve our understanding of the evolution of infectious disease as well as provide information that could also be used to modify these pathogens to make them more efficient killers. Likewise, the techniques developed for the microencapsulation of pharmaceuticals to protect them during aerosol delivery and release them over time could also be applied to the development of biological weapons.[140]

The field of genetic engineering is rife with examples of multi-use research. Research on gene therapy is aimed at perfecting the art of inserting foreign genetic material into viruses and

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[134] Burck, "Chemical Weapons Production Technology and the Conversion of Civilian Production," pp. 122-163.
[135] OTA, *Technologies Underlying Weapons of Mass Destruction*, pp. 84-87.
[136] Jonathan B. Tucker, "Dilemmas of a Dual-Use Technology: Toxins in Medicine and Warfare," *Politics and the Life Sciences*, Vol. 13, No. 1 (February 1994), pp. 52-53; Jiri Patocka and Miroslav Splino, "Botulinum Toxin: From Poison to Medicinal Agent," *The ASA Newsletter*, No. 88 (February 29, 2002), pp. 14-23; and Eric A. Johnson, "Clostridial Toxins as Therapeutic Agents: Benefits of Nature's Most Toxic Proteins," *Annual Review of Microbiology,* No. 53 (1999), pp. 551-575.
[137] United States of America, *Biologically Derived Toxins: Quantities for Legitimate Use*, Ad Hoc Group of Governmental Experts to Identify and Examine Potential Verification Measures from a Scientific and Technical Standpoint, BWC/CONF.III/VEREX/WP.88, Geneva, December 4, 1992; and Alan P. Zelicoff, "The Dual-Use Nature of Biotechnology: Some Examples from Medical Therapeutics," *Director's Series on Proliferation*, No. 4, (Livermore, Calif.: Lawrence Livermore National Laboratory, May 1994), pp. 82-83.
[138] United Nations Monitoring, Verification, and Inspection Commission (UNMOVIC), *Unresolved Disarmament Issues: Iraq's Proscribed Weapons Programmes* (New York: United Nations, March 6, 2003), pp. 131-132.
[139] Carina Dennis, "The Bugs of War," *Nature*, May 17, 2001, pp. 232-235; and Julian Parkhill, et al., "Genome Sequence of *Yersinia pestis*, the Causative Agent of Plague," *Nature*, October 4, 2001, pp. 523-527.
[140] Malcolm Dando, *The New Biological Weapons: Threat, Proliferation, and Control* (Boulder, Colo.: Lynne Reinner, 2001), p. 110.

using them as vectors that can avoid the human immune system.[141] In 2002, scientists synthesized the virus that causes polio from man-made genetic material, an accomplishment that could eventually be used to synthesize larger and more complicated viral pathogens such as variola.[142] Scientific research may also devise new ways to create new and dangerous pathogens by accident.[143] In 2001, Australian scientists inserted a gene for the immune regulatory protein interleukin-4 (IL-4) into mousepox that inadvertently resulted in a virus that would kill all of the mice exposed to it, included those immunized against ordinary mousepox.[144] This experiment demonstrated a possible method for engineering a highly virulent and vaccine-resistant form of variola, the virus that causes smallpox. The Soviet Union actively sought to apply advances in Western genetic engineering to the development of new biological weapons.[145] Milton Leitenberg has identified several examples of the same techniques and pathogens being utilized in the former Soviet Union's offensive program, defensive programs within the United States and United Kingdom, and in civilian biomedical research.[146] For example, in the 1980s, the United States Army developed techniques to insert foreign genetic material into vaccinia, the virus used as a vaccine for smallpox, to develop new vaccines. Soviet scientists took advantage of this research and the genetic similarities between vaccinia and variola to develop an improved smallpox weapon.[147]

Biotechnology's multi-use nature is also evident in the equipment used in the production, weaponization, and dissemination of biological agents. The same fermenters, egg incubators, and tissue cell cultures found in the pharmaceutical, dairy, and brewery industries can also be utilized to produce biological warfare agents. According to a former UNSCOM inspector, all of the equipment and supplies Iraq used for research and development, testing, pilot plant trials, and production of biological weapons were dual-use.[148] After the Gulf War, Iraq was able to gain considerable experience in the production of dry bulk bacterial agents under the cover of biopesticide production at Al Hakam. The same equipment and processes could also be applied to the production of *B. anthracis* in dry powder form.[149] The equipment required to dry and mill a pharmaceutical product for aerosol delivery does not differ greatly from equipment needed to

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[141] Peter Aldhous, "Biologists Urged to Address Risk of Data Aiding Bioweapon Design," *Nature,* November 15, 2001, pp. 237-238; and Block, "Living Nightmares," pp. 60-65.

[142] Jeronimo Cello, Aniko V. Paul, and Eckard Wimmer, "Chemical Synthesis of Poliovirus cDNA: Generation of Infectious Virus in the Absence of a Natural Template," *Science*, August 9, 2002, pp. 1016-1018; and Institute of Medicine, *Assessment of Future Scientific Needs for Live Variola Virus* (Washington, D.C.: National Academy Press, 1999), pp. 64-65.

[143] In 2003, researchers inadvertently increased the virulence of the pathogen that causes tuberculosis. Nobuyuki Shimono, et al., "Hypervirulent Mutant of *Mycobacterium tuberculosis* Resulting From Disruption of the *mce1* Operon," *Proceedings of the National Academy of Sciences*, Vol. 100, No. 26 (December 23, 2003), pp. 15918-15923.

[144] Ronald J. Jackson, et al., "Expression of Mouse Interleukin-4 by a Recombinant Ectromelia Virus Suppresses Cytolytic Lymphocyte Responses and Overcomes Genetic Resistance to Mousepox," *Journal of Virology*, Vo. 75, No. 3 (February 2001), pp. 1205-1210.

[145] Interview with Serguei Popov, former Soviet biological weapons scientist, Manassas, Virginia, July 25, 2002; and Alibek, *Biohazard*, p. 231.

[146] Milton Leitenberg, "Distinguishing Offensive From Defensive Biological Weapons Research," *Critical Reviews in Microbiology*, Vol. 29, No. 3 (2003), pp. 233-234.

[147] Alibek, *Biohazard*, pp. 259-260; and Leitenberg, "Distinguishing Offensive From Defensive Biological Weapons Research." pp. 232-233.

[148] Zilinskas, "Verifying Compliance to the Biological and Toxin Weapons Convention," p. 198.

[149] UNMOVIC, *Unresolved Disarmament Issues*, p. 132.

produce an easily aerosolized biological warfare agent.[150] The centrifuges used in the Soviet program to purify and concentrate liquid slurries of bacteria were similar to those used to make milk and butter and were produced at a civilian dairy equipment plant.[151] Even the machines used by Iraq and the Soviet Union to fill munitions with biological agents had civilian uses.[152] Finally, in some cases civilian equipment can be used to disseminate biological agents. In the 1980s, Iraq modified and successfully tested domestic and imported agricultural sprayers for the dissemination of biological agents.[153]

The multi-use property of biotechnology allows a nation developing biological weapons to hide its activities in civilian institutes that appear to be, or actually are, conducting legitimate pharmaceutical or medical research. Most countries believed to have worked on or be working on biological weapons, including Iran, Iraq, Libya, and Israel have exploited the multi-use nature of biotechnology to conduct the research, development, and production of biological warfare agents in ostensibly civilian facilities.[154] The Soviet Union created Biopreparat as a civilian research organization in the 1970s to exploit the emerging field of molecular biology for military applications. Ken Alibek, deputy director of the organization, has described the purpose of this subterfuge: "Ostensibly operating as a civilian pharmaceutical enterprise, the agency could engage in genetic research without arousing suspicion. It could participate in international conferences, interact with the world scientific community, and obtain disease strains from foreign microbe banks—all activities which would have been impossible for a military laboratory."[155] A similar logic led South Africa to conduct its secret chemical and biological weapons program in front companies that concealed the role of the military, granted scientists free access to the international scientific community, and assisted with the procurement of dual-use equipment and materials from abroad.[156] Iraq's remarkable progress before the 1991 Gulf War from biological weapons research to production in only five years was due in part to its exploitation of civilian vaccine facilities for the production of biological warfare agents.[157]

Overlap Between Offensive And Defensive Activities

A second phenomenon that further undermines the ability of states to reliably distinguish between activities prohibited and permitted under the BWC is the substantial overlap between these types of activities. Although biological weapons (munitions designed to disseminate biological agents) and biological defenses (syringes filled with vaccine) can be readily distinguished when placed side by side, the research, development, production, and testing activities used to develop these capabilities are similar, if not identical, in many ways. The overlap between offensive and defensive activities provides states with another means of masking an offensive program and complicates efforts to assess compliance with biological arms control and disarmament agreements.

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[150] Dando, *The New Biological Weapons*, p. 110.
[151] Alibek, *Biohazard*, p. 98.
[152] Alibek, *Biohazard*, p. 99; and Trevan, *Saddam's Secrets*, p. 314.
[153] UNMOVIC, *Unresolved Disarmament Issues*, pp. 57-60.
[154] Gregory Koblentz, "Countering Dual-Use Facilities: Lessons From Iraq and Sudan," *Jane's Intelligence Review*, Vol. 11, No. 3 (March 1999), pp. 48-53.
[155] Alibek, *Biohazard*, p. 22.
[156] Gould and Folb, "The South African Chemical and Biological Warfare Program," p. 14.
[157] The fermenters at the civilian facilities were either transferred to the biological weapon production plant at Al Hakam or converted on-site to the production of biological warfare agents. Trevan, *Saddam's Secrets*, pp. 336-337, 346-347; and Mitchell B. Wallerstein, "Responding to Proliferation Threats," *Strategic Forum*, No. 138 (May 1998), http://www.ndu.edu/inss/strforum/SF138/forum138.html.

At the research and development stage, it is extraordinarily difficult to differentiate between research conducted solely for defensive purposes and research that is undertaken for the development of weapons. The same equipment, materials, technologies, and techniques are used for both types of research.[158] For example, experiments to manipulate an organism's virulence are staples of both defensive and offensive programs and generate similar types of knowledge. Defensive programs conduct such research to identify ways to decrease an organism's virulence in order to create a better vaccine while offensive programs explore ways to heighten an organism's virulence. Russian scientists have portrayed research conducted under the former Soviet program on enhancing the virulence of *B. anthracis* and conferring multiple antibiotic-resistance to *B. anthracis* as efforts to develop improved defenses against this agent.[159]

The production processes for some vaccines and biological warfare agents are also similar. In 1990-1991, when the United States sought to stockpile botulinum antitoxin, it first had to grow large quantities of the toxin, which was then treated with formalin to inactivate it while preserving its immunogenic properties.[160] Killed vaccines go through a similar process that results in the production of large quantities of the pathogen until the organisms are chemically treated and killed.[161]

Both offensive and defensive programs also need to engage in generating and testing aerosols of infectious agents and simulants in both the laboratory and the field. Defensive programs conduct such experiments to develop animal models for studying the pathogenesis of disease, evaluating the effectiveness of vaccines and treatments, and testing detection systems and decontamination procedures.[162] Offensive programs engage in aerosol testing to determine the effectiveness of different strains and preparations of an agent, the optimal environmental parameters for disseminating the agent, and the performance of biological munitions.[163] Both types of programs are also interested in understanding the behavior of aerosols in order to predict the effects of a biological attack. Although the scale of testing and nature of agents employed would differ between these types of programs, such differences would not be readily apparent to outside observers.[164]

Even apparently benign defensive activities such as immunizing soldiers against anticipated biological warfare threats can have an offensive connotation. It would be reasonable to infer that an aggressor contemplating the use of a biological weapon would want to ensure that its own troops are protected in the event of blowback.[165] During the Cold War, the United States viewed Soviet chemical and biological defensive preparations as evidence of intent to initiate the use of these weapons.[166] According to press reports, the United States government views the

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[158] SIPRI, *The Problem of Chemical and Biological Warfare,* Vol. 5: *The Prevention of CBW* (New York: Humanities Press, 1974), p. 111.

[159] A.V. Stepanov, et al., "Development of Novel Vaccines Against Anthrax in Man," *Journal of Biotechnology*, Vol. 44 (1996), pp. 155-160; and A.P. Pomerantsev, et al., "Expression of Cereolysine AB Genes in *Bacillus Anthracis* Vaccine Strain Ensures Protection Against Experimental Hemolytic Anthrax Infection," *Vaccine*, Vol. 15, No. 17/18 (1997), pp. 1846-1850.

[160] Tucker, "Dilemmas of a Dual-Use Technology, p. 56.

[161] Leitenberg, "Distinguishing Offensive From Defensive Biological Weapons Research," p. 246.

[162] Department of Defense, *Final Programmatic Environmental Impact Statement on the Biological Defense Research Program* (Frederick, M.D.: U.S. Army Medical Research and Development Command, April 1989), pp. 2-6 to 2-8, http://mrmc.detrick.army.mil/docs/env/BDRP-NetText.pdf.

[163] Alibek, *Biohazard*, p. 97.

[164] Haar, *The Future of Biological Weapons*, pp. 66-67.

[165] SIPRI, *The Problem of Chemical and Biological Warfare,* Vol. 5, p. 111.

[166] SIPRI, *The Problem of Chemical and Biological Warfare,* Vol. 2, pp. 163-164.

immunization of Iraqi and North Korean soldiers against smallpox as evidence that these countries possess variola virus, plan on using it as a weapon, and want to protect their own forces. As one anonymous Department of Defense official put it: "The vaccinations are as close to a smoking gun as you can come."[167] This inference, however, is not always warranted. After Operation Iraqi Freedom, it was determined that Iraq did not in fact possess variola virus.[168] Likewise, the vaccination of American soldiers against anthrax and smallpox are not indicators of intent to use these agents as biological weapons.

Perhaps the most vexing challenge to distinguishing between offensive and defensive programs is the need for defensive programs to engage in offensive research to prepare for current threats or to anticipate new ones. This type of research goes beyond that described above since the goal is to create a limited offensive capability in order to assess vulnerabilities and evaluate the effectiveness of current and planned defenses.[169] As with any other form of warfare, understanding the threats posed by others is a prerequisite for developing an effective defense. In 1969, when the United States terminated its offensive biological warfare program, it was recognized that, "Maintenance of a defensive RDT&E [research, development, test, and evaluation] program inherently requires some offensive RDT&E effort."[170] The British scientists involved in their biological warfare program also realized that "defence cannot be arranged intelligently without study of the offence."[171] As one historian of the United States' former biological weapons program has observed, "Research and development in the offensive aspects of BW proceeded hand in hand with defensive developments for, in truth, the two are almost inseparable."[172] These types of activities fall into a grey area of the BWC. The treaty does not prohibit research on biological and toxin agents and allows their development and production for protective, prophylactic or other peaceful purposes.[173] This ambiguity has been cynically manipulated by Russian and South African officials who have claimed that their past offensive activities were motivated by external threats and that their sole purpose was to assess the threat and develop countermeasures.[174]

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[167] William Broad and Judith Miller, "Government Report Says 3 Nations Hide Stocks of Smallpox," *New York Times*, June 13, 1999, p. A1.

[168] "Scientists Hunted Futilely in Iraq For Signs of Smallpox," *Associated Press*, September 19, 2003.

[169] SIPRI, *The Problem of Chemical and Biological Warfare,* Vol. 2, pp. 276-282.

[170] Report to the National Security Council, *US Policy on Chemical and Biological Warfare and Agents*, Submitted by the Interdepartmental Political-Military Group in response to NSSM 59, November 10, 1969, p. 27, http://foia.state.gov/documents/FOIADocs/000050DA.pdf.

[171] Dr. Paul Fildes, head of British biological warfare research during World War II, quoted in Brian Balmer, *Britain and Biological Warfare: Expert Advice and Science Policy, 1930-1965* (London: Palgrave, 2001), p. 56.

[172] Richard Clendenin, *Science and Technology at Fort Detrick, 1943-1968* (Frederick, M.D.: Fort Detrick, 1968), p. 10.

[173] The treaty does not define what constitutes research or the activities that are considered protective, prophylactic, or peaceful. Haar, *The Future of Biological Weapons*, p. 16.

[174] On the Russian claims, see the interviews with Gen. Valentin Yevstigneyev, head of the Ministry of Defense's biological defense directorate, in Dmitriy Frolov, "We Never Filled Our Models With Live Cultures: The Biological Protection Service Will Engage in Protection Only," *Nezavisimaya Gazeta* (Moscow), December 2, 1992, p. 6, as translated in JPRS-TAC-92-037, December 30, 1992, pp. 61-63; and "Valentin Yevstigneyev on Issues Relating to Russian Biological Weapons," *Kaderny ControlDigest*, No. 11, Summer 1999, http://www.pircenter.org/board/article.php3?artid=77.

On the claims of Wouter Basson, former head of the South African chemical and biological warfare program, that the program's activities were motivated by defensive considerations, see Burger, and Gould, *Secrets and Lies*, p. 183.

This lack of a clear boundary between offensive and defensive programs has been a source of continuing controversy for the United States biodefense program. In the 1980s, the U.S. Army increased its spending on defensive biological warfare research in response to intelligence that Soviet Union had an active biological weapons program, including the application of genetic engineering. The military's research on genetically modified organisms, exotic diseases, and construction of a new aerosol test facility were subsequently criticized and restricted due to their perceived association with offensive activities.[175]

Secrecy to Protect National Security and Proprietary Information

Facilities engaged in defensive and civilian activities frequently have legitimate needs for a limited degree of secrecy to protect national security and proprietary business information. This secrecy makes it more difficult for outside observers to determine the intent behind a program or capability and can foster suspicion and mistrust. Furthermore, the safeguards for protecting sensitive information demanded by states uninterested in developing biological weapons necessarily make it easier for states pursuing these weapons to hide their illicit activities. Even advocates of strengthening the BWC acknowledge that a verification regime that is sensitive to national security and commercial concerns will likely be unable to reliably detect violations of the treaty.[176]

States developing defenses against biological weapons may need to keep certain aspects and characteristics of these activities secret to ensure the effectiveness of their preparations. Intelligence on foreign biological threats, specific vulnerabilities, and the range of medical countermeasures available have been cited as "obvious examples where secrecy would be advisable."[177] Making such information publicly available could enable an adversary to identify and exploit weaknesses in defensive preparations and intelligence gathering. Given the diversity of biological warfare agents, an adversary could select an agent for which it knows the target state lacks any or adequate defenses. In addition, with the advent of genetic engineering, it is possible to modify pathogens to be resistant to antibiotics, circumvent vaccine-induced immunity, or evade diagnostic and detection systems.[178] The Soviet Union is known to have engaged in the development of genetically engineered biological weapons and Iraq initiated a similar effort in 1990.[179]

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[175] Charles Piller and Keith R. Yamamoto, *Gene Wars: Military Control Over the New Genetic Technologies* (New York: Morrow, 1988); Jonathan King and Harlee Strauss, "The Hazards of Defensive Biological Warfare Programs" in Wright, *Preventing a Biological Arms Race*, pp. 120-132; and Susan Wright and Stuart Ketcham, "The Problem of Interpreting the U.S. Biological Defense Research Program," in Wright, *Preventing a Biological Arms Race*, pp. 169-196; and Senate Committee on Government Affairs, *Global Spread of Chemical and Biological Weapons* (Washington, D.C.: U.S. GPO, 1990).

[176] Chevrier, "Verifying the Unverifiable," p. 99; Zilinskas, "Verifying Compliance to the Biological and Toxin Weapons Convention," p. 211; and Rosenberg, "U.S. Policy and the BWC Protocol," p. 2.

[177] Dando, *Biological Warfare in the 21st Century*, p. 190. In addition, SIPRI has listed methods of dissemination, results of field tests, studies of tactical and strategic implications based on this information, and the nature of countermeasures that an aggressor could bypass as examples of information that should be classified under a defensive program. SIPRI, *The Problem of Chemical and Biological Warfare*, Volume 6: *Technical Aspects of Early Warning and Verification* (New York: Humanities Press, 1975), p. 25.

[178] DOD, *Biotechnology and Genetic Engineering: Implications for the Development of New Warfare Agents* (Washington, D.C.: DOD, 1996); Tucker, "The Future of Biological Warfare," pp. 61-71; Block, "Living Nightmares," pp. 39-75; and Kadlec and Zelicoff, "Implications of the Biotechnology Revolution for Weapons Development and Arms Control," pp. 11-26.

[179] On the Soviet program, see Alibek, *Biohazard*. On the Iraqi effort, see UNMOVIC, *Unresolved Disarmament Issues*, pp. 127-129.

When the United States abandoned its offensive program in 1969, it committed itself to conducting its defensive program as openly as possible. However, the United States determined that the performance of detection systems, threat assessments, and vulnerability studies may require classification.[180] Although this policy is not believed to have changed, the number and nature of classified biodefense programs has increased since the mid 1990s. In September 2001, the *New York Times* revealed the existence of several secret biological threat assessment projects sponsored by the United States government. The projects included the construction of a small biological agent production facility, the testing of copies of a Soviet-designed biological bomblet, and the creation of a genetically-engineered strain of *B. anthracis* developed by the Soviet Union that was able to circumvent some vaccines.[181] The United States claimed that the purpose of these research projects was defensive and legal under the BWC, but the combination of capabilities under development and the secrecy of the work raised questions at home and abroad about the commitment of the United States to enforcing the BWC.[182] In contrast, some officials involved in biodefense activities believes that there is already an excessive amount of publicly available information on the United States biodefense program that exposes current shortfalls and gaps in defensive preparedness.[183]

The pharmaceutical and biotechnology industries, which have the greatest concentration of multi-use technology to research, develop, produce and test biological weapons, also jealously guard their confidential business information.[184] Proprietary information is particularly valuable in these industries because of their competitiveness and the costs of developing successful products. These industries are knowledge-intensive and invest heavily in research and development to generate new products.[185] On average, it takes 12 to 15 years and $350 to $500 million to develop a new medicine.[186] It has been estimated that for every 25,000 to 50,000 compounds discovered and investigated by researchers, only one will successfully make it to market and earn a positive return on the research and development costs.[187] Historically, the first

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[180] Interdepartmental Political Military Working Group, *Annual Review of United States Chemical Warfare and Biological Research Programs as of 1 November 1970*, December 5, 1970, pp. 23-24, http://foia.state.gov/documents/FOIADocs/000050DB.pdf.

[181] Judith Miller, Stephen Engelberg, and William J. Broad, "U.S. Germ Warfare Research Pushes Treaty Limits," *New York Times*, September 4, 2001, p. A1; and Miller, Engelberg, and Broad, *Germs*, pp. 290-298, 308-310.

[182] Judith Miller, "When Is Bomb Not a Bomb? Germ Experts Confront U.S.," *New York Times*, September 5, 2001, p. A5; Elisa Harris, "Research Not to Be Hidden," *New York Times*, September 6, 20001; Barbara Hatch Rosenberg and Milton Leitenberg, "Who's Afraid of a Germ Warfare Treaty?" *Los Angeles Times*, September 6, 2001; and Mark Wheelis and Malcolm Dando, "Back to Bioweapons," *Bulletin of the Atomic Scientists*, Vol. 59, No. 1 (January/February 2003), pp. 40-46.

[183] Robert P. Kadlec, and Randall J. Larsen, "Passive Defense," in Hays, Peter L., Vincent J. Jodoin, and Alan R. Van Tassel, eds., *Countering the Proliferation and Use of Weapons of Mass Destruction* (New York: McGraw-Hill, 1998), p. 232.

[184] Will D. Carpenter and Michael Moodie, "Industry and Arms Control," in Zilinskas, *Biological Warfare*, pp. 185-191.

[185] The pharmaceutical industry invests a far higher percentage of revenue in research and development than the chemical industry and even more than other high-technology industries such as aerospace and electronics. Gillian R. Woollett, "Industry's Role, Concerns, and Interests in the Negotiations of a BWC Compliance Protocol," in Graham S. Pearson, Gillian R. Woollett, Marie I. Chevrier, Jonathan B. Tucker, and Amy E. Smithson, *Biological Weapons Proliferation: Reasons for Concern, Courses of Action* (Washington, DC: Henry L. Stimson Center, January 1998), p. 42.

[186] Woollett, "Industry's Role, Concerns, and Interests in the Negotiations of a BWC Compliance Protocol," p. 40.

[187] Ibid., pp. 40-41; and Al Homberg, "Industry Concerns Regarding Disclosure of Proprietary Information," *The Director's Series on Proliferation*, No. 4 (Livermore, Calif: Lawrence Livermore National Laboratory, May 1994), p. 93.

drug to market for a particular disease or condition has been the most profitable. As a result, the pharmaceutical industry has experienced a number of corporate espionage cases in recent years.[188] Secrecy is especially important during the research phase before a promising organism or compound has been patented. Since the research and development process for a new drug can take 10 to 12 years and drugs are protected by patents for 17 years, companies typically have five to seven years to make a profit before a drug is available for generic production.[189] Firms can extend the window of profitability by delaying the application for a patent and instead rely on trade secrecy to protect their discovery. Once patent protection does expire, a firm's advantage in competing against generic versions of its product may be due to customized production equipment and processes. These proprietary innovations are often held as trade secrets due to the difficulty in obtaining patent protection or detecting patent infringement by a competitor.[190] As a result, even pilot plants and manufacturing plants contain sensitive information that need to be protected against unauthorized disclosure.[191]

Offensive Programs Lack Unique Signatures

The phenomenon discussed above help explain the difficulty in distinguishing between a biological weapon program and defensive or civilian programs. However, detecting an offensive biological warfare program in the first place is also difficult due to the paucity of unique signatures associated with such a program.[192]

Detecting facilities utilized in the production of biological warfare agents is difficult for several reasons. First, pathogen production facilities can be externally identical to a pharmaceutical facility and even be a pharmaceutical facility. High levels of biocontainment are not necessary or sufficient for a plant to produce biological warfare agents. Iraq produced *B. anthracis* and botulinum toxin without these precautions.[193] Meanwhile, modern pharmaceutical facilities have begun incorporating multipurpose containment features in plants to ensure quality control.[194] The physical characteristics of a facility such as heavy security, storage bunkers, and incinerator stacks may look suspicious, but are not direct evidence of an offensive program. Second, large facilities or stockpiles of agent are not required for a nation to have a significant military capability. Advanced technology such as continuous-flow fermenters and viral reactors reduces the size of a production facility and accelerates the production process, obviating the need to stockpile biological weapons.[195] A logical outgrowth of this trend towards smaller production facilities is mobile biological weapon production facilities. According to Ken Alibek, the Soviet Union was developing such a capability in the late 1980s in response to American and

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[188] Dane Zabriskie, "Strengthening the Biological Weapons Convention and Implications on the Pharmaceutical Industry and Biotechnology Industry," *Current Opinion in Biotechnology*, Vol. 9 (1998), p. 313.

[189] Homberg, "Industry Concerns Regarding Disclosure of Proprietary Information," p. 93.

[190] Zabriskie, "Strengthening the Biological Weapons Convention and Implications on the Pharmaceutical Industry and Biotechnology Industry," p. 313.

[191] Homberg, "Industry Concerns Regarding Disclosure of Proprietary Information," pp. 96-97.

[192] OTA, *Technologies Underlying Weapons of Mass Destruction*, pp. 99-113; Zilinskas, "Verifying Compliance to the Biological and Toxin Weapons Convention," p. 199; Raymond A. Zilinskas, "Detecting and Deterring Biological Weapons in Iraq: The Role of Aerial Surveillance," *Politics and the Life Sciences*, Vol. 14, No. 2 (August 1995), p. 257; and Amy Smithson, "Man Versus Microbes: The Negotiations to Strengthen the Biological Weapon Convention," in Pearson, et. al., *Biological Weapons Proliferation,* pp. 108-109.

[193] Zilinskas, "Iraq's Biological Weapons," p. 420.

[194] These systems can also be used to prevent the leakage of pathogens into the environment. Haar, *The Future of Biological Weapons*, p. 88.

[195] Spertzel, Wannemacher, and Linden, *Global Proliferation,* Vol. 4, pp. 22, 27.

British demands to conduct inspections of Biopreparat facilities.[196] Third, the production of biological warfare agents does not produce easy-to-detect effluents such as those associated with the production of chemical and nuclear weapons.[197]

The weaponization of biological warfare agents also does not generate readily identifiable signatures. The munitions themselves may be modified versions of civilian aerosol generators, chemical warheads, conventional bombs, or aircraft fuel tanks.[198] These munitions would be unremarkable and virtually identical to the original items. Only an analysis of their contents would their true identity. In the early 1990s, UNSCOM destroyed what it thought were chemical munitions but were in fact biological munitions; the only feature that differentiated these munitions were black stripes on their exterior.[199] Indeed, a biological weapon program could piggyback on a chemical weapon program: the munitions, filling and testing facilities are all similar.[200] Regarding weaponization, much of the activity required to design and test a munition could be conducted in specially equipped chambers located in nondescript buildings. Field tests and associated facilities could be camouflaged as chemical weapons tests, biopesticide trials, or as vulnerability studies.[201] Iraq's weaponization and testing activities were the most difficult aspect of Iraq's biological weapons program for UNSCOM to uncover.[202] As a result of the lack of unique signatures associated with biological weapons programs, these programs pose a notoriously difficult target for intelligence agencies. This issue is addressed in chapter 6.

The next two sections examine the challenges in verifying biological arms control and disarmament agreements. The origins of the BWC illustrate how the problem of indistinguishability stymied efforts to include verification provisions in the treaty. UNSCOM's investigation of Iraq's biological weapons program during the 1990s illustrates the challenges faced by the most intrusive arms control regime ever devised in uncovering this secret program.

BIOLOGICAL WEAPONS CONVENTION

The Convention on the Prohibition of the Development, Production, and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their Destruction, also known as the Biological Weapons Convention (BWC) was opened for signature on April 10, 1972 and entered into force on March 26, 1975. The BWC was the first international arms control agreement to outlaw an entire class of weapons. In its preamble, the treaty states that the use of biological weapons would be "repugnant to the conscience of mankind" and that the prohibition of these weapons is "for the sake of all mankind." As of November 2003, 151 nations had become parties

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[196] Alibek, *Biohazard*, pp. 145, 191, 205.
[197] OTA, *Technologies Underlying Weapons of Mass Destruction*, pp. 49, 106, 164.
[198] Iraq pursued all of these options for developing its biological munitions. Zilinskas, "Iraq's Biological Weapons," p. 420.
[199] Miller, Engelberg, and Broad, *Germs*, p. 131; and Jean Krasno and James Sutterlin, *The United Nations and Iraq: Defanging the Viper* (Westport, Conn.: Praeger, 2003), p. 66.
[200] Spertzel, Wannemacher, and Linden, *Global Proliferation*, Vol. 4, p. 42.
[201] Despite having identified what turned out to be the primary Soviet biological weapons proving ground on Vozrozhdeniya Island in the Aral Sea as early as the 1940s, American intelligence agencies were unable to obtain definitive evidence regarding Soviet activities on the island at least through the mid-1960s and possibly into the late 1980s. Wilton E. Lexow and Julian Hoptman, "The Enigma of Soviet BW," *Studies in Intelligence*, Vol. 9 (Spring 1965), pp. 15-20, http://www.foia.cia.gov; and Mangold and Goldberg, *Plague Wars*, p. 85.
[202] Zilinskas, "Detecting and Deterring Biological Weapons," p. 195.

to the treaty and another 16 had signed but not ratified it.[203] The negotiating history of the BWC reveals how the treaty's lack of verification provisions is due to the difficulty of distinguishing between offensive and peaceful activities, the legitimate need for secrecy, and concern over the strategic consequences of biological weapons proliferation. These factors are still at work today and are responsible for impeding progress in developing a protocol to strengthen the treaty.

Origins of the Treaty

The BWC had its origin in an August 1968 British proposal to separate chemical and biological weapons in international disarmament negotiations and to focus international efforts on banning biological weapons.[204] Until this point, negotiators at the Eighteen Nation Disarmament Conference (ENDC) in Geneva had sought an agreement to prohibit both chemical and biological weapons. International interest in such an agreement had intensified during the mid-1960s in response to the use of tear gas herbicides, and defoliants in Vietnam by the United States. Due to the controversial nature of the American intervention in Vietnam and the desire of Communist nations to use the forum for propaganda purposes, the negotiations quickly bogged down.

The British proposal to focus on a ban on biological weapons was based on four assumptions articulated in a 1966-1967 study by Hedley Bull of the British Foreign Office. First, chemical and biological weapons were deemed not useful for deterrence and since the United Kingdom and other nuclear powers would retain their nuclear weapons anyway, they would not need chemical and biological weapons for deterrence. Second, since significant chemical and biological weapons capabilities were not believed to be widely available aside from the nuclear states, the key concern was horizontal proliferation to less developed nations. Third, defensive research would have to be allowed to continue and do so under secrecy to avoid revealing vulnerabilities or providing information that could be utilized offensively by another nation. Fourth, effective verification of non-possession would not be possible due to the multi-use nature of biology and the difficulty in distinguishing between civilian, defensive, and offensive activities.[205]

These findings were shared with the officials from the U.S. Arms Control and Disarmament Agency (ACDA) in October 1967. The American reaction was cool. First, ACDA officials highlighted the difficulty of verifying a biological nonproliferation treaty due, in part, to "the strict secrecy imposed by certain civil 'B' plants, at any rate in the U.S.A., on their commercial activities."[206] Even prior to the British study, United States officials were already well aware of the difficulties in verifying a biological arms control agreement. A 1961 Department of Defense study emphasized the dual-use nature of biotechnology and the

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[203] *List Of States Parties To The Convention On The Prohibition Of The Development, Production And Stockpiling Of Bacteriological (Biological) And Toxin Weapons And On Their Destruction,* November 2003, http://www.opbw.org/convention/btwcsps.html.

[204] For a summary of the negotiations leading to the BWC, see Susan Wright, "Geopolitical Origins," in Wright, *Biological Warfare and Disarmament*, pp. 313-342.

[205] U.K Foreign Office, Arms Control and Disarmament Research Unit, "Arms Control Implications of Chemical and Biological Warfare," report written by Hedley Bull, ACDRU (66) 2 (2nd Draft), 4 July 1966, FO 371/187448 cited in Wright, "Geopolitical Origins," pp. 322-325.

[206] U.K. Foreign Office, M.F. Cullis, "Discussions with American on Arms Control Aspects of Chemical and Bacteriological Weapons," 27 October 1967, FCO 10/179, Public Records Office, London, United Kingdom [hereafter PRO]; and U.K. Foreign Office, "Record of Informal Talks Between British and American Officials on Arms Control Prospects for Biological and Chemical Weapons held at the Foreign Office, London, 12-13 October 1967," 15 November 1967, FCO 10/170, PRO.

consequent difficulty distinguishing between prohibited military activities and permitted civilian ones.[207] A 1962 study conducted on behalf of ACDA concluded that, "development and production of such weapons seem virtually uninspectable."[208] This study also found that, "A measure that deals with the research, development, and production of CW/BW weapons is not worthwhile because of the virtual impossibility of verification of compliance with such a measure and because of the likelihood of discord resulting from imprecise knowledge concerning an apparent violation."[209] A 1968 ACDA study on inspection techniques of potential biological weapon facilities was stymied when the contractors conducting the study were denied access to four of the eighteen facilities they wished to visit to develop and test their inspection concepts. The primary concern of company officials was the potential loss of trade secrets.[210] Second, the ACDA officials indicated to their British counterparts that due to the domestic and international criticisms it was receiving for using irritant and anti-plant chemical agents in Vietnam, the United States did not want any new chemical and biological weapons-related initiatives introduced in international forums.[211]

As a result of the United States' resistance to any proposals that would provide a basis for other nations to further criticize American actions in Vietnam, British arms control officials decided that the best chance for progress required dealing separately with chemical and biological weapons. This new approach to ban the production, possession and use of biological weapons was discussed with American officials in early July 1968. The American officials raised two principal objections: the extreme difficulty in verifying such an agreement and the need to respect commercial secrecy. The British agreed to table only a working paper on the topic with an understanding that a draft convention could be introduced the following year.[212]

During internal British deliberations on the content of the working paper proposing a ban on biological weapons, the most contentious issue revolved around how to verify such a ban. The difficulty in distinguishing between offensive programs and defensive or civilian activities and detecting the production of biological weapons was recognized as insurmountable. In addition, the military wanted to preserve its ability to conduct defensive research at the chemical and biological research and development facility at Porton Down. However, it was also recognized that this type of research "could be applied simply, rapidly and covertly to the construction of an aggressive capability."[213] Thus, the overlap between defensive and offensive research and capabilities introduced a substantial degree of ambiguity in the British proposal. As a result, a British Ministry of Defense official remarked on the verification issue: "One could 'drive a coach and horses' through any proposal of the kind now being discussed."[214]

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[207] Operations Research Group, *Arms Control of CBR Weapons,* Vol. 1: *Military Aspects* (Army Chemical Center, M.D.: U.S. Army Chemical Corps, February 9, 1961) cited in Dando, *The New Biological Weapons*, p. 136.
[208] Institute for Defense Analysis, *Woods Hole Summer Study: Verification and Response in Disarmament Agreements, Summary Report*, ACDA/ST-5 (Washington, D.C.: Arms Control and Disarmament Agency, November 1962), p. 7.
[209] Institute for Defense Analysis, *Woods Hole Summer Study*, p. 21.
[210] *Inspectability of C&B Weapons Production, Transportation and Storage (Second Phase),* Vol. 4: *Technical Inspection Procedures and Methods (Biological Agents and Weapons)*, ACDA/ST-108, Prepared for the U.S. Arms Control and Disarmament Agency (Kansas City, M.O.: Midwest Research Institute, January 1968), pp. 24-25, Box 13, Chemical and Biological Weapons Collection, National Security Archives, Washington, D.C. [hereafter NSA].
[211] Wright, "Geopolitical Origins," p. 327.
[212] Ibid., p. 328.
[213] Ronald Hope-Jones, "Microbiological Warfare," 24 July 1968, FCO 10/182, PRO.
[214] U.K. Cabinet, Office of the Chief Scientific Advisor, "Brief for MISC 214 Meeting (2nd) on Friday, 19 July 1968, Foreign Office Working Paper on Biological Warfare," Handwritten, nonverbatim account, CAB 168/125, PRO.

On August 6, 1968, the United Kingdom introduced its working paper to the ENDC. The paper first outlined the deficiencies in the 1925 Geneva Protocol and the difficulty in achieving chemical disarmament. The paper then noted that unlike chemical warfare, biological warfare has not been proven in battle and that these weapons were viewed with even greater abhorrence than chemical weapons. As a result, the paper suggested separating chemical and biological disarmament efforts. However, the working paper stated that, "verification, in the sense in which the term is normally used in disarmament negotiations, is not possible in either the chemical or microbiological field. The difficulty, as far as the microbiological field is concerned, is that the organisms which would be used are required for medical and veterinary uses and could be produced quickly, cheaply and without special facilities either in established laboratories or in makeshift facilities."[215] As the Minister of State for Foreign Affairs Fred Mully emphasized to the disarmament conference: "I recognize that the greatest difficulty we have to face is that of verification...The principal difficulty arises from the fact that almost all the material and equipment with which we are trying to deal here have legitimate peaceful purposes...and [it is] impracticable to inspect every laboratory in every country. We must accept, therefore, that no verification is possible in the sense of the term as we normally use it in disarmament discussions."[216] As a confidence-building measure, the working paper called for defensive research to be as transparent as possible in light of the need to protect security and industrial secrets and to be subject to international investigation if necessary.[217] The working paper also suggested the creation of a "competent body of experts" to investigate alleged violations of the treaty and the referral of alleged violations to the Security Council if satisfactory cooperation was not provided.[218] The British proposal was immediately criticized by Western, the Soviet bloc, and non-aligned nations alike. The main objections were that chemical weapons were not also prohibited and that the working paper contained no verification measures.[219]

Undaunted by these criticisms, the United Kingdom introduced a draft convention to the ENDC on July 10, 1969 that prohibited the production and use of biological weapons as well as research aimed at the production of these weapons. The British delegation reaffirmed that verification of the ban was not possible. According to Mulley, "verification, in the sense in which that term is used in disarmament negotiation, is simply not possible in the field of biological warfare. The agents which might be used for hostile purposes are generally indistinguishable from those which are needed for peaceful medical purposes, and militarily significant quantities of a biological warfare agent could be produced clandestinely in a small house or large garage."[220] Although the convention did not include any verification measures, it did include a mechanism for the Secretary-General or Security Council to address allegations of the use of biological weapons and violations of the convention.[221] A revised draft was submitted in August incorporating changes suggested by delegates at the newly renamed Conference of the

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[215] Cited in SIPRI, *The Problem of Chemical and Biological Warfare,* Vol. 4: *CB Disarmament Negotiations, 1920-1970* (New York: Humanities Press, 1971), p. 255.

[216] "Statement by British disarmament minister (Mulley) to the Eighteen Nation Disarmament Committee, August 6, 1968," in ACDA, *Documents on Disarmament 1968* (Washington, D.C.: U.S. GPO, 1968), pp. 561-562.

[217] Cited in SIPRI, *The Problem of Chemical and Biological Warfare,* Volume 4, p. 256.

[218] Ibid., pp. 256-257.

[219] Ibid.,, pp. 257-260.

[220] "Statement by the British Representative (Mulley) to the Eighteen Nation Disarmament Committee: Chemical and Biological Warfare [Extract], July 10, 1969," in ACDA, *Documents on Disarmament 1969* (Washington, D.C.: U.S. GPO, 1969), pp. 321-322.

[221] "British Proposal Submitted to the Eighteen Nation Disarmament Committee: Draft Convention on Biological Warfare, July 10, 1969," in ACDA, *Documents on Disarmament 1969*, pp. 324-327.

Committee on Disarmament.[222] However, the British proposal to separate chemical and biological weapons and the lack of any verification measures in the treaty continued to meet resistance from the socialist and non-aligned camps. Two breakthroughs, one on the part of the United States and one on the part of the Soviet Union, were required to overcome this logjam and enable the superpowers to reach an agreement on a treaty banning biological weapons.

The first breakthrough came on November 25, 1969 when President Richard M. Nixon announced that the United States was renouncing the use of biological weapons, would terminate its offensive biological research, and would destroy its stockpile of biological agents and munitions.[223] Although the new policy limited the United States to conducting only defensive biological research, it was recognized that: "This does not preclude research into those offensive aspects of bacteriological/biological agents necessary to determine what defensive measures are required."[224] President Nixon also announced that the United States would support the principles and objectives embodied in the British draft convention despite the lack of verification provisions.

Since verification had long been a key stumbling block for strategic arms control initiatives during the Cold War, it is worth examining further why the United States was willing to accept this treaty without any verification. By 1969, ACDA believed that controlling chemical and biological weapons was only possible with intrusive inspections but that the relatively small threat posed by illicit clandestine production of CBW by an adversary would not require a verification system with as much reliability as in the nuclear field. The right of "challenge inspections" and a strong national intelligence effort could create an unacceptable risk for would-be violators of a chemical and biological arms control agreement, "particularly since no country is known or even suspected of basing its national security planning on these weapons."[225] According to James Leonard, Assistant Director of ACDA and the lead U.S. negotiator in Geneva, and Alan Neidle, Leonard's deputy at ACDA and the head of ACDA's biological weapons working group in Washington, the U.S. decision not to pursue verification provisions in BWC had several sources. First, the military was convinced that these weapons had little utility and therefore were not concerned if another country was developing them. Second, the United States had already unilaterally disarmed and did not plan on rearming even if others violated the treaty. Third, it was hoped that the norm established by the treaty would deter other nations from developing biological weapons by forcing them to make a national decision to violate the treaty. Fourth, the Soviets were opposed to any on-site inspection measures.[226] According to Neidle, "No one in the US government, including the military, disagreed that in these circumstances

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[222] "Revised British Draft Convention for the Prohibition of Biological Methods of Warfare, August 16, 1969," in ACDA, *Documents on Disarmament 1969*, pp. 431-433; and "Statement by the British Representative (Porter) to the Conference of the Committee on Disarmament: Prohibition of Biological Warfare, August 26, 1969," in ACDA, *Documents on Disarmament 1969*, pp. 436-440.

[223] This renunciation was extended to toxins in February 1970 and the draft British convention was adjusted accordingly. Tucker, "A Farewell to Germs," pp. 107-148.

[224] National Security Council, "United States Policy on Chemical Warfare Program and Bacteriological/Biological Research Program," *National Security Decision Memorandum 35*, November 25, 1969, p. 3, http://www.gwu.edu/~nsarchiv/NSAEBB/NSAEBB58/RNCBW8.pdf

[225] Bowman Cutter, Chairman, Study Group on Topic "Arms Control Including Geneva Protocol of 1925", *The U.S. Position on Arms Control Including the Question of Ratification of the Geneva Protocol of 1925*, Revised Draft, September 25, 1969, pp. 26-28, FOIA.

[226] Mangold and Goldberg, *Plague Wars*, pp. 55-57, 402 fn 26.

[unilateral renunciation] it was in the US interest to have a multilateral treaty prohibiting biological weapons even if effective verification could not be obtained."[227]

The second breakthrough occurred on March 30, 1971 when the Soviet Union, after long opposition to the separation of chemical and biological weapons in disarmament negotiations, reversed itself and submitted a draft biological weapons treaty very similar to the Anglo-American draft.[228] At the time, the U.S. assessment was that the Soviets used the treaty to signal its interest in arms control and engage the Nixon Administration in strategic nuclear issues.[229] The Soviet Union's true intentions in agreeing to this treaty would not be known for many years. On August 5, 1971, the United States and Soviet Union introduced separate but identical texts to the Conference of the Committee on Disarmament (CCD), the renamed successor to the ENDC.[230] The Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction was approved by the United Nations General Assembly on December 16, 1971, opened for signature on April 10, 1972 and entered into force on March 26, 1975.[231]

Conclusion

In her analysis of the origins of the BWC, Susan Wright bemoans the process that led to this treaty and the factors that motivated the United States and United Kingdom. According to Wright, "These conditions—the search for military advantage, deference to the requirements of the superpower, the reliance of powerful Western states on nuclear weapons for deterrence, the assumption of powerful Western states that the BW problem is posed primarily by certain non-Western states, the secrecy in which commercial and military biological activities are enshrouded, and the fundamental ambiguity at the heart of the ban on biological warfare—remain largely unacknowledged or even unseen today."[232] The conditions identified by Wright as decisive factors in the formulation of the BWC support the prediction that the offense-dominant nature of biological weapons, the indistinguishability of biotechnology, and the legitimate need for secrecy combine to create serious impediments to achieving effective biological arms control.

UNITED NATIONS SPECIAL COMMISSION

This section analyzes the investigation of Iraq's biological weapons program by UNSCOM from 1991 to 1998, the most important effort by the international community to verify biological arms control. UNSCOM was the most intrusive arms control regime ever devised and had access to an unprecedented range of inspection techniques and technologies. Although UNSCOM was successful in uncovering aspects of Iraq's past biological weapons activities, a comprehensive account of Iraq's biological agent research, production, and weaponization only emerged following a high-level defection in August 1995. Furthermore, the

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[227] Alan F. Neidle, "The Rise and Fall of Multilateral Arms Control: Choices for the United States," in Edward C. Luck, ed., *Arms Control: The Multilateral Alternative* (New York: New York University Press, 1983), p. 13.
[228] "Statement by the Soviet Representative (Roshchin) to the Conference of the Committee on Disarmament: Chemical and Bacteriological Weapons, March 30, 1971," in ACDA, *Documents on Disarmament 1971* (Washington, D.C.: U.S. GPO, 1971), pp. 183-190.
[229] Ambassador James Leonard cited in Mangold and Goldberg, *Plague Wars*, p. 59.
[230] "Draft Convention on the Prohibition of the Development, Production, and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction, August 5, 1971," in ACDA, *Documents on Disarmament 1971*, pp. 456-460.
[231] Floweree, "Chemical and Biological Weapons and Arms Control," p. 1005.
[232] Wright, "Geopolitical Origins," p. 336.

conditions required for UNSCOM's success cast serious doubt on the ability of an international organization to achieve similar results in the context of a multilateral biological verification treaty. This case illustrates how indistinguishability greatly complicates verification and the extraordinary measures that were required to overcome a dedicated state's attempts to retain an offensive capability based on multi-use technologies.

In 1991, in the aftermath of Iraq's defeat in the Gulf War, the United Nations Security Council created an organization to oversee the dismantling of Iraq's nuclear, biological and chemical weapons and ballistic missiles: the United Nations Special Commission (UNSCOM).[233] In April 1991, Iraq declared that it had no biological weapons or programs to develop such weapons. Although early inspections led Iraq to admit to conducting biological military research, inspectors believed that Iraq was hiding a larger, offensive program. However, until July 1995, Iraq denied this. After UNSCOM inspectors accumulated convincing evidence that Iraq had obtained all of the materials necessary for a biological weapons program and could not credibly account for the peaceful use of such materials, Iraq admitted to the production of biological warfare agents at Al Hakam and other facilities. In August 1995, after the defection of Hussein Kamal who had previously directed the nuclear, biological, chemical and missile programs, Iraq admitted to producing even larger quantities of agent, filling them into munitions, testing them, and deploying them on the eve of the 1991 Gulf war. UNSCOM had still not verified the completeness and accuracy of the Iraqi revelations when it withdrew from Iraq in December 1998. In December 1999, the United Nations Security Council disbanded UNSCOM and created a new organization, the United Nations Monitoring, Verification and Inspection Commission (UNMOVIC), to replace it.

The UNSCOM experience has been used by both proponents and opponents of biological arms control to support their case. One school of thought views UNSCOM's investigation as a failure and attributes the uncovering of Iraq's secret program to the defection of Hussein Kamal.[234] In contrast, another school of thought sees the UNSCOM experience as an unqualified success that demonstrated of the possibility of a robust regime to detect a secret biological weapons program.[235] What is undisputed is that UNSCOM was the most intrusive arms control regime ever devised and provided real-world testing of many of the technologies and techniques that could be used to support verification of the BWC.[236] Although UNSCOM eventually forced Iraq to admit that it had an extensive offensive program, it was not able to verify the destruction of the program or to deter continued biological weapons-related activities by Iraq. Therefore, it is important to analyze not only what UNSCOM accomplished, but also how it did so. This is vital for determining the sources of UNSCOM's successes and failures and for understanding how effective a future biological arms control regime could be. As a result, after a brief description of

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[233] The International Atomic Energy Agency, which administered international safeguards on nuclear materials, was given shared responsibility for implementing the Security Council's resolution regarding Iraq's nuclear weapon program.

[234] See Robert P. Kadlec, Allan P. Zelicoff, and Ann M. Vrtis, "Biological Weapons Control: Prospects and Implications for the Future," in Lederberg, *Biological Weapons*, p. 96; Edward J. Lacey, "The UNSCOM Experience," *Arms Control Today*, August 1996, p. 11; and Kathleen C. Bailey, *The UN Inspections in Iraq: Lessons for On-Site Verification* (Boulder, Colo.: Westview Press, 1995), p. 48; and Kenneth M. Pollack, *The Threatening Storm: The Case for Invading Iraq* (New York: Random House, 2002), p. 236.

[235] Graham S. Pearson, *The UNSCOM Saga: Chemical and Biological Weapons Non-Proliferation* (New York: St. Martin's Press, 1999), pp. 203-205.

[236] Stephen Black, "UNSCOM and the Iraqi Biological Weapons Program: Technical Success, Political Failure," in Wright, *Biological Warfare and Disarmament* p. 285.

UNSCOM's mandate and authority, the rest of this case is devoted to a description and analysis of UNSCOM's investigation of Iraq's biological weapons program.

Due to the prolonged duration of UNSCOM's activities in Iraq, as well as their complexity, this analysis is divided into three distinct phases. The first phase covers UNSCOM's search for an offensive Iraqi program in 1991 following the Gulf War. The second phase examines UNSCOM's collection and analysis of evidence between 1992 and June 1995, which resulted in Iraq's confession of a past offensive program. The third phase begins with Hussein Kamal's defection in August 1995, which forced Baghdad to provide a comprehensive accounting of its biological research, production, and weaponization activities, and ends with the withdrawal of UNSCOM from Iraq in December 1998. The final section of this case addresses the generalizability of the UNSCOM experience for future biological arms control efforts. While UNSCOM amply demonstrated the hurdles in biological verification, the conditions necessary for the organization's accomplishments cast serious doubt on the feasibility of a multilateral biological arms control verification regime.

At the outset it must be pointed out that no history of UNSCOM, or an assessment of its effectiveness, can be complete until the full history of Iraq's weapons of mass destruction programs and its attempts to conceal these programs are known. Although the activities of the Iraq Survey Group (ISG) are providing fresh information on these issues, their work is not yet complete. Given the lack of data on the true extent of Iraq's biological weapons program, it is not possible to know what proportion of the pre-1991 biological weapons program was uncovered by UNSCOM or what biological weapons-related activities Iraq was able to perform covertly while subject to UNSCOM inspections and monitoring.

UNSCOM's Mandate and Powers

On April 8, 1991, the Security Council approved Resolution 687 establishing the cease-fire terms for the Gulf War. According to the resolution, "Iraq shall unconditionally accept the destruction, removal, or rendering harmless, under international supervision, of:

(a) All chemical and biological weapons and all stocks of agents and all related subsystems and components and all research, development, support and manufacturing facilities;

(b) All ballistic missiles with a range greater than 150 kilometres and related major parts, and repair and production facilities."

Iraq was also required to "unconditionally undertake not to use, develop, construct or acquire" any of these proscribed items. Iraq was ordered to submit to the Secretary-General, within fifteen days of the adoption of the resolution, a declaration of the locations, amounts, and types of all proscribed items and agree to inspection by UNSCOM at declared sites and any additional sites designated by UNSCOM. Furthermore, UNSCOM was authorized to establish a system of ongoing monitoring and verification (OMV) of Iraq's compliance with these demands. UNSCOM thus had three missions: to verify the accuracy and completeness of Iraq's declarations, to conduct inspections to ensure that Iraq did not retain any proscribed items, and to construct a system to monitor continued Iraqi compliance with the terms of the resolution.

Resolution 687 utilized a carrot-and-stick approach to gain Iraqi compliance. The stick was the threat of renewed military action. As the cease-fire resolution for the Gulf War, Resolution 687 was created under Chapter VII of the United Nations Charter, which authorizes the Security Council to take action against threats to international peace and security. As a result, a breach of the resolution could lead to a reversion to the pre-April 1991 state of affairs, namely authorization of the use of all necessary force to restore international peace and security. The

carrot was a linkage between Iraqi fulfillment of the disarmament provisions of Resolution 687 and the lifting of the embargo on Iraqi oil sales imposed by Resolution 661. The combination of a large stick and tempting carrot was believed to be sufficient to induce immediate Iraqi cooperation. This would turn out to be a major miscalculation.

UNSCOM was granted extraordinary powers to implement its mandate. In May 1991, the Secretary-General of the United Nations informed Iraq that the breadth of UNSCOM's rights inside of Iraq would include unrestricted freedom of movement without advance notice, unimpeded access to any site or facility, designation of any site for observation, inspection, or monitoring, access to any relevant record or data, and the construction of facilities and installation of equipment for observation, inspection or other monitoring activity. In addition, UNSCOM had the right to conduct interviews, take photographs from the air or ground, and collect and analyze samples of any kind as well as export them for off-site analysis.[237]

Following several examples of Iraqi non-compliance with, and obstruction of, the early activities of UNSCOM and the IAEA, the Security Council approved Resolution 707 in August 1991 that provided additional and more specific demands on Iraq to verifiably disarm its nuclear, biological, chemical, and missile weapons. Resolution 707 made Iraqi obligations to declare its weapons of mass destruction programs more explicit, authorized aerial reconnaissance and surveillance operations, and obliged Iraq to cease its concealment and deception activities.[238] As a result, UNSCOM was able to initiate flights of U-2 reconnaissance aircraft on loan from the United States beginning in September 1991 and to begin conducting helicopter missions from Baghdad in June 1992.[239]

Resolution 715, passed in October 1991, extended UNSCOM's right to "anytime, anywhere" inspections indefinitely as part of UNSCOM's ongoing monitoring and verification program, even once Iraq's banned weapons were destroyed, and extended this access to Iraq's dual-use facilities.[240] This extension of UNSCOM authority and power was resisted by Iraq until November 1993. As a result of these Security Council resolutions, UNSCOM was authorized to "conduct any number of unannounced inspections of any site, facility, activity, material, or other items anywhere in Iraq and conduct aerial overflights of any area, location, site or facility in Iraq for the purpose of inspection, surveillance, transportation, or logistics upon such conditions as UNSCOM may decide...Iraq is obliged to provide (and UNSCOM has the right of access to) information on sites, facilities, materials, equipment, documentation, imports, activities, and intentions. UNSCOM may seize, copy, or photograph any item or record; it may use any sensor; it may take any samples; and it may use any means of analysis it deems necessary. Further, it may search any means of transport and ask any question."[241] In sum, inspection and monitoring regime imposed by the Security Council on Iraq was the most intrusive ever devised.

The next three sections examine how UNSCOM used these authorities and powers to investigate Iraq's biological weapons program. These investigations can be divided into three phases. The first phase covers the search of Iraq's biological weapons program from the first Iraqi declaration in April 1991 to the third biological weapon-related inspection in November 1991. The second phase lasted from November 1991 to the first Iraqi revelation of an offensive

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[237] Javrier Perez de Cuellar, Secretary-General of the United Nations, Letter to His Excellency Ahmed Hussein, Minister for Foreign Affairs of the Republic of Iraq, 6 May 1991.

[238] United Nations Security Council, Resolution 707 (1991), S/RES/707, August 15, 1991.

[239] Rolf Ekeus, "The United Nations Special Commission on Iraq," in SIPRI, *SIPRI Yearbook 1993: World Armaments and Disarmament* (Oxford: Oxford University Press, 1993), p. 694.

[240] Trevan, *Saddam's Secrets*, p. 17.

[241] Tim Trevan, "Exploiting Intelligence in International Organizations," in Zilinskas, *Biological Warfare*, pp. 212.

program on July 1, 1995. During the third and final phase, UNSCOM attempted to verify Iraq's declarations regarding its biological weapons program until UNSCOM withdrew from Iraq in December 1998. The final section summarizes lessons learned from the UNSCOM experience and evaluates the applicability of this experience to future efforts to verify biological arms control and disarmament agreements.

Phase I: The Search for Iraq's Biological Weapons Program (April 1991-November 1991)

In April 1991, Iraq was required to declare its nuclear, biological, chemical, and missile activities to UNSCOM and the IAEA under Resolution 687. Iraq's April 1991 biological weapons declaration stated, "Iraq does not possess any biological weapons or related items as mentioned" in Resolution 687.[242] During the first phase of UNSCOM's investigation, the main task of the inspectors was to establish whether or not Iraq had an offensive biological weapons program. This section describes and analyzes the three inspections of suspected Iraqi biological weapons sites conducted in 1991.

BW-1

UNSCOM conducted its first biological weapon inspection from August 2 to August 8, 1991. The biological team was headed by David Kelly, a British microbiologist and biodefense researcher, who had already participated in inspections of suspected biological weapons sites in the Soviet Union. The team's goal was to conduct no-notice inspections of five sites suspected by American and British intelligence of being involved in Iraq's biological weapons program: Fudaliyah, Al Dawrah, Salman Pak, Al Kindi, and Amariyah. These inspections represented the first no-notice inspection of biological sites in a country hostile to the inspectors.[243]

On August 2, the inspectors met with an Iraqi delegation in Baghdad that elaborated on Iraq's earlier biological declaration. The Iraqis now admitted that "biological research activities for military purposes" took place at Salman Pak under the auspices of the Technical Research Center under the direction of Dr. Ahmed Murtada.[244] Iraqi officials told the inspectors that ten people had been engaged in biological weapons research. This team, headed by Dr. Rihab Taha, conducted research on B*acillus anthracis* (the causative agent of anthrax), C*lostridium botulinum* (botulinum toxin) and C*lostridium perfringens* (gas gangrene). As a result of this declaration, the inspectors zeroed in on Salman Pak, which had already been identified prior to the war as an Iraqi chemical and biological weapons research and development center.[245]

The next day the inspectors traveled to Salman Pak with the intention of traveling to the other four sites later on. The team split into two groups: one to survey the site and another to interview the senior leadership, Drs. Taha and Murtada. According to Taha, Iraq launched a defensive biological research program in 1986. The program included the production of the harmless microorganisms B*acillus subtilis* and B*acillus thuringensis* to simulate the production of the related B. *anthracis* and engaged in only laboratory-scale production of botulinum toxin

[242] Government of Iraq, letter addressed to the Secretary-General of the United Nations (Initial disarmament declaration), 18 April 1991, cited in Black, "UNSCOM and the Iraqi Biological Weapons Program," p. 288.
[243] Trevan, *Saddam's Secrets*, pp. 21-22.
[244] Murtada was a brigadier general in the Iraqi military and also director general of the Badr Scientific Establishment, a munition design and production plant. Inspectors saw these affiliations as a connection between biological research and weaponization. Trevan, *Saddam's Secrets*, p. 147.
[245] Bailey, *The UN Inspections in Iraq*, p. 39.

and *B. anthracis*.[246] According to Taha, the program was small and the results were inconclusive: only three of the members had PhDs and a total of ten papers were produced.[247] The program was terminated in August 1990 with the destruction of all of its biological warfare agents due to the impending war.[248] The inspectors noted a lack of evidence of Iraqi work on protective equipment or materials despite Iraqi claims that they had developed military vaccines against cholera and typhoid and were working on vaccines against anthrax and botulinum toxin.[249]

After the survey team found some animal cages, including ones designed for primates, Taha admitted that experiments had been conducted on animals to ascertain the toxicity of agents. The inspectors noted that these types of studies would have required an aerosolization chamber. Iraq admitted that such a device had been installed at Salman Pak in the early 1980s, but claimed they couldn't find it. Eventually the Iraqis led the inspectors to a spot two kilometers away where the aerosol chamber, now crushed, had been dumped.[250] Additional evidence of Iraqi attempts to conceal the true nature of the site included Iraqi demolition of buildings that had survived bombing during the Gulf War, including those that housed fermenters, the aerosol test chamber, and a small incinerator. These sites were also bulldozed with fresh dirt piled on top. In addition large piles of burnt ash outside of buildings and in basements indicated that large amounts of documents had been burned recently.[251]

On the third day of discussions, Dr. Murtada, the director of TRC, admitted that planning for the program began prior to 1986. Murtada explained that his lack of detailed knowledge about the program was a function of Dr. Taha reporting directly to Hussein Kamal Hassan, who had been the head of the Ministry of Industry and Military Industrialization (MIMI) and was Minister of Defense by 1991. The chief inspector, David Kelly, confronted Murtada with his conclusion that given the equipment and research conducted at Salman Pak, the program could not be solely defensive. According to Trevan, "Murtada acquiesced to this statement, implicitly agreeing that there had been an offensive biological weapons program."[252] Near the end of the inspection, Taha presented Kelly's team with vials of seed stock of the biological warfare agents and simulants that Iraq had admitted working with and had claimed to have destroyed in August.[253] In return for the seed stocks, Taha sought a statement from Kelly that Iraq had complied with Resolution 687 and that the biological file could be closed. Kelly flatly refused

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[246] Ibid., p. 38; and Jonathan B. Tucker, "Lessons of Iraq's Biological Warfare Programme," *Arms Control*, Vol. 14, No. 3 (December 1993), p. 254.

[247] Raymond A. Zilinskas, "UNSCOM and the UNSCOM Experience in Iraq," *Politics and the Life Sciences*, Vol. 14, No. 2 (August 1995), p. 232.

[248] Trevan, *Saddam's Secrets*, pp. 28-32.

[249] Tucker, "Lessons of Iraq's Biological Warfare Programme," p. 254.

[250] Trevan, *Saddam's Secrets*, pp. 32-34.

[251] Karen Jansen, "Biological Weapons Proliferation," in Steven Mataija and J. Marshall Beier, *Multilateral Verification and the Post-Gulf Environment: Learning from the UNSCOM Experience* (Toronto, Canada: York University, 1992), p. 113.

[252] Higher-ranking Iraqi officials subsequently disavowed Murtada's statement and denied that the research at Salman Pak had an offensive orientation. Trevan, *Saddam's Secrets*, p. 34.

[253] United Nations Security Council, *Letter dated 24 October 1991 from the Executive Chairman of the Special Commission established b the Secretary-General pursuant to paragraph 9 (b) (i) of resolution 687 (1991) addressed to the Secretary-General*, S/23165 (New York: United Nations, October 25, 1991), p. 30. These cultures had been stored at the Serum and Vaccine Institute in Amariyah, the first link of this institute to Iraq's biological program. Trevan, *Saddam's Secrets*, p. 278.

this request.[254] The Iraqi admission of biological warfare research and its turning over of the seed stocks were the first step on the long of road of "cheat and retreat."

In all, the team spent five days at Salman Pak. Following the inspection of Salman Pak, Kelly intended to spend another week in Iraq visiting the other fours sites on their list as well as a site called Al Hakam that Iraq had just declared was being used to store a number of fermenters. However, concurrent missile and nuclear inspections being conducted by UNSCOM and IAEA were according higher priority and they received the limited logistical support available in Iraq for inspectors.[255]

BW-2

The second biological weapons inspection, again led by David Kelly, was conducted from September 20 to October 3, 1991 with inspectors visiting ten sites that could be used for biological weapons research or production.[256] These sites included a pharmaceutical plant at Samarra, vaccine facilities at Al Dawrah, Abu Ghraib (Al Kindi Company), and Amariyah, single cell protein (SCP) facilities at Taji and Al Hakam, an agricultural and water research facility at Fudaliyah, a blood bank at Medical City in Baghdad, a slaughterhouse in Baghdad, and a bakery in An Najaf.[257] All four of the sites that the first group of inspectors had been unable to visit were inspected by this team. The range of sites visited indicates the potential for ostensibly civilian facilities to be used for developing biological weapons due to the multi-use nature of biotechnology.

The blood bank at Medical City, the Baghdad Slaughter House and the bakery at An Najaf were immediately cleared of suspicion. The other sites, however, exhibited varying levels of capabilities for conducting research or production of biological weapons. The Samarra Pharmaceutical Facility, 100 kilometers north of Baghdad, produced pills and stored bulk quantities of drugs. The inspectors observed that the plant had poor quality control and that little attention was paid to occupational health and safety standards. The facility was assessed as being a legitimate pharmaceutical plant.[258]

The inspectors also visited three vaccine production plants. These types of plants are commonly viewed as the most suitable civilian facilities for use in producing biological weapons due to the availability of the necessary equipment and skilled personnel needed to grow large volumes of micro-organisms. Since some vaccines use killed vaccine, they have experience in producing large quantities of pathogens that are later neutralized. The Al Manal Foot and Mouth Disease Vaccine plant at Al Dawrah, 5 kilometers southwest of Baghdad, had been designed and built by a French firm. Although the inspectors determined that the plant was being used for its declared purpose, its fermenters, lyophilizers (freeze driers), and cell homogenizers were judged to be useful for production biological warfare agents. Inspectors therefore recommended that the facility be monitored in the future. At the Al Kindi Company for Serum and Vaccine Production in Abu Ghraib, 27 kilometers west of Baghdad, Iraq produced veterinary vaccines for anthrax, clostridium, fowlpox virus, and rinderpest. Inspectors observed Iraqi technicians in a "warm

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[254] Trevan, *Saddam's Secrets*, pp. 34-36.

[255] The IAEA was following up on the dramatic success of its recent inspections which had uncovered Iraq's secret uranium enrichment program and the missile inspection was based on time-sensitive intelligence that Iraq was hiding Scud missiles and launchers at a military complex in Taji. Trevan, *Saddam's Secrets*, pp. 94-96.

[256] The team was composed of the same senior scientists as the first team. Jansen, "Biological Weapons Proliferation," p. 113.

[257] Bailey, *The UN Inspections in Iraq*, p. 41.

[258] Ibid.

room" manually making clostridium vaccine in 5-liter flasks. Iraq claimed that the plant had the ability to produce 1,000 liters of clostridium vaccine a week. The fermenters that used to be at the site had been transferred to Al Hakam. The Serum and Vaccine Institute at Amariyah, 60 kilometers southwest of Baghdad, manually produced vaccines for typhoid and cholera and distributed indigenous and imported vaccines. The institute also conducted research on vaccines for diptheria and brucellosis. Inspectors determined the site had the ability to produce pathogens despite poor health and safety measures.[259]

The inspectors also visited two now-abandoned sites. The agricultural and water resources research institute at Fudaliyah was reportedly closed in December 1989 because it was unproductive. Two fermenters designed for the production of foodstuffs were found on-site which could produce pathogens. The facility had only low level of containment with no biohazard cabinets. The site at Taji had been used to produce single cell protein (SCP) but was subsequently abandoned and was assessed as not being useful for producing biological warfare agents. The site's fermenter had been taken to Al Hakam.[260] According to biological inspector Karen Jansen, all of these facilities "were obviously legitimate....The Iraqis were able to answer any questions to the complete satisfaction of the inspectors and provide documents to validate any uncertainties."[261]

The UNSCOM team spent three days at Al Hakam. Iraq had initially listed Al Hakam as a warehouse used to stored fermenters. By the time the site was visited by BW-2, Iraq claimed that the site was used to produce SCP to supplement animal feed. The facility raised suspicions almost immediately based on its layout, history, organizational ties, and fermentation capability.

Al Hakam had several distinctive features that appeared inappropriate given its stated civilian purpose. Its remote location in the desert made no sense from a civilian perspective since the facility required a skilled workforce as well as large volumes of high-quality water. In addition, the complex was massive, measuring three by six kilometers with the main buildings four kilometers apart. This layout was viewed as too large and spread out for a civilian site but appropriate for preventing an accident at one building from affecting the entire facility. The facility was also surrounded by a barbed wire fence, contained partially underground bunkers and dummy bunkers, air defenses, ten guard posts, and pop-up tire shredder at front gate. These were hardly standard features for a civilian SCP production facility. There was also evidence that the site had been sanitized recently, including evidence that an airlock at the laboratory building had been removed.[262]

Dr. Nissar al Hindawi was introduced as head of Al Hakam. He was said to have been responsible for establishing the now-abandoned SCP production facility at Taji.[263] Interviews conducted by the inspectors established that Al Hakam, like Salman Pak, was part of the Technical Research Center and had been built quickly and secretly by an Iraqi military construction company in the late 1980s.[264] Another link between Al Hakam and Salman Pak was found in photographs supplied by a human source of key Iraqi officials involved with Salman Pak standing outside of Al Hakam.[265] In addition, Iraq had not publicized the establishment of Al

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[259] Ibid., p. 42.
[260] Ibid.., pp. 42-43.
[261] Jansen, "Biological Weapons Proliferation," p. 113.
[262] Trevan, *Saddam's Secrets*, pp. 116-117; Bailey, *The UN Inspections in Iraq,* p. 43; and Jansen, "Biological Weapons Proliferation," pp. 113-114.
[263] Trevan, *Saddam's Secrets*, p. 148; and Bailey, *The UN Inspections in Iraq,* p. 43.
[264] Jansen, "Biological Weapons Proliferation," pp. 113-114.
[265] Tucker, "Lessons of Iraq's Biological Warfare Programme," p. 256.

Hakam despite its status as the nation's premier SCP production facility. Although the Iraqis had answers for all of the inspectors' questions, the answers were unsatisfactory and the team was unable to determine the scope and commercial viability of the SCP program. Furthermore, the Iraqis could not produce any documentation supporting their claims about the purpose and history of the facility.[266]

Al Hakam also boasted an impressive fermentation capability that could support a large-scale biological weapon production program. Al Hakam had twelve fermenters with a total capacity of close to 15,000 liters. None of the fermenters were functioning at the time of the inspection.[267] The facility also housed a large building that had been intended to hold a 5,000-liter Chemap fermenter. After the inspection, UNSCOM learned that the Swiss firm that was to supply Iraq with the 5,000-liter fermenter for its SCP program was shown a site at Latifiyah, 30 kilometers away. The firm told UNSCOM that they were never told of Al Hakam or a site beside Latifiyah and reported that, in contrast to other projects in Iraq, they were not supposed to establish on-site support for the equipment.[268] In addition, the inspectors found it suspicious that the 5,000-liter fermenter that Iraq had ordered from Chemap was not large enough to satisfy the nation's SCP needs.[269]

Although the inspectors were able to collect evidence that Al Hakam was not the simple civilian site portrayed by the Iraqis, the inspectors did not find any evidence of biological warfare agents or weapons. All of the samples taken from the fermenters and tested for the presence of biological warfare agents were negative.[270] In addition, a crucial indicator of biological weapons production was missing. The facility was not outfitted with the air handling or containment equipment necessary to work with dangerous pathogens. Also, the Chemap fermenters were not designed for use with dangerous pathogens and would require special seals, filters and other modifications for large-scale production of biological weapons.[271] Kelly pointed out though that the fermenters could be wrapped in plastic and then heat-sealed to provide some safety.[272] As a result of the lack of appropriate biosafety measures, some inspectors believed that large-scale production of pathogens at the site would be too dangerous.[273] In addition, inspectors also assessed the site as "embryonic" and not yet operational. In addition, the fermentation capability on site was deemed to be "junk" collected from a number of sites throughout Iraq. According to Jansen, "it wasn't far enough along to have produced SCP or anything else."[274]

CBW-1

A joint chemical-biological inspection was launched from November 17-30, 1991 to conduct short-notice inspections of fifteen sites, primarily airfield bunkers and ammunition

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[266] Tucker, "Lessons of Iraq's Biological Warfare Programme," p. 256; and Jansen, "Biological Weapons Proliferation," p. 114.
[267] Bailey, *The UN Inspections in Iraq*, p. 43; and Pearson, *The UNSCOM Saga*, p. 147.
[268] Jansen, "Biological Weapons Proliferation," p. 114; and Bailey, *The UN Inspections in Iraq*, p. 43.
[269] Bailey, *The UN Inspections in Iraq*, p. 48.
[270] The inspectors used an enzyme-linked immunosorbent assay (ELISA) analyzer at their headquarters in Baghdad to test for the presence of *B. anthracis*, botulinum toxin, and *Y. pestis*. Tests for other organisms had to be conducted at a lab in the United Kingdom. Bailey, *The UN Inspections in Iraq*, pp. 43, 50.
[271] Tucker, "Lessons of Iraq's Biological Warfare Programme," p. 257.
[272] Trevan, *Saddam's Secrets*, p. 117.
[273] Bailey, *The UN Inspections in Iraq*, p. 43; and GAO, *Arms Control: U.S. and International Efforts to Ban Biological Weapons*, GAO/NSIAD-93-113 (Washington, D.C.: GAO, December 1992), p. 56.
[274] Jansen, "Biological Weapons Proliferation," p. 114.

depots, for signs of chemical or biological weapons activity.[275] UNSCOM used photographs from its U-2 aircraft on loan from the United States to identify undeclared bunkers with special characteristics associated with the storage of chemical or biological munitions, such as heavier than usual security, segregation from the conventional munition storage area, and the presence of air-conditioning equipment. No evidence of past or present storage of chemical or biological weapons was found. However, three undeclared Scud transporters were found at Karbala and equipment to manufacture 250- and 500-gauge bombs suitable for filling with chemical and biological agents was found at a sugar factory in Mosul.[276] In addition, two military aircraft with 40-liter external tanks equipped with spray nozzles were spotted at the Mosul airfield. Iraq explained that the aircraft were used for seeding rain clouds although the area is arid with little agriculture. No samples of the tanks or nozzles were taken.[277] This mission was also reported to be looking for a secret biological weapon production facility and a stockpile of agent based on new intelligence.[278] This was the last biological inspection in 1991 and marked the end of the first phase in UNSCOM's investigation of Iraq's biological weapons program.

Summary of Phase 1 Findings

In its first report to the Security Council on Iraqi compliance with Resolution 687, UNSCOM reported, "Conclusive evidence that Iraq was engaged in an advanced military biological research programme has been collected. No evidence of actual weaponization has been found."[279] The report singled out Salman Pak as the research center for the program and suggested the existence of a production center, although Al Hakam was not named.[280] Despite a number of indicators that Al Hakam was not the civilian SCP facility Iraq claimed it to be, the inspectors did not have a common view on whether Al Hakam was designed for biological weapons research and production.[281] A month after the inspection of Al Hakam, the chairman of UNSCOM, Rolf Ekeus, told reporters, "Iraq had a very advanced military offensive program in biological research. So it is peculiar that we have not found a real production plant yet."[282] According to Jansen, "Whatever the true intent of this site [Al Hakam], there is no way to conclusively determine what it was by an on-site inspection."[283]

Based on physical inspection, interviews, and access to documents, the inspectors concluded that the nine civilian, multi-use facilities visited by the first two biological teams were

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[275] United Nations Security Council, *Third Report by the Executive Chairman of the Special Commission established b the Secretary-General pursuant to paragraph 9 (b) (i) of resolution 687 (1991)*, S/24108 (New York: United Nations, June 16, 1992), p. 20.

[276] This equipment had been removed from Iraq's chemical weapons manufacturing complex at Muthanna to protect it against airstrikes during the Gulf War. Trevan, *Saddam's Secrets*, pp. 171-172.

[277] Bailey, *The UN Inspections in Iraq*, pp. 14-15, 44.

[278] Paul Lewis, "UN Weapons Inspectors Renew Hunt in Iraq," *New York Times*, November 17, 1991, p. A12.

[279] United Nations Security Council, *Letter dated 24 October 1991 from the Executive Chairman of the Special Commission established b the Secretary-General pursuant to paragraph 9 (b) (i) of resolution 687 (1991) addressed to the Secretary-General*, S/23165 (New York: United Nations, October 25, 1991), p. 6.

[280] United Nations Security Council, *Letter dated 24 October 1991 from the Executive Chairman of the Special Commission established b the Secretary-General pursuant to paragraph 9 (b) (i) of resolution 687 (1991) addressed to the Secretary-General*, S/23165, (New York: United Nations, October 25, 1991), p. 30.

[281] Bailey, *The UN Inspections in Iraq*, p. 47.

[282] Lewis, "UN Weapons Inspectors Renew Hunt in Iraq," p. A12.

[283] Jansen, "Biological Weapons Proliferation," p. 114.

legitimate civilian enterprises and not involved in the development of biological weapons.[284] Dawrah, the Al Kindi Veterinary Vaccine Production Plant, and the Serum and Vaccine Institute at Amariyah, however, were judged capable of engaging in biological weapons research and production.[285] In 1992, the United Kingdom published a working paper summarizing UNSCOM's first year of conducting biological inspections in Iraq.[286] The British working paper concluded that at each facility visited, the inspection teams were able to come to "reasonably definitive" assessments of the capabilities they observed and their relevance to an offensive biological program. At the vaccine plant at Dawrah, for example, the team confirmed that the declared activities were indeed being carried out and that they were "reasonably assured that past activities did not differ" although the plant was assessed as being capable of producing biological warfare agents with additional resources and modifications.[287] The principal conclusions of this study were that the inspectors were able to produce confident assessments of the eleven sites they visited, that they identified indicators differentiating between biological weapons research and legitimate civilian activity, and that the level of openness and cooperation exhibited at legitimate sites differed from that at suspected weapons facilities.[288] As will be shown, this confidence was misplaced and this early assessment of the performance of the biological inspections was overly optimistic.

Evaluation of Phase 1

UNSCOM's only unqualified success during this first phase was the identification of Salman Pak as Iraq's biological weapons research center. Most of the inspectors interviewed by Bailey agreed that if Iraq had chosen to stonewall the inspectors on the first team, the physical inspection of Salman Pak would not have enabled the inspectors to uncover the information provided by Iraq on the nature and extent of their biological program. Inspectors were unable to locate documents, equipment, material, or other details that the Iraqis did not disclose.[289] Due to damage caused by the air campaign, self-inflicted destruction, and Iraqi lack of cooperation, it was not possible for the inspectors to develop a complete picture of what Iraq had been doing at Salman Pak. The inspectors felt that the only information available to them was what Iraq wanted to give them.[290]

The inspectors were right to be suspicious that Al Hakam was involved in the biological weapons program, but they failed to discover that facility had already been used to produce biological warfare agents for almost two years prior to the inspection.[291] Furthermore, the

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[284] Gordon Vachon, "Chemical and Biological Weapons: Working Group Summary," in Mataija and Beier, *Multilateral Verification and the Post-Gulf Environment*, p. 128; Jansen, "Biological Weapons Proliferation," p. 113; and Trevan, *Saddam's Secrets*, p. 118.

[285] Trevan, *Saddam's Secrets*, p. 118.

[286] The paper covered UNSCOM's first two biological inspections and the joint CBW inspection discussed in this section. United Kingdom, *UN Special Commission BW Inspections in Iraq: Lessons for the Ad Hoc Experts Group on Verification*, BWC/CONF.III/VEREX.WP5, 1992.

[287] United Kingdom, *UN Special Commission BW Inspections in Iraq*, p. 8.

[288] Ibid., p. 15

[289] Bailey, *The UN Inspections in Iraq*, pp. 41, 53.

[290] Jansen, "Biological Weapons Proliferation," p. 113; David L Huxsoll, "The Nature and Scope of the BW Threat," *Director's Series on Proliferation*, No. 4 (Livermore, Calif.: Lawrence Livermore National Laboratory, May 1994), p. 27.

[291] Production of botulinum toxin and *B. anthracis* at Al Hakam began in mid-1989. United Nations Security Council, *Report of the Secretary-General on the Status of the Implementation of the Special Commission's Plan for*

inspectors failed to detect pre-Gulf War biological weapons research and production activity at Fudaliyah, Dawrah and Taji. A summary of UNSCOM's performance in identifying Iraqi biological weapons sites in 1991 is provided in Table 3-1.

Table 3-1. Assessment of UNSCOM Performance During Phase 1

Facility	**Declared Purpose**	**UNSCOM Assessment**	**Actual Purpose**
Salman Pak	Military biological research	BW research	BW research
Al Hakam	Single cell protein plant	Suspected future BW production plant	BW production plant
Dawrah	Veterinary vaccine plant	True	BW production and research
Al Kindi	Veterinary vaccine plant	True	Transferred production equipment to Al Hakam
Amariyah	Vaccine production and research	True	As stated?
Fudaliyah	Abandoned research center	True	BW production
Taji	Abandoned single cell protein pilot plant	True	Abandoned BW production plant
Baghdad Slaughter House	Slaughterhouse	True	As stated
Najaf	Bakery	True	As stated
Medical City	Blood bank	True	As stated
Samarra	Pharmaceutical plant	True	As stated

Information provided by national intelligence agencies was crucial for guiding inspectors to the right locations during these inspections. Iraq later admitted that four of the five sites that were supposed to have been visited by the first biological inspection team were involved in its biological weapons program and UNSCOM continued to remain suspicious of the fifth facility (Amariyah). Of the eleven sites inspected by David Kelly and his teams in 1991, six were later found to be part of Iraq's biological weapons program.[292] This also means that five legitimate sites were "false positives." By the end of the second inspection, UNSCOM had visited all of Iraq's major biological research and production sites although this would not be know for several years. According to Trevan, "The team's failure to prove the link [between these facilities and the Iraq's biological weapons program] testifies to the inherent difficulties in tracking down biological weapons, and to the determination of the Iraqi authorities to keep them secret."[293] At

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the Ongoing Monitoring and Verification of Iraq's Compliance with Relevant Parts of Section C of Security Council Resolution 687 (1991), S/1995/864 (New York: United Nations, October 11, 1995), p. 24.

[292] However, Al Hakam was identified by Iraq in August 1991, not by a foreign intelligence agency. Trevan, *Saddam's Secrets*, p. 118.

[293] Trevan, *Saddam's Secrets*, p. 119.

that point, UNSCOM believed Iraq had a minor offensive research and development program before the Gulf War that did not involve large-scale production.[294] UNSCOM had used its best intelligence to pinpoint sites for inspections, but was unable to prove the suspicions of inspectors and now there was no more intelligence available on which to base new inspections.[295] Surveying UNSCOM's early efforts to uncover Iraq's biological weapons program, Jonathan Tucker concluded: "The Iraqi case points out the difficulty of reaching unambiguous judgments about BTW [biological and toxin weapon] activities, many of which are inherently dual-use and thus require an assessment of intent as well as capability."[296] By early 1992, one inspector concluded, "One thing is for sure, without any tangible evidence that contradicts what we have been told, we are unlikely to uncover anything more."[297]

Phase 2: Putting the Pieces Together (November 1991-June 1995)

Throughout 1992 and 1993, the investigation of Iraq's biological weapons program remained largely dormant. By 1994, there had been only three biological inspections, compared to 12 chemical inspections and 19 missile inspections, and none of them had uncovered any new information regarding Iraq's past biological weapons program.[298] In addition, throughout 1992 and 1993 Iraq stonewalled UNSCOM officials during political and technical meetings where more information on the Iraq's biological program and dual-use industry was sought.[299] Iraq's acceptance of Resolution 715 November 1993 and the implementation of UNSCOM's plan for the ongoing monitoring and verification (OMV) system generated new information and opportunities for the inspectors. In addition, crucial information was obtained from outside of Iraq that provided UNSCOM with new avenues of investigation. The key to the unraveling of Iraq's deception would be an innocuous material called complex growth media that is used to culture and grow bacteria. Iraq's inability to provide a credible accounting of its importation and utilization of this growth media would play a key role in Iraq's disclosure in July 1995 that it had an offensive biological warfare program and had produced a large quantity of biological warfare agents.

Establishing the OMV System

The seed for the breakthrough in the investigation of Iraq's biological weapons program was planted in October 1991, but it did not begin to germinate until November 1993 and it did not produce any fruit until early 1995. On October 11, 1991, the United Nations Security Council passed Resolution 715 that authorized the establishment of a long-term ongoing monitoring and verification (OMV) system in Iraq. The biological OMV was envisioned as an integrated monitoring and surveillance system using aerial surveillance, on-site inspections, material and equipment tracking, real-time monitoring cameras, regular declarations of dual-use activities and materials by Iraq, and data from national intelligence agencies.[300] The system was designed to

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[294] GAO, *Arms Control: U.S. and International Efforts to Ban Biological Weapons*, p. 56.
[295] Ibid; and Trevan, *Saddam's Secrets*, pp. 115-119.
[296] Tucker, "Lessons of Iraq's Biological Warfare Programme," p. 261.
[297] Jansen, "Biological Weapons Proliferation," p. 115.
[298] United Nations Security Council, *Seventh Report of the Executive Chairman of the Special Commission established by the Secretary-General pursuant to paragraph 9 (b) (i) of Security Council resolution 687 (1991) on the activities of the Special Commission*, S/1994/750 (New York: United Nations, June 24, 1994), pp. 30-31; and Pearson, *The UNSCOM Saga*, pp. 128, 130.
[299] Trevan, *Saddam's Secrets*, pp. 151-152, 217-218, 248-249.
[300] Black, "UNSCOM and the Iraqi Biological Weapons Program," p. 291.

monitor declared dual-use sites, equipments, and materials that were being used for legitimate civilian purposes and to detect diversions of these sites and items for proscribed purposes. The success of the OMV system was predicated on the success of UNSCOM in gaining a complete understanding of Iraq's dual-use capabilities. The OMV was not designed to detect undeclared or proscribed sites or items, which was a function of UNSCOM's disarmament mission.[301]

Iraq finally accepted Resolution 715 in November 1993 and began submitting declarations of its dual-use equipment and facilities to UNSCOM in January 1994.[302] Resolution 715 required Iraq to make exhaustive declarations to UNSCOM regarding virtually every aspect of the biological activities being conducted in the country. Iraq had to declare all microorganisms, toxins, and related equipment and facilities that could be used for biological warfare, and all research on pathogenic microorganisms and toxins. Also to be disclosed were all facilities and labs that worked with these agents, had biosafety containment features, had a fermentation capacity in excess of 40 liters, or produced vaccines. Furthermore, Iraq was prohibited from carrying out within its military organization any activities involving microorganisms or toxins or conducting research or other activities with diseases other than those of an indigenous nature or expected to arise imminently. Iraq was also barred from breeding vectors or importing certain microorganisms, toxins or vaccines without UNSCOM's permission. Finally, Iraq was allowed to possess no more than one biosafety level four lab and two biosafety level three labs.[303] The facilities judged by UNSCOM to be at highest risk for diversion to a weapons program were required to make declarations on a monthly basis regarding their activities. Other facilities were required to make declarations every six months. UNSCOM spent much of 1994 following up on Iraqi declarations of dual-use sites and preparing them for monitoring. During first ten months of 1994, 24 of 29 UNSCOM inspections, including 13 biological inspections, were dedicated to establishing the OMV systems in the chemical, biological, and missile fields.[304]

As part of this preparation for the biological OMV system, UNSCOM needed to establish a baseline inventory of Iraq's biological weapons-capable, dual-use equipment, much of which had been imported. Despite Iraq's refusal to provide UNSCOM with the names of its foreign suppliers and attempts to hide such information, UNSCOM was able to obtain the names of Iraq's foreign suppliers of cell cultures, fermenters, aerosol generators, milling machines, and growth media.[305] In December 1993, Annick Paul-Henriot, a French lawyer working for UNSCOM, sent letters to the governments of Iraq's known foreign suppliers requesting information on exports of biological products to Iraq. Responses were slow but eventually provided information on Iraqi imports of fermenters, aerosol generators, and inhalation chambers.[306] In addition, UNSCOM learned that most of these shipments had gone through the Technical and Scientific Materials Division (TSMD) of the Ministry of Trade.[307]

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[301] Stephen Black, "Investigating Iraq's Biological Weapons Program," in Lederberg, *Biological Weapons*, p. 164.
[302] United Nations Security Council, *Sixth report of the Executive Chairman of the Special Commission established b the Secretary-General pursuant to paragraph 9 (b) (i) of resolution 687 (1991) on the activities of the Special Commission*, S/26910 (New York: United Nations, December 21, 1993), p. 6.
[303] United Nations Security Council, *Plan for future ongoing monitoring and verification of Iraq's compliance with relevant parts of section C of Security Council resolution 687 (1991)*, S/22871/Rev. 1 (New York: United Nations, October 2, 1991), pp. 9-11, 26-28.
[304] Pearson, *The UNSCOM Saga*, pp. 134-135.
[305] Trevan, *Sadam's Secrets*, p. 169.
[306] Trevan, *Saddam's Secrets*, pp. 271-272.
[307] John Barry, "Unearthing the Truth," *Newsweek*, March 2, 1998, p. 40.

On April 8, 1994, UNSCOM conducted the first inspection to establish a baseline for biological monitoring (BW-4). This was UNSCOM's first biological inspection in almost a year.[308] The outcome of the inspection illustrates the difficulties posed in monitoring dual-use facilities and the ambiguity that therefore surrounds biological capabilities. The team's mission was to conduct baseline inspections of the 35 sites declared by Iraq in January 1994 and inspect two undeclared sites to determine if they should be included in the monitoring system. The sites inspected included university, medical diagnostic, veterinary, and food control laboratories, breweries and industrial alcohol production factories, and production facilities for vaccines, single-cell proteins, fertilizers, castor oil, and pesticides.[309] Each of these facilities had either equipment or capabilities that could be utilized in the research, development, production, or testing of biological warfare agents. At the conclusion of the inspections, the chief inspector, a German expert who had participated in several previous inspections and seminars held at the UNSCOM headquarters in New York City, declared that UNSCOM now knew all that it needed about Iraq's biological activities and capabilities and he did not foresee the need for any additional information from Iraq. He also reported that, in contrast to the findings of the second biological inspection team, the foot and mouth disease vaccine plant at al Dawrah, the Al Kindi veterinary vaccine production plant at Abu Ghraib, and the Serum and Vaccine Institute at Amariyah were not capable of producing biological warfare agents. In addition, Al Hakam was deemed unsuitable for biological weapon production due to the lack of proper safety features.[310] This incident illustrates the ambiguity surrounding multi-use biological capabilities, the potential for experts to have different interpretations of the same evidence, and the importance of the judgment of inspectors in assessing the intent behind a facility.[311]

Throughout 1994, UNSCOM uncovered new indications that Iraq was hiding biological weapons-relevant capabilities and that civilian institutions may be connected to Iraq's past offensive program. During BW-6 in June 1994, UNSCOM inspectors were surprised to find that the staff at certain universities were well briefed on the personnel on the team, the high level of expertise of these staff in anaerobic microbiology (which is required to produce the anaerobic microorganisms *B. anthracis*, *C. botulinum* and *C. perfringens*), the amount of anaerobic equipment in the laboratories, and the size of the biology department's budget. According to Trevan, "The overall impression was that there was a centrally organized campaign to disperse equipment for researching and producing anaerobic bacteria in seemingly innocent locations in order to hide them from the prying eyes of UNSCOM inspectors."[312] During BW-8 between July and September 1994, inspectors discovered that several Iraqis who had worked on the military research program at Salman Pak were now managing ostensibly civilian biological facilities such as the foot and mouth disease vaccine plant at al Dawrah, the Al Kindi vaccine plant, and the Serum and Vaccine Institute at Amariyah. All of these sites had been on David Kelly's initial list

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[308] United Nations Security Council, *Report of the Secretary-General on the Status of the Implementation of the Plan for the Ongoing Monitoring and Verification of Iraq's Compliance with Relevant Parts of Section C of Security Council Resolution 687 (1991)*, S/1994/489 (New York: United Nations, April 22, 1994), p. 10.

[309] United Nations Security Council, *Report of the Secretary-General on the Status of the Implementation of the Plan for the Ongoing Monitoring and Verification of Iraq's Compliance with Relevant Parts of Section C of Security Council Resolution 687 (1991)*, S/1994/1138 (New York: United Nations, October 7, 1994), p. 24.

[310] Fortunately, he did recommend that all of these facilities be included in UNSCOM's monitoring program. Trevan, *Saddam's Secrets*, p. 261.

[311] A senior State Department arms control official who participated in inspections of suspected biological weapons sites in the former Soviet Union compared offensive biological warfare activities to pornography: "you know it when you see it." Interview with Ambassador Donald Mahley, Cambridge, Massachusetts, April 3, 2003.

[312] Trevan, *Saddam's Secrets*, p. 263.

of sites suspected of being involved in the Iraqi biological weapons program although no evidence had yet been found to link them to biological weapons activities.[313] In addition, the biological inspection teams charged with establishing the OMV system kept running into problems. The Iraqis failed to declare equipment and facilities, moved equipment around between inspections and in general prevented UNSCOM from obtaining a complete and accurate baseline of Iraqi capabilities in the biological field. In the absence of reliable baseline data, UNSCOM's biological experts recommended against beginning biological monitoring.[314]

By October 1994, UNSCOM's biological inspectors were still unable to prove its suspicions that Iraq was hiding an offensive biological warfare program, but were also unwilling to approve the beginning of the biological OMV system. At the same time, UNSCOM chairman Rolf Ekeus was coming under increased pressure from Security Council members to institute monitoring of Iraq's dual-use biological facilities. The OMV programs for the missile and chemical fields had become operational by August 1994 and October 1994, respectively.[315] Ekeus was skeptical that Iraq had an advanced biological weapons program that had engaged in large-scale production or weaponization. As Ekeus explained, "I was skeptical about the BW program. I felt that they probably hadn't done much.... I thought that they had done some more advanced research, maybe tried to do some production."[316] He was not alone. Rod Barton, an Australian microbiologist with experience in the biodefense sector, recalled that when he joined UNSCOM in September 1994, "My perception was, maybe they had a research program, but as to producing, well, they probably didn't get that far...I was sitting on the fence [regarding Al Hakam]. There were quite a lot of people who had been there, well-qualified people who did not believe it."[317]

In contrast, Paul-Henriot and Richard Spertzel, the former deputy commander of the U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID) and another new member of UNSCOM's biological team, were convinced that Iraq was hiding an offensive biological weapons program and wanted to place a large number of facilities under monitoring to either flush out the program or prevent its re-emergence. Spertzel and Paul-Henriot wanted to subject 80 biological facilities to monitoring which Ekeus was afraid he could not justify to the Security Council given the lack of evidence of a past Iraqi program. Spertzel and Paul-Henriot patiently laid out all of the circumstantial evidence they had gathered on the Iraqi BW program. They demonstrated that Iraq's account of its past biological weapons program was illogical, inconsistent, and unsupported by any documentation. In addition, information obtained from external sources showed that Iraq had obtained all of the materials necessary for large-scale

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[313] Ibid., p. 275.

[314] Thomas Stock, Erhard Geissler, and Tim Trevan, "Chemical and Biological Arms Control," in SIPRI, *SIPRI Yearbook 1995: Armaments, Disarmament, and International Security* (Oxford: Oxford University Press, 1995), p. 757.

[315] Pearson, *The UNSCOM Saga*, p. 100; United Nations Security Council, *Letter dated 25 January 1999 from the Executive Chairman of the Special Commission established by the Secretary-General pursuant to paragraph 9 (b) (i) of Security Council resolution 687 (1991) addressed to the President of the Security Council*, S/1999/94 (New York: United Nations, January 29, 1999), p. 216.

[316] Quoted in Margaret Sloane, *UNSCOM's Inspections for Biological Weapons in Iraq, 1991-1998*, M.A. thesis, Fletcher School, Tufts University, 2002, p. 5.

[317] Quoted in Miller, Engelberg, and Broad, *Germs*, p. 149.

production of biological warfare agents.[318] Based on these assessments, Ekeus agreed to establish a broad monitoring regime on Iraqi biological facilities.[319]

What followed was an intensive campaign to gather more information on Iraq's biological capabilities and activities in order to establish the monitoring system. The biological inspectors conducted their first interview mission in November 1994 to talk to scientists who had worked on Iraq's declared defensive program or were associated with the program. The team managed to interview 28 persons, including nine of the ten former employees who had worked on the military biology research program at Salman Pak. Access to these individuals, whose identities had not been previously revealed, was seen as an important sign of progress.[320] However, the Iraqis interviewed were evasive, appeared to have been thoroughly coached beforehand, and exhibited collective amnesia. Although this behavior was uncooperative, it indicated that Iraq was still hiding something.[321] The inspectors managed to learn several interesting facts that connected Al Hakam to Salman Pak and linked both facilities to the chemical weapons program based at Muthanna.[322] In addition, the inspectors learned that TSMID, which on paper was part of the Ministry of Trade, actually reported to the Military Industrialization Commission and was the sole ordering arm for the Technical Research Center, the organization responsible for Salman Pak and Al Hakam.[323]

As a result of Iraq's poor record of cooperation in the biological field, UNSCOM reported to the Security Council at the end of 1994 that: "The Commission faces its greatest problems in accounting for Iraq's past biological programme. Iraq's account is minimal and has no inherent logic...While Iraq maintains that the programme was in the early research stages and would be defensively oriented, the indications all point to an offensive program."[324] Although the interviews and information on Iraq's foreign procurement provided additional indications that Iraq was still concealing aspects of its past biological activities, the inspectors did not yet have solid evidence that Iraq was concealing an offensive program. However, UNSCOM's assurance that Iraq was doing so was strengthened by an interview in February 1995 with General Wafiq al Samarra'i, the former head of Iraq's military intelligence. Samarra'I, who had recently defected to Turkey, was the first Iraqi defector interviewed by UNSCOM with credible knowledge of Iraq's biological weapons program.[325] He told the inspectors that the biological weapons program had been underway at Salman Pak since at least 1982 under the supervision of

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[318] Trevan, *Saddam's Secrets*, pp. 275-281; and Barry, "Unearthing the Truth," p. 40.

[319] Miller, Engelberg, and Broad, *Germs*, p. 146; Sloane, *UNSCOM's Inspections for Biological Weapons in Iraq*, pp. 5-6.

[320] Iraq had earlier claimed that these people could not be located because they were now earning a living as cab drivers. United Nations Security Council, *Addendum to the eighth report of the Executive Chairman of the Special Commission established b the Secretary-General pursuant to paragraph 9 (b) (i) of resolution 687 (1991)*, S/1994/1422/Add. 1 (New York: United Nations, December 15, 1994), p. 11; and Rod Barton, "Unraveling Iraq's Biological Weapons Program: A Personal Account," Presentation at the Harvard Sussex Program CBW Colloquia, Belfer Center for Science and International Affairs, Harvard University, Cambridge, MA, January 29, 2001.

[321] Barton, "The Application of the UNSCOM Experience to International Biological Arms Control," p. 222; and Trevan, *Saddam's Secrets*, p. 284.

[322] Barton, "The Application of the UNSCOM Experience to International Biological Arms Control," p. 222.

[323] Barton, "Unravelling Iraq's Biological Weapons Program: A Personal Account"; Black, "UNSCOM and the Iraqi Biological Weapons Program," p. 292; and Barton, "The Application of the UNSCOM Experience to International Biological Arms Control," p. 222.

[324] United Nations Security Council, *Eighth report of the Executive Chairman of the Special Commission established b the Secretary-General pursuant to paragraph 9 (b) (i) of resolution 687 (1991)*, S/1994/1422 (New York: United Nations, 15 December 1994), pp. 6-7.

[325] Charles Duelfer, "The Inevitable Failure of Inspections in Iraq," *Arms Control Today*, September 2002, p. 11.

the Iraqi intelligence service. He also reported that in 1991 Iraq had 200 biological bombs that weighed either 500 kilograms or 500 pounds and that weapons-related documents had been hidden at the Samarra Drug Company.[326] By April 1995, UNSCOM had developed a persuasive case that Iraq was continuing to conceal an offensive program based on Iraq's importation of growth media and other dual-use equipment and the nature of the Al Hakam facility.

Growth Media

The major breakthrough that allowed UNSCOM to expose Iraq's past biological weapons program centered around Iraq's importation of massive quantities of growth media from Europe.[327] Based on the information obtained during the November 1994 interviews, UNSCOM sought information from countries regarding their exports to front companies associated with Iraq's biological weapons program, including TSMID.[328] Through discussions with European suppliers and information provided by Israeli intelligence, UNSCOM was able to document TSMID's import of growth media between 1987 and 1990, including the import of 40 tons of growth media in 1988 alone.[329] Although Iraq's imports of growth media had been known beforehand, these details on the types and quantities were new information.[330] This quantity of growth media was sufficient to support a modest-sized pharmaceutical plant, but Iraq did not have such a facility.[331] Iraq's own November 1994 declaration to UNSCOM reported that hospitals consumed only 200 kilograms of growth media a year.[332] Given the connection between TSMID and the Iraqi biological program, UNSCOM believed that the growth media was imported for the purpose of producing biological weapons. Between January and March 1995, UNSCOM sought a credible explanation from Iraq regarding the fate of the growth media.

Iraq at first denied that TSMID or Salman Pak had ordered the growth media. After being told that UNSCOM had copies of letters of credit showing Iraqi payment for the growth media, the Iraqis changed their story. They now claimed that instead of ordering only for Salman Pak, TSMID ordered the growth media for the Ministry of Health. This unusual arrangement was made because TSMID had hard currency while the Ministry of Health did not.[333] Iraq also claimed that such a large amount of media was imported due to incompetence and stupidity on

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[326] In August 1995, Iraq would admit to having had 166 bombs and 25 missile warheads filled with biological agent in 1991, very close to Samarrai's figure of 200. Trevan, *Saddam's Secrets,* pp. 298-300, 331.

[327] One of the best accounts of this aspect of UNSCOM's investigation is Sloane, *UNSCOM's Inspections for Biological Weapons in Iraq.*

[328] Rolf Ekeus, *Iraq's Biological Weapons Program: UNSCOM's Experience* (New York: United Nations, November 20, 1996), p. 3.

[329] Barton, "Unravelling Iraq's Biological Weapons Program"; Trevan, *Saddam's Secrets*, p. 287; Barry, "Unearthing the Truth," p. 40; James Bone, "Chemical Agents," *Times of London*, December 13, 1997; and William Broad and Judith Miller, "Iraq's Deadliest Arms: Puzzles Breed Fear," *New York Times*, February 26, 1998, p. A1.

[330] In October 1991, the German Federal Economics Ministry revealed that Hamburg-based firm W.E.T. had supplied microbiological materials, including fermenters and growth media, to Iraq. The order was placed by military officials who worked for State Establishment for Pesticides Production and claimed that it was to be used by labs in clinical hospitals. W.E.T. was also known to have supplied Iraq's chemical program. Bailey, *The UN Inspections in Iraq*, p. 104.

In addition, Israel reportedly provided information to UNSCOM in June 1994 that Iraq had imported large quantities of complex growth media suitable for the production of biological warfare agents in the late 1980s. Trevan, *Saddam's Secrets*, p. 275.

[331] Barton, "The Application of the UNSCOM Experience to International Biological Arms Control," p. 223.

[332] Trevan, *Saddam's Secrets*, p. 288.

[333] Ibid., pp. 288-289; Barton, "Unravelling Iraq's Biological Weapons Program."

the part of Iraqi bureaucrats.[334] The inspectors eventually located 23 tons of growth media. Iraq claimed that the remaining 17 tons had been sent to hospital laboratories, but was destroyed during riots following the 1991 Gulf War. Coincidentally, the media was distributed only to hospitals in areas that suffered riots. In addition, both the quantities and types of growth media imported by Iraq were inappropriate for this purpose. Iraq also provided the inspectors with documents from Ministry of Health to support its story. Inspectors soon determined that the documents were not authentic. Iraq claimed that these documents were "copies" because some of the originals had been lost in an electrical fire that destroyed only the contents of a single drawer in a file cabinet. The other original documents fell off the back of a truck while being moved.[335] By April 1995, all of these claims had been investigated and had been rebutted, were deemed implausible or remained unsupported by any evidence.[336]

Al Hakam

At the same time that inspectors were knocking holes in Iraq's account of its purchase and utilization of growth media, they were also uncovering new information about Al Hakam's true purpose and past history. Since the original inspection in October 1991, UNSCOM had remained suspicious about Iraqi claims that Al Hakam was a civilian SCP production plant. The facility had been constructed under great secrecy, had a layout similar to other Iraqi weapons facilities, had a level of security inconsistent with its stated purpose, had never been publicly identified as a civilian facility, and had not been visited by foreign contractors. What's more, Iraq had also falsified end-user certificates for a fermenter and spare parts purchased for Al Hakam.[337]

In early 1995, UNSCOM uncovered evidence that Iraq had planned on installing an advanced air filtration system in the building said to be the animal house and that a similar system had been ordered for installation on one of the laboratory buildings. The use of such sophisticated equipment was inconsistent with the declared purpose of these buildings, but would be required for work with biological warfare agents.[338] The initial clue to this discovery came when UNSCOM inspector Richard Spertzel obtained the architectural drawings for Al Hakam and observed that they indicated a high quality ventilation system for the animal house, which appeared excessive for the stated purpose. The draftsman, an air conditioning engineer from the University of Technology Consulting Bureau, claimed it was for a chicken house but could not provide any additional information except that the project was referred to as Project 900. Spertzel then learned that Al Hakam's drainage and sewage system had been designed by another organization, the al Faw Consultative Bureau, a subsidiary of Military Industrialization Commission. The designer referred to the site as Project 324. Both engineers stated that they had not visited the site. The compartmentalization of the site design and the lack of on-site access to the designers seemed suspicious to Spertzel. Later that day, Spertzel asked Taha which project code for Al Hakam was correct: 900 or 324? Taha stated that Project 324 referred to the entire Al Hakam project while Project 900 was a subunit. In addition, Spertzel recalled a piece of intelligence he had had access to during his work on the Army's biodefense program in the

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[334] Trevan, *Saddam's Secrets*, p. 295.
[335] Ibid., pp. 303-310.
[336] Black, "UNSCOM and the Iraqi Biological Weapons Program," p. 292.
[337] United Nations Security Council, *Report of the Secretary-General on the activities of the Special Commission established b the Secretary-General pursuant to paragraph 9 (b) (i) of resolution 687 (1991)*, S/1995/284 (New York: United Nations, April 10, 1995), p. 19.
[338] Ibid.

1980s. He remembered seeing an intelligence report on Iraq that referred to buildings E and H at Project 324 in Iraq that were reportedly outfitted with high efficiency particulate air (HEPA) filters and negative air pressure systems which are crucial components of a biocontainment system associated with work on dangerous pathogens. However, the location of Project 324 was unknown. The staff in New York checked the Al Hakam site diagram provided by the Iraqis and found that buildings E and H matched a laboratory and animal house. UNSCOM had just found the biological weapon facility that U.S. intelligence had picked up in the 1980s.[339]

Although not reported publicly at the time, UNSCOM had discovered a new anomaly in the ongoing activities at Al Hakam. In addition to the production of SCP, Iraq also claimed that the facility was engaged in the production of the biopesticide *Bacillus thuringiensis*, a spore-forming bacteria closely related to *B. anthracis*, commonly known as BT. Through analysis of samples taken from the spray driers at Al Hakam in December 1994, UNSCOM found that BT was being produced in dry powder form in small (less than 10 micron) size. This size was inconsistent with biopesticide applications, but was perfect for dissemination of a biological weapon. In addition, when the BT from Al Hakam was examined under an electron microscope, UNSCOM found that it lacked the characteristic protein-crystal inclusions needed for insecticidal activity.[340] Compared to the liquid slurries that Iraq produced before the Gulf War, dry powders of biological warfare agents are more potent, more stable, easier to disseminate, and survive longer in aerosol form in arid environments such as the Middle East.[341] Spertzel concluded that the dry powder BT was being used as a stimulant to practice the production of dry *B. anthracis*. Extensive sampling inside and outside of Al Hakam in 1994, however, did not indicate the presence of biological warfare agents.[342]

Finally, thanks to foreign suppliers and intelligence agencies, UNSCOM was able to document attempted and successful efforts by TSMID to procure a range of dual-use equipment and materials needed to produce and process biological warfare agents. For example, TSMID's purchase of four filling machines, a spray drier, an inhalation chamber, and a sophisticated laboratory were linked by UNSCOM to Al Hakam. In addition, TSMID attempted to order three large fermenters and disguise the fact that Al Hakam was the equipment's ultimate destination. UNSCOM also learned that TSMID had attempted to obtain a highly virulent strain of *B. anthracis* from the United Kingdom that would be well suited for use as a biological warfare agent. [343]

The Biological OMV Becomes Operational

The biological OMV system finally became operational in April 1995. The system eventually covered 82 facilities including vaccine and pharmaceutical plants, breweries, distilleries, dairies, university labs, and public health and diagnostic laboratories.[344] The number

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[339] Trevan, *Saddam's Secrets*, pp. 274, 291-292; and Miller, Engelberg, and Broad, *Germs*, pp. 148-149.

[340] Richard O. Spertzel, "Sampling and Analysis as a Monitoring Tool: Lessons from the UNSCOM Experience," in Jonathan B. Tucker, ed., *The Utility of Sampling and Analysis for Compliance Monitoring of the Biological Weapons Convention* (Livermore, Calif.: Lawrence Livermore National Laboratory and Monterey Institute for International Studies, February 1997), p. 22.

[341] Patrick, "Biological Warfare," p. 5.

[342] Spertzel, "Sampling and Analysis as a Monitoring Tool," pp. 22-23.

[343] Trevan, *Saddam's Secrets*, pp. 314-316; and Pearson, *The UNSCOM Saga*, pp. 140-141.

[344] United Nations Security Council, *Report of the Secretary-General on the status of the implementation of the Special Commission's plan for ongoing monitoring and verification of Iraq's compliance with relevant parts of section C of Security Council resolution 687 (1991)*, S/1995/864 (New York: United Nations, October 11, 1995), p. 20.

and diversity of the facilities that needed to be monitored illustrates the ease with which civilian dual-use sites could be converted to weapons purposes. To verify that the facilities did not engage in prohibited activities, UNSCOM stationed a permanent team of four to six inspectors in Baghdad who would visit one or more sites every day. The highest risk facilities were visited weekly while the lowest risk facilities were visited yearly on a random basis. The inspectors were authorized to conduct interviews, examine records, physically examine equipment, and take samples.[345] In addition, inspectors inventoried and tagged all dual-use equipment that could be used in a biological weapons program. UNSCOM tagged more dual-use equipment in the biological field than in the missile and chemical fields combined. By 1999, UNSCOM's biological database listed 1,334 individual pieces of equipment.[346]

UNSCOM Makes Its Case

By April 1995, UNSCOM was also ready to go public with the evidence supporting its conclusion that Iraq was concealing a biological weapons program. In its April 1995 report to the Security Council, the Special Commission wrote: "The Commission assesses that Iraq obtained or sought to obtain all the items and materials required to produce biological warfare agents in Iraq. With Iraq's failure to account for all these items and materials for legitimate purposes, the only conclusion that can be drawn is that there is a high risk that they had been purchased and in part used for proscribed purposes—the production of agents for biological weapons."[347] Iraq's inability to credibly refute this assessment led to Iraq's disclosure of an offensive program in July 1995.

Despite UNSCOM's strong case that Iraq was hiding an offensive biological weapons program, Iraq continued stonewalling. However, Iraq's support within the Security Council was slipping. As Margaret Sloan explains, "It was the totality of the growth media story that was compelling. Everyone could understand because the quantities were so enormous and Iraq's explanations of its use and ultimate fate were not even slightly plausible."[348] UNSCOM biological inspector Gabriele Kraatz-Wadsack explains that it was the "big trigger because of the import and the discrepancy and the investigation and the fudged documents."[349] According to Spertzel, "the significance of the growth media was a hook that the news media could get a hold of and understand and, frankly, that the Security Council could latch on to."[350]

The thoroughness of the April 1995 Security Council report and Iraq's implausible denials undercut the support they had been receiving from French and Russian their allies on the Security Council. In order to recover some credibility, Russia and France began pressuring Iraq to come clean so that sanctions might be lifted.[351] Ekeus briefed the Security Council on Iraqi non-cooperation on growth media again in May 1995. According to Barton, "the Security Council response was that Iraq really had a case to answer, and I think that was a turning point in

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[345] Barton, "The Application of the UNSCOM Experience to International Biological Arms Control," pp. 228-229.
[346] United Nations Security Council, *Letter dated 25 January 1999 from the Executive Chairman of the Special Commission established by the Secretary-General pursuant to paragraph 9 (b) (i) of Security Council resolution 687 (1991) addressed to the President of the Security Council*, S/1999/94 (New York: United Nations, January 29, 1999), pp. 223, 247, 256.
[347] United Nations Security Council, *Report of the Secretary-General on the activities of the Special Commission established b the Secretary-General pursuant to paragraph 9 (b) (i) of resolution 687 (1991)*, S/1995/284 (New York: United Nations, April 10, 1995), p. 16.
[348] Sloane *UNSCOM's Inspections for Biological Weapons in Iraq*, p. 18.
[349] Quoted in Ibid.
[350] Quoted in Ibid.
[351] Trevan, *Saddam's Secrets*, pp. 324-325.

our investigation because even Iraq's friends – and they had some friends on the Security Council – and even Iraq's friends said to Iraq, 'You can't continue with this story about media riots, documents falling off the back of a truck'."[352] Spertzel recalls that "they couldn't shake the media, and so they finally had to make a partial admission. They told us that categorically...And they were unabashed about it; they said they simply couldn't shake off the impact of that media. I mean it was a good hook. Something that they just couldn't sweep under the rug."[353]

During a set of meetings in Baghdad from May 29-June 1, 1995, Iraqi Deputy Prime Minister Tariq Aziz offered UNSCOM chairman Rolf Ekeus a deal. As Ekeus explains, "I undertook to give a comprehensive and reasonably positive update in the UNSCOM June report to the Security Council concerning the assessment of Iraq's CW and missile programs. To that, Tariq Aziz was to add a full accounting for Iraq's BW-related capabilities and activities."[354] In short, if Iraq could see that significant progress was being made on closing the chemical and missile files, it would address the sole significant outstanding issue for UNSCOM: the biological weapons program.

In the June report, UNSCOM reported that it had sufficient confidence in its knowledge of Iraqi chemical and missile capabilities, that Iraq no longer retained significant proscribed chemical or missile capabilities, and that the chemical and missile OMV systems was operational. However, the report noted the lack of progress on resolving the concerns in the biological field that had been raised in the April 1995 report.[355] As a result of Ekeus holding up his end of the deal, the inability to adequately explain the fate of the missing growth media, the prospect that more incriminating evidence could be revealed, and pressure from a unified Security Council, Iraq was forced to provide a new account of its past biological weapons activities.

On July 1, 1995, General Amer Rashid and Dr. Rihab Taha made a brief oral presentation to Ekeus and his biological team. For the first time, Iraq admitted that it had had an offensive biological program. Iraq claimed that the program began in April 1986 at Salman Pak and starting in 1989 began production of 600 liters of *B. anthracis* and 9,000 liters of botulinum toxin at Al Hakam. These production activities reportedly consumed over fifteen tons of growth media. The program was said to have been terminated in October 1990 and all of the bulk agent was destroyed. Iraq denied that it filled any biological agents into weapons.[356] In addition, Iraq denied the involvement of Muthanna in the biological program, the production of biological warfare agents at any sites besides Al Hakam, the weaponization of biological agents, the testing of biological weapons, and any connections between the program and the military. The briefing appeared to be a rather clumsy attempt to disclose enough information to account for what Iraq believed UNSCOM already knew about while minimizing disclosures about other aspects of the offensive program. UNSCOM strongly suspected that Iraq's new account of agent production was "manipulated to provide what Iraq hoped would pass as a credible accounting of the missing media."[357] In addition, UNSCOM experts calculated that the Iraqi account of its biological agent

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[352] Quoted in Sloane, *UNSCOM's Inspections for Biological Weapons in Iraq*, p. 14.
[353] Quoted in Ibid., p. 21.
[354] Rolf Ekeus, "UN Biological Inspections in Iraq," in Drell, Sofaer, and Wilson, *The New Terror*, p. 245.
[355] Ibid., p. 246.
[356] Ekeus, *Iraq's Biological Weapons Program*, p. 4; and Trevan, *Saddam's Secrets*, pp. 325-327.
[357] United Nations Security Council, *Report of the Secretary-General on the status of the implementation of the Special Commission's plan for ongoing monitoring and verification of Iraq's compliance with relevant parts of section C of Security Council resolution 687 (1991)*, S/1995/864 (New York: United Nations, October 11, 1995), p. 21; and Barton, "The Application of the UNSCOM Experience to International Biological Arms Control," p. 225.

production was contradictory and inaccurate and still did not account for at least five tons of missing growth media.[358] For example, based on the growth media Iraq was known to have imported, it should have produced more *B. anthracis* than *C. botulinum*.[359] UNSCOM was also skeptical of Iraq's claim that it terminated the biological program in the fall of 1990 since Iraq had already admitted to expanding its production of chemical weapons at this time. Instead of resolving UNSCOM's suspicions about its biological program, the limited disclosure was seen as another example of Iraq's strategy of "cheat and retreat."

Nonetheless, this new information was codified in a new "Full, Final, Complete Disclosure" (FFCD) submitted by Iraq on August 4. The next day, in a meeting with Aziz in Baghdad, Ekeus noted the central role of the Military Industrialization Commission (MIC) in Iraq's proscribed weapons programs and requested a meeting with General Hussein Kamal Hassan, the head of MIC, during his next visit in order to resolve remaining problems with the biological file. Aziz promised to pass this request along to Kamal. However, Tariq Aziz also made it clear that Iraq's cooperation with UNSCOM was nearing an end. He issued an ultimatum that the biological file must be closed by end of August or else all cooperation with UNSCOM would be halted.[360] Iraq apparently calculated that its limited disclosure on July 1 would allow it to offer a credible explanation of the missing growth media, thereby removing UNSCOM's most potent example of Iraqi non-compliance with Resolution 687. This would allow Iraq to regain the support of France and Russia in lifting the UN sanctions.

Evaluation of Phase 2

Iraq's disclosure of an offensive biological weapons program in July 1995, after four years of denial, was seen as a great victory for UNSCOM. According to Ekeus, "it was the crushing evidence, based on inspection efforts, and the analytical activities of the BW team—combined with political pressure exerted by UNSCOM and a united Security Council—that brought the Iraqi government to a point where it had to end over four years of systematic misrepresentation and lying at all levels."[361] Solid evidence of imports of large quantities of particular growth media that Iraq could not credibly account for provided UNSCOM with "tangible evidence that was easily understood by non-technical" diplomats.[362] The accumulation of this evidence was due to dogged detective work by the biological inspectors, the cooperation of companies in foreign countries, and the assistance of national intelligence services. In the case of the growth media, information on Iraq's foreign procurement provided by foreign suppliers and Israel provided inspectors with several leads to investigate on the ground in Iraq. Despite Iraqi obstruction and deception, the inspectors were able to link these imports to Iraq's biological weapons program or force Iraq to invent increasingly complicated and less plausible cover stories.

Praise for UNSCOM's success in forcing Iraq to concede that it had developed an offensive program and had produced biological warfare agents at Al Hakam should be tempered by several considerations. First, on-site inspections of Al Hakam were not sufficient to demonstrate the facility's role in the Iraqi biological weapons program. There was a lack of consensus among inspectors regarding Al Hakam's capability to produce biological warfare

[358] United Nations, "Press Briefing by Executive Chairman of Special Commission on Monitoring Iraqi Disarmament," August 11, 1995.
[359] Trevan, *Saddam's Secrets*, p. 328.
[360] Ibid., p. 329.
[361] Ekeus, "UN Biological Inspections in Iraq," p. 245.
[362] Ekeus, *Iraq's Biological Weapons Program*, p. 9.

agents. Besides the German chief inspector who gave the site a clean bill of health, David Franz, a former deputy commander of USAMRIID and UNSCOM chief biological inspector, also judged that Iraq had not produced human pathogens at Al Hakam due to the lack of biosafety features.[363] Second, UNSCOM found no direct evidence of Al Hakam's production of biological warfare agents despite extensive sampling of the facility.[364] Likewise, sampling at Salman Pak yielded only negative results.[365] As a result of these negative findings, Iraq tried to persuade members of the Security Council that these results demonstrated Iraqi compliance with Resolution 687 and that the biological file should be closed.

A third consideration is that Iraq continued to use Al Hakam during the early 1990s to engage in biological weapons-related research and development activities undetected for four years. As a result, Iraq developed the capability to produce a dry version of the biopesticide *B. thuringensis* milled to a size of 1-10 microns, ideal for aerosolization as a biological weapon.[366] In effect, Iraq was able to successfully disguise a "warm" biological weapons capability from UNSCOM inspectors as a biopesticide research and production facility and was even able to upgrade its capability to produce biological weapons from a crude liquid slurry to a dry powder with the proper size particles for effective dissemination.[367] Fourth, UNSCOM believed that Iraq had weaponized biological agents, but did not know how many munitions or what kind they were, where they were stored or deployed, or what happened to them after the Gulf War.[368] This aspect of the Iraqi biological weapons program was only revealed in the aftermath of Hussein Kamal's defection to Jordan.

Phase 3: Revelation and Confirmation (August 1995-December 1998)

Before UNSCOM could begin to make any significant progress confirming Iraq's newest account of its biological weapons program offered on July 1 or Iraq could make good on its threat of August 5 to end cooperation with the inspectors by the end of the month, the defection of a very senior Iraqi official to Jordan dramatically changed the balance of power between Iraq and the inspectors. As a result, Iraq was again placed on the defensive and was forced to disclose an even larger and more advanced biological weapons program than it had admitted to only a month earlier.

The Defection of Hussein Kamal

On August 7, 1995, Hussein Kamal Hassan, who had played a key role in the development and concealment of Iraq's nuclear, biological, chemical and missile programs, defected to Jordan.[369] To understand the importance of Hussein Kamal's defection and why it

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[363] In contrast, former U.S. biological weapons scientist William Patrick visited Al Hakam in 1994 and became convinced that the facility had not been built just to produce SCP. Miller, Engelberg, and Broad, *Germs*, pp. 144-145.

[364] Spertzel, "Sampling and Analysis as a Monitoring Tool," pp. 22-23; and Zilinskas, "Detecting and Deterring Biological Weapons," p. 202.

[365] Alan J. Mohr, "Biological Sampling and Analysis Procedures for the United Nations Special Commission (UNSCOM) in Iraq," *Politics and the Life Sciences*, Vol. 14, No. 2 (August 1995), pp. 240-243.

[366] Trevan, *Saddam's Secrets*, pp. 314-315.

[367] Wallerstein, "Responding to Proliferation Threats"; and Kadlec, Zelicoff, and Vrtis, "Biological Weapons Control," p. 105.

[368] Zilinskas, "Detecting and Deterring Biological Weapons," p. 195.

[369] The motivation for Kamal's defection is not known for certain. According to Iraq expert Amatzia Baram, Kamal fled due to his fear of Uday Hussein, Saddam Hussein's elder son. Uday had had a long-running feud with his uncle Watban Ibrahim and with Hussein Kamal regarding the latter's control over Iraq's lucrative smuggling operation.

provoked such a strong response from Iraq, it is first necessary to understand Kamal's role in Iraq's weapons of mass destruction programs. Kamal, a cousin of Saddam Hussein and a member of his clan, was able to convert his ambition, management skills, and relationship with Saddam Hussein into a bureaucratic empire that would eventually control Iraq's weapons of mass destruction programs, civilian and military industry, and the regime's internal security.[370] By 1988, Kamal was in charge of the Amn al-Khass, or Special Security Organization (SSO), which was responsible for presidential security and supervising the rest of Iraq's internal security and intelligence agencies. Iraq's biological weapons program also came under the auspices of the SSO. Kamal was also the head of the Ministry of Industry and Military Industrialization (MIMI), which combined Iraq's military and civilian industry under one super-ministry and facilitated the acquisition of dual-use technology for military projects under civilian covers. MIMI was also responsible for Iraq's nuclear, chemical and missile programs. By 1988, "Hussein Kamal was now officially the second most powerful man in the country with personal control over Iraq's entire industrial apparatus."[371] Kamal served as the Minister of Defense in 1991 and after the Persian Gulf War he returned to his prior role as head of the renamed Military Industrialization Commission (MIC). Therefore, by the time he defected in August 1995, Kamal had spent over ten years developing and concealing Iraq's weapons of mass destruction and protecting the senior leadership from internal and external threats.

Iraq's Newest Disclosure

On August 12, in his first public appearance after his defection, Kamal held a press conference in Amman and announced his intention to overthrow Saddam Hussein.[372] Baghdad immediately began to take actions to limit the damage that could be inflicted by Kamal's revelations regarding Iraq's proscribed weapons. The next day, Iraq informed UNSCOM that Kamal had been responsible for hiding elements of Iraq's weapon of mass destruction programs without the knowledge of senior Iraqi officials. Ekeus was invited back to Baghdad so that Iraq could share this newly discovered information.[373] Ekeus arrived in Baghdad on August 17 and was briefed by Iraq on a new account of Iraq's proscribed weapons programs. Iraqi officials now admitted that their biological weapons program had included greater production, more agents, and more facilities than previously admitted and had also included the testing and deployment of biological weapons.

According to this new account, Iraq's pursuit of biological weapons began in 1974, not 1985. The early program, based at Salman Pak, was managed by an intelligence agency and ended due to fraud and incompetence in the late 1970s. A new biological weapon program was

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Uday reportedly encroached on Kamal's military industrialization empire, which was a rich source of kickbacks. When Kamal confronted him, Uday threatened to have him investigated for corruption or killed. On the night of August 6, Uday tried to kill his uncle Watban Ibrahim. Although the uncle was only wounded, several others were killed. Kamal feared that he was next and so he fled to Jordan along with his brother, their wives (who were both daughters of Saddam Hussein) and children, and a small entourage. Amatzia Baram, *Building Toward Crisis: Saddam Husayn's Strategy for Survival* (Washington, D.C.: Washington Institute for Near East Policy, 1998), pp. 8-9, 12-13.

[370] This section is drawn from Scott Ritter, *Endgame: Solving the Iraq Problem Once and For All* (New York: Simon & Schuster, 1999), pp. 76-93; and Kenneth Timmerman, *The Death Lobby: How the West Armed Iraq* (Boston, Mass.: Houghton Mifflin, 1991), pp. 36, 257-258.

[371] Timmerman, *The Death Lobby*, p. 288.

[372] Andrew Cockburn and Patrick Cockburn, *Out of the Ashes: The Resurrection of Saddam Hussein* (New York: HarperCollins, 1999), p. 199.

[373] Pearson, *The UNSCOM Saga*, p. 144.

initiated in 1985 at the chemical weapons facility at Muthanna. Facilities involved in research and production in the 1980s included not only Salman Pak and Al Hakam, but also Muthanna, the single cell protein plant at Taji, the agricultural water resources research center at Fudaliyah, and the foot and mouth disease vaccine facility at Daura. In addition, the Al Kindi veterinary plant supplied fermenters used at Al Hakam for biological warfare agent production. Besides its work on *B. anthracis*, *C. botulinum*, and *C. perfringens*, Iraq now admitted that it had also conducted research on aflatoxin, mycotoxins, ricin, wheat smut, hemorrhagic conjunctivitis virus, rotavirus, and camelpox. Iraq also admitted that it had produced 19,000 liters of botulinum toxin, 8,500 liters of *B. anthracis*, 2,200 of aflatoxin, and 340 liters of *C. perfringens*. Finally, Iraq disclosed that it had filled 18,000 liters of biological agent into munitions. Bombs, artillery rockets, artillery shells, and spray tanks were tested for use with biological agents. Prior to the 1991 Gulf War, 166 bombs and 25 Al Hussein missile warheads were filled with *B. anthracis*, botulinum toxin and aflatoxin and deployed to four locations. Iraq claimed that after the Gulf War the munitions were filled with deactivation chemicals then destroyed and buried. The bulk agent that remained at Al Hakam was similarly neutralized and then dumped out of the facility's waste system.[374] Table 3-2 provides a summary of the evolution of Iraqi claims regarding its biological program.

Iraq's offensive program was remarkable in its scope. Iraq conducted work on both lethal and incapacitating anti-personnel agents as well as an anti-plant agent. Iraq also developed and tested a range of tactical, operational, and strategic delivery systems. The program included multiple research and pilot plant production sites as well as a dedicated production site at Al Hakam. These accomplishments were even more remarkable given Iraq's claim that only five years had elapsed since the current program's inception.

On August 20, at the conclusion of his visit to Baghdad, Ekeus complained that despite the new Iraqi disclosures, not one new document had been produced to support this new account of Iraq's proscribed weapons programs. Before departing Baghdad, Ekeus was directed to a farm said to have been owned by Hussein Kamal. In a locked chicken house on the farm were 150 boxes of hardware, documents, and other records from the proscribed weapons programs. Iraq admitted that, contrary to their initial claim that all relevant documents had been destroyed during the summer of 1991, orders had been issued at the time to sites working on proscribed weapons to collect and package "important documents" relating to the technology of weapons production and transfer them to the Special Security Organization.[375] Kamal, as head of the SSO, had been responsible for preserving these documents and hiding them from the UN inspectors.

Among this collection containing more than a million pages of documents, only one box with some two hundred documents was related to Iraq's biological warfare program.[376] Half of the documents were previously published papers on biological warfare from universities and think tanks while the other half dealt with various scientific aspects of bacterial agents. However, none of these documents dealt with aflatoxin, viruses, weaponization, or the "know how" on

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[374] United Nations Security Council, *Report of the Secretary-General on the Status of the Implementation of the Special Commission's Plan for the Ongoing Monitoring and Verification of Iraq's Compliance with Relevant Parts of Section C of Security Council Resolution 687 (1991)*, S/1995/864 (New York: United Nations, October 11, 1995), pp. 22-27.

[375] Ibid., p. 11.

[376] Krasno and Sutterlin, *The United Nations and Iraq*, p. 61; and United Nations Security Council, *Letter dated 25 January 1999 from the Executive Chairman of the Special Commission established by the Secretary-General pursuant to paragraph 9 (b) (i) of Security Council resolution 687 (1991) addressed to the President of the Security Council*, S/1999/94 (New York: United Nations, January 29, 1999), p. 104.

producing and processing biological warfare agents.[377] Other documents missing from the chicken farm included records of production, procurement networks, sources of supply, and archives from the Military Industrialization Commission and Ministry of Defense.[378]

Table 3-2. Evolution of Iraqi Disclosures Regarding Its Biological Weapon Program

	April 1991	**August 1991**	**July 1, 1995**	**August 17, 1995**
History of BW Program	No BW Program	Defensive only; from 1986 to August 1990	Offensive; from April 1986 to October 1990	Offensive; from 1974 to May/June 1991
Facilities	None	Salman Pak	Salman Pak, Al Hakam	Salman Pak, Al Hakam, Muthanna, Taji, Daura, Fudaliyah
Agents	None	*B. anthracis, C. botulinum, C. perfringens*	*B. anthracis, C. botulinum, C. perfringens*	*B. anthracis, C. botulinum, C. perfringens,* aflatoxin, mycotoxins, ricin, wheat smut, hemorrhagic conjunctivitis virus, rotavirus, and camelpox
Production	None	None	9,000 liters of botulinum toxin and 600 liters of *B. anthracis*	19,000 liters of botulinum toxin, 8,500 liters of *B. anthracis*, 2,200 liters of aflatoxin, and 340 liters of *C. perfringens*
Weaponization	None	None	None	LD-250 and R-400 bombs, 122mm artillery rockets, 155mm artillery shells, aerosol generators, and spray tanks tested; R-400 bombs and Al Hussein warheads deployed

The most prominent discovery was a red book that described the testing of biological weapons, including photographs, and appeared to be a briefing book for senior Iraqi officials. However, the album covered work only through 1989 and several pages were missing.[379] According to UNSCOM, "Most of these documents related to research and did not add a great deal to the Commission's overall understanding of the programme...Many of the biological documents were scientific reprints from foreign journals. Clearly, they represent only a minor portion of a BW programme that ran from 1973 until at least 1991."[380] Pearson writes that these documents

[377] David Kelly cited in Mangold and Goldberg, *Plague Wars*, p. 293.

[378] United Nations Security Council, *Report of the Secretary-General on the Status of the Implementation of the Special Commission's Plan for the Ongoing Monitoring and Verification of Iraq's Compliance with Relevant Parts of Section C of Security Council Resolution 687 (1991)*, S/1995/864 (New York: United Nations, October 11, 1995), p. 11.

[379] William J. Broad and Judith Miller, "Germs, Atoms and Poison Gas: The Iraqi Shell Game," *New York Times*, December 20, 1998, p. WK5.

[380] United Nations Security Council, *Letter dated 25 January 1999 from the Executive Chairman of the Special Commission established by the Secretary-General pursuant to paragraph 9 (b) (i) of Security Council resolution 687 (1991) addressed to the President of the Security Council*, S/1999/94 (New York: United Nations, January 29, 1999), pp. 98, 104.

"greatly aided the further elucidation of *what had already been partially uncovered by UNSCOM.*"[381]

Hussein Kamal's Revelations

Following this visit to Baghdad, Ekeus and other officials from UNSCOM and IAEA traveled to Amman to meet with Kamal. According to Trevan, the meeting with Kamal in Amman "did not go quite as UNSCOM had hoped." Instead of a detailed question and answer session, Kamal talked about the regime and weapons program in general.[382] He was able to confirm the command structure for the programs and their overall aims and shape and provided interesting information on how Iraq concealed proscribed items from UNSCOM.

On the evening of August 22, Ekeus and Nikita Smidovitch from UNSCOM and Mauricio Zifferero from IAEA met with Kamal for three hours.[383] Kamal identified the key managers of the biological program as Amer al-Saadi, General Amer Rashid, and Murtada, the former head of Muthanna and TSMID.[384] Kamal also identified Nasser Hindawi as a key scientist who had been part of the program from the beginning and had been Rihab Taha's boss.

Kamal also provided an overview of the project's organizational history. He stated that the program moved from Salman Pak to Muthanna and then to Al Hakam and Dawrah and Fudaliyah. The facility at Dawrah was said to be the center of anthrax production and Fudaliyah was also used to produce biological warfare agents. Kamal did not volunteer much additional information, but confirmed information put forward by Ekeus or Smidovich. Kamal confirmed that Iraq had conducted research on a hemorrhagic virus, but he could not remember the name. He also confirmed that a pathogen against wheat had been produced but not used. Kamal told the inspectors that an agent whose name he could not recall, but Ekeus thought might by a mycotoxin, was unsuccessfully developed to poison a sweet water lake in Iran.[385] Regarding weaponization, Kamal confirmed that munitions were filled with biological agent at Muthanna in December 1990. He stated that the aerial bombs were made of fiberglass or used epoxy resin and confirmed that Iraq had produced 25 biological warheads for ballistic missiles. Kamal also reported that Iraq had destroyed its biological agents and weapons but he was unclear as to when this occurred. At one point he stated that the destruction took place "after visits of inspection teams" and later he says that "it was done before you come [sic] in." Although Smidovitch told Kamal that UNSCOM had found no trace of the destruction, Kamal stated that UNSCOM had found the spot where the agents and/or weapons were buried. Smidovich asked if this was the place north of Baghdad but Kamal responded that he did not remember the details. Overall, Kamal gave UNSCOM high marks for their efforts to uncover Iraq's prohibited weapons. He told the inspectors, "You have important role in Iraq with this. You should not underestimate yourself. You are very effective in Iraq."[386]

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[381] Pearson, *The UNSCOM Saga*, p. 191 (italics in original).

[382] Trevan, *Saddam's Secrets*, p. 332.

[383] Unless otherwise noted, this section is drawn from United Nations Special Commission, "Note for the File," undated, http://www.un.org/Depts/unmovic/documents/hk.pdf.

[384] Amer Hamoudi al-Saadi and Amer Rashid were Kamal's deputies in the Ministry of Industry and Military Industrialization (MIMI) in the 1980s. Timmerman, *The Death Lobby*, pp. 36, 79

[385] It is unclear from the transcript if the development or the use of the agent was unsuccessful.

[386] At the time of the defection it was not clear if Kamal was being completely truthful or if he was withholding information to improve his bargaining position with UNSCOM and the United States. Based on a document written shortly after Kamal's defection by Hossam Amin, then head of the National Monitoring Directorate which served as the official Iraqi liaison with UNSCOM and the IAEA, it appears that Kamal provided the UN with everything he

The value of the information provided by Kamal has generally been rated as less than impressive by UNSCOM officials. UNSCOM historian Stephen Black has written, "Hussein Kamal would eventually provide few details and little specific evidence to the Commission"[387] At a minimum, the information that Kamal provided could be used to confirm the most recent disclosures by Baghdad. Far more important than what Kamal revealed, however, was Baghdad's response to his defection. Given Kamal's key role in the development and concealment of Iraq's proscribed weapons for so many years, Baghdad was forced to make sweeping new disclosures regarding all of its proscribed weapons programs and provide a huge cache of documents and other materials to the UN inspectors.

As a result of these revelations, in May and June 1996 UNSCOM demolished the Al Hakam facility, disabled the air handling system at the Dawrah facility, and destroyed the remaining growth media and equipment at Dawrah and Fudaliyah that had been used for biological warfare agent production.[388]

Sampling Finally Yields Smoking Gun

Following Kamal's defection and Iraq's new disclosures, UNSCOM renewed its effort to verify Iraq's declarations about its past biological warfare program. Iraq soon began stonewalling the inspectors again and subsequent interviews and inspections were not very fruitful. The biological sampling of former weapons facilities, however, yielded useful information for the first time. Sampling of Al Hakam in 1991 and 1992 had not reveal any incriminating data, but by 1996 and 1997 new technology made it possible to obtain samples from the same piece of equipment that yielded highly significant data.[389] Direct evidence of Iraqi production of biological warfare agents was found by UNSCOM in May 1996 when samples were taken from dismantled equipment from Al Hakam, the Dawrah vaccine plant, and Al Fudaliyah.[390] UNSCOM found evidence of *B. anthracis* spores on two fermenters and a mobile storage tank at the plant at Dawrah.[391] Despite Iraq's claim that it produced *B. anthracis* only at Al Hakam, the finding at Dawrah was considered credible because the strain detected was used in Iraq's biological weapons program.[392] This finding also corroborated Kamal's claim that Dawrah had been involved in the production of *B. anthracis*.

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knew about Iraq's proscribed weapons programs. Barton Gellman, "Iraq's Arsenal Was Only on Paper," *Washington Post*, January 7, 2004, p. A1.

[387] Stephen Black, "Verification Under Duress: The Case of UNSCOM," in Trevor Findlay, ed., *Verification Yearbook 2000* (London: VERTIC, 2000), p. 121. For similar assessments, see Rolf Ekeus, "Yes, Let's Go Into Iraq," *Washington Post*, September 15, 2002, p. B1; and Zilinskas, "Detecting and Deterring Biological Weapons," p. 195.

[388] United Nations Security Council, *Report of the Secretary-General on the activities of the Special Commission established by the Secretary-General pursuant to paragraph 9 (b) (i) of resolution 687 (1991)*, S/1996/848 (New York: United Nations, October 11, 1996), p. 7.

[389] Ekeus, "UN Biological Inspections in Iraq," p. 254; and Ekeus, "Yes, Let's Go Into Iraq," p. B1.

[390] Ekeus, *Iraq's Biological Weapons Program*, p. 5; Stephen Morse, "Detecting Biological Warfare Agents," in Zilinskas, *Biological Warfare*, p. 98; Spertzel, "Sampling and Analysis as a Monitoring Tool," pp. 22-23; Christian Seelos, "Lessons From Iraq on Bioweapons," *Nature*, March 18, 1999, p. 188; and UNMOVIC, *Unresolved Disarmament Issues*, p. 100.

[391] United Nations Security Council, *Letter dated 25 January 1999 from the Executive Chairman of the Special Commission established by the Secretary-General pursuant to paragraph 9 (b) (i) of Security Council resolution 687 (1991) addressed to the President of the Security Council*, S/1999/94 (New York: United Nations, January 29, 1999), pp. 128, 157.

[392] UNMOVIC, *Unresolved Disarmament Issues*, p. 95.

In addition, sampling of excavated munitions that had been unilaterally destroyed by Iraq provided UNSCOM with conclusive evidence that Iraq had filled bombs and missile warheads with biological warfare agents. This sampling was made possible, however, only because Iraq showed UNSCOM the site where it said its biological munitions had been destroyed and buried in 1991.[393] This incident illustrated once again UNSCOM's dependence on Iraqi disclosures and cooperation to collect evidence of Iraq's past biological weapons activities. In February 1997, UNSCOM excavated pits at Al Aziziyah where Iraq claimed to have buried R-400A biological bombs and found three intact bombs partially filled with a liquid that tested positive for the presence of botulinum toxin or *C. botulinum*.[394] In 1998, UNSCOM took samples from the excavated remnants of Al Hussein warheads located at Al Nibai where Iraq claimed it neutralized, destroyed, and buried special chemical and biological warheads in July 1991. Iraq had earlier admitted that it had filled 25 Al Hussein warheads with biological agents: five with *B. anthracis*, sixteen with botulinum toxin, and four with aflatoxin. Analysis of these samples showed that traces of *B. anthracis* had been identified on remnants of at least seven separate missile warheads, two more than Iraq claimed to have been filled with this agent.[395] In response to USNCOM's presentation of these results, Iraq reported that it had in fact filled sixteen warheads with *B. anthracis* and five with botulinum toxin. However, Iraq claimed that this change did not affect Iraq's declaration about the total quantity of agents produced and weaponized.[396] The ease with which Iraq adjusted these numbers to accommodate new information presented by UNSCOM did not inspire confidence in their accuracy.

The Investigation Stalls

Since its first revelations in July 1995, Iraq had submitted three "Full, Final, Complete Disclosures" (FFCDs) of its proscribed biological program to UNSCOM. Given the lies, half-truths, and omissions contained in these declarations one inspector dubbed these documents: "full, final and complete fairy tales."[397] The first FFCD was presented in early August 1995 and incorporated the information disclosed by Iraq on July 1. After Kamal's defection, this FFCD was declared null and void by Iraq. The second FFCD was submitted in June 1996 and incorporated information that Iraq revealed in the wake of Kamal's defection. UNSCOM conducted intensive efforts to verify its contents through eight inspections and other technical discussions. In March 1997 an international panel of experts reviewed that FFCD and

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[393] A November 1996 UNSCOM mission to collect samples of biological agents disseminated during outdoor testing of biological munitions was unsuccessful due to Iraqi unwillingness to identify the specific locations where the testing took place. Pearson, *The UNSCOM Saga*, p. 158.

[394] United Nations Security Council, *Letter dated 25 January 1999 from the Executive Chairman of the Special Commission established by the Secretary-General pursuant to paragraph 9 (b) (i) of Security Council resolution 687 (1991) addressed to the President of the Security Council*, S/1999/94 (New York: United Nations, January 29, 1999), p. 118; and Central Intelligence Agency (CIA), *Intelligence Related to Possible Sources of Biological Agent Exposure During the Persian Gulf War* (Langley, Va.: CIA, August 2000), http://www.gulflink.osd.mil/library/43917.htm.

[395] Pearson, *The UNSCOM Saga*, p. 164.

[396] Graham S. Pearson, "Detecting Biological and Toxin Weapon Agents in an Inspection Environment," in Kelle, Dando, and Nixdorff, *The Role of Biotechnology in Countering BTW Agents*, p. 153.

[397] Trevan, *Saddam's Secrets*, p. 11.

recommended its rejection because of the inadequacy of the material presented throughout the document.[398]

In September 1997, Iraq submitted its third "final" FFCD. This FFCD contained essentially no new significant information compared to the June 1996 document that the Commission had already rejected as incomplete. Nevertheless, in 1997 and 1998 three independent review panels were organized to examine this FFCD. All three reviews found the document deficient in completeness and accuracy. An international panel of biological weapons experts reviewed the latest FFCD in October 1997 and unanimously concluded that it "was incomplete and contained significant inaccuracies. It is in no way a full account of the scale and scope of the BW programme which started about 1974."[399]

UNSCOM's frustration with Iraqi stonewalling and lack of cooperation was evident from its reports to the Security Council. In October 1997, Richard Butler, the new executive chairman of UNSCOM, reported: "There is incomprehension of why Iraq is persisting so strongly with both refusing to make the facts known about its biological weapons programme and why it is so insistent on blocking the Commission's own efforts to reach those facts."[400] A November 1997 emergency session of UNSCOM Commissioners found that the biological file "is the most serious and persistent area where Iraq has disregarded its obligations to the United Nations." The Commissioners also noted that Iraq's September 1997 FFCD was "unacceptable, and it remains unsupported by verifiable evidence and documentation."[401]

At Iraq's request, a Technical Evaluation Meeting (TEM) between Iraqi officials and a new panel of international experts organized by UNSCOM was convened in Vienna in March 1998. The TEM format was devised as a way of bringing together UNSCOM and international experts with Iraqi officials to conclusively resolve all outstanding issues regarding a particular weapon system. Similar meetings had already been held regarding the nerve agent VX and chemical and biological missile warheads. Iraq did not present any new information on its biological weapons program at the meeting. The international panel of experts found that the FFCD was deficient in all areas and contained "major mistakes, inconsistencies, and gaps in information."[402] As a result, the experts concluded: "No additional confidence in the veracity and expanse of the FFCD was derived from the TEM."[403]

A third review of the September 1997 FFCD was conducted by a team of international experts in Baghdad in July 1998. The team focused on those elements of the declaration most directly related to the material balance: weapons, bulk agents, and growth media. Once again, no new material was presented by Iraq. The group found the FFCD to be "inadequate" and that no

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[398] United Nations Security Council, *Report of the Secretary-General on the activities of the Special Commission established b the Secretary-General pursuant to paragraph 9 (b) (i) of resolution 687 (1991)*, S/1997/301 (New York: United Nations, April 11, 1997), p. 17.

[399] United Nations Security Council, *Report of the Secretary-General on the activities of the Special Commission established b the Secretary-General pursuant to paragraph 9 (b) (i) of resolution 687 (1991)*, S/1997/774 (New York: United Nations, October 6, 1997), p. 37.

[400] Ibid., p. 27.

[401] United Nations Security Council, *Letter Dated 22 November 1997 From the Executive Chairman of the Special Commission established by the Secretary-General pursuant to paragraph 9 (b) (i) of Security Council Resolution 687 (1991) addressed to the President of the Security Council*, S/1997/922 (New York: United Nations, November 24, 1997), p. 4.

[402] United Nations Security Council, *Letter dated 8 April 1998 from the Executive Chairman of the Special Commission established by the Secretary-General pursuant to paragraph 9 (b) (i) of resolution 687 (1991) addressed to the President of the Security Council*, S/1998/308 (New York: United Nations, April 8, 1998), p. 4.

[403] Ibid., p. 11.

further verification or assessment of the Iraqi biological declaration should be conducted until Iraq provided new information. The team concluded that, "any other approach would be a waste of time."[404] This meeting would prove to be Iraq's last opportunity to account for its past activities and to present evidence to UNSCOM that it had eliminated its biological weapons program.

On December 16, 1998, UNSCOM withdrew its inspectors from Iraq due to a lack of cooperation from Iraq. During December 16-18, American and British forces attacked leadership, military, and weapons of mass destruction-related sites in Iraq as part of Operation Desert Fox.[405] UNSCOM did not return to Iraq. On December 17, 1999, UNSCOM was disbanded by the Security Council and replaced by the newly created United Nations Monitoring, Verification, and Inspection Commission (UNMOVIC).

Evaluation of Phase 3

The last phase of UNSCOM's investigation of Iraq's biological weapons program began with a bang and ended with a whimper. Kamal's defection and Baghdad's subsequent revelations in August 1995 unveiled an extensive and advanced biological weapons program. For a brief period, Iraq cooperated with UNSCOM in verifying this new account of its offensive program. However, Iraq soon resumed its strategy of "cheat and retreat." In its final report to the Security Council, UNSCOM observed, "Since July 1995, the Commission has conducted 35 biological inspections directly or indirectly related to investigations of Iraq's proscribed BW programme...This considerable effort has been negated by Iraq's intransigence and failure to provide cooperation concerning its biological weapons since January 1996."[406] UNSCOM's inspections continued to find inconsistencies, contradictions, omissions, and outright lies in Iraqi declarations about past activities. UNSCOM and the three panels of international biological experts identified serious problems with almost every aspect of Iraq's declarations including history, organization, facilities, procurement, research and development, production, weaponization and concealment efforts. In summary, UNSCOM's attempts to verify Iraq's FFCDs were "generally without success."[407] Furthermore, during this phase, UNSCOM was unable to develop another lead as important and compelling as the missing growth media.

The only breakthrough achieved by UNSCOM was in the field of biological sampling and analysis, but this was too little, too late. Sampling of production equipment and munitions, a fruitless endeavor in the early 1990s, detected traces of biological warfare agents in 1996 and 1997. However, by this time Iraq had already admitted to having an offensive program that had produced and weaponized biological agents. Sampling proved useful for verifying Iraqi claims and provided some indications that the current Iraqi accounts of production and weaponization

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[404] United Nations Security Council, *Letter Dated 5 August 1998 from the Executive Chairman of the Special Commission Established by the Secretary-General Pursuant to Paragraph 9 (b) (i) of Security Council Resolution 687 (1991) Addressed to the President of the Security Council*, S/1998/719 (New York: United Nations, August 5, 1998), p. 9.

[405] Anthony Cordesman, *The Lessons of Desert Fox: A Preliminary Analysis* (Washington, D.C.: Center for Strategic and International Studies, February 16, 1999), http://csis.org/stratassessment/reports/DFLessons21599.pdf

[406] United Nations Security Council, *Letter dated 25 January 1999 from the Executive Chairman of the Special Commission established by the Secretary-General pursuant to paragraph 9 (b) (i) of Security Council resolution 687 (1991) addressed to the President of the Security Council*, S/1999/94 (New York: United Nations, January 29, 1999), p. 105.

[407] Ibid.

were still not accurate. The sampling did not provide UNSCOM with the kind of "smoking gun" evidence that would have been most useful prior to August 1995.

The most dramatic revelation in August 1995, that Iraq had tested a range of biological munitions and deployed close to 200 biological bombs and missile warheads on the eve of the Gulf War, was probably only obtainable through a knowledgeable defector or through a direct Iraqi admission. Until Kamal's defection, Iraq steadfastly denied that it had weaponized any of the bulk biological warfare agents it had admitted to producing. Aside from the information provided by General Samarra'i, UNSCOM apparently lacked any useful information on the nature or extent of Iraq's weaponization of biological agents before Hussein Kamal's defection.[408] Since Iraq's biological munitions were produced indigenously, based on conventional munitions, or were modified versions of innocuous items such as auxiliary fuel tanks and agricultural sprayers, UNSCOM would not have been able to follow the paper trail generated by import and export activities that had been so useful in the cases of the growth media and dual-use equipment. Without information from external sources such as national intelligence agencies or records of foreign procurement, Iraq's munition-related activities and capabilities would likely have continued to elude UNSCOM.

Information available since the collapse of Saddam Hussein's regime in 2003 indicates that Iraq never abandoned its interest in biological weapons, but was forced to modify its strategy for pursuing this interest in response to UNSCOM's success in uncovering the pre-1991 program. According to the Iraq Survey Group (ISG), which began investigating Iraq's weapons of mass destruction programs in June 2003, the Iraqi intelligence service sponsored a secret network of two dozen laboratories and safe houses that contained equipment that was subject to UN monitoring and was suitable for conducting research on chemical and biological weapons. The labs were relatively small and located in civilian settings such as houses, residential areas, businesses, and a hospital. This laboratory network was deemed capable of preserving biological weapons expertise, conducting research and development, and maintaining the ability to resume biological weapons production. According to Kay, "All of this suggests Iraq after 1996 further compartmentalized its program and focused on maintaining smaller, covert capabilities that could be activated quickly to surge the production of BW agents."[409] The existence of such a secret laboratory network had been suspected by UNSCOM after 1996, but inspectors had failed to discover any of these labs.[410] A former brigadier general in the Iraqi intelligence service has provided supporting details about this network. He claims that his agency established a network of clandestine cells and small, crude laboratories in late 1996 and 1997 with the goal of reconstituting the chemical and biological weapons programs after UNSCOM's departure. Each cell was composed of three or four scientists who had not been part of the previous weapons programs so they would be unknown to UNSCOM. The cells were created because UNSCOM had effectively dismantled the pre-1991 programs and continued inspections and sanctions made it too difficult to carry out more advanced or larger activities. The teams did not actually produce any weapons, but conducted research and planning for the eventual reconstitution of full-fledged weapons programs. According to the former general, "We could start again anytime. It's very

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[408] Email communication with Richard Spertzel, former head of UNSCOM biological inspectors, March 27, 2004.

[409] David Kay, *Interim Progress Report on the Activities of the Iraq Survey Group (ISG),* Prepared Statement for the House Permanent Select Committee on Intelligence, the House Committee on Appropriations, Subcommittee on Defense, and the Senate Select Committee on Intelligence, October 2, 2003, http://www.cia.gov/cia/public_affairs/speeches/2003/david_kay_10022003.html.

[410] Bob Drogin, "Friendly Fire: What David Kay Really Found," *The New Republic*, October 27, 2003, p. 23; and Walter Pincus, "Intelligence Weaknesses Are Cited," *Washington Post*, November 29, 2003, p. A18.

easy. Especially biological."[411] While these findings illustrate Baghdad's ongoing interest in developing biological weapons and indicate intent to restart its biological weapon program at some point in the future, they also illustrate how effective UNSCOM was in forcing Iraq to scale back its activities in order to avoid detection.

Net Assessment of UNSCOM

A net assessment of UNSCOM's investigation of Iraq's biological weapons program does not yield a simple and clear-cut review. UNSCOM's success was neither swift nor complete, but it was significant. Between 1991 and 1994, UNSCOM visited several dual-capable sites in Iraq including Al Hakam, Dawrah, Taji, and Fudaliyah and failed to find any incriminating evidence that linked them with biological weapons activities.[412] As a result, until 1995, Iraq was able to retain the facilities, equipment, growth media and personnel at Al Hakam to restart production of biological weapons. UNSCOM's investigation, supported by information from foreign suppliers and national intelligence agencies, eventually led to the collection of a large amount of compelling yet circumstantial evidence that indicated that Iraq was hiding an offensive program. UNSCOM was also able to refute Iraq's claims to the contrary or demonstrate the implausibility of Iraq's alternative explanations. Although UNSCOM's detective work forced Iraq to admit to an offensive program and the production of biological warfare agents at Al Hakam, it took the defection of Hussein Kamal for Iraq to reveal a more complete history of the program, scope of research and production activities, and the extent of weaponization. This disclosure allowed UNSCOM to destroy the production equipment, facilities, and growth media that Iraq had used in its offensive program. UNSCOM, however, was unable to satisfactorily verify Iraq's newest accounts of the program. Although this failure was due to Iraqi obstruction, it illustrates the limits of UNSCOM's independent capabilities and its reliance on Iraqi cooperation. Furthermore, Iraq was able to conduct biological weapons-related research and development under UNSCOM's nose: first at Al Hakam and later in the secret laboratory network established by the Iraqi intelligence service.

UNSCOM's accomplishments were due in large part to the range of inspection techniques and technologies it was able to employ. UNSCOM's investigative arsenal included intrusive anyplace and anytime inspections, information on imports and exports, document collection and analysis, interviews, unrestricted right to aerial photography, unlimited authority to conduct biological sampling, intelligence provided by governments and defectors, and the capability to analyze the information from all of these sources.[413] Many of these methods were field-tested for the first time by UNSCOM and their collective contribution to UNSCOM's success has been cited as evidence of the feasibility of an international verification regime to strengthen the BWC.[414]

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[411] This account was provided by a former brigadier general in Mukhbarat who refused to provide documents supporting his story to a reporter. However, the officer, who was involved primarily in covert procurement operations abroad, was able to fill in details on a previously reported Iraqi smuggling ring and he demonstrated a knowledge of Iraq's former weapons program that matched information available to former U.N. inspectors. Bob Drogin, "Iraq Had Secret Labs, Officer Says," *Los Angeles Times*, June 8, 2003.

[412] Ekeus, *Iraq's Biological Weapons Program*, p. 3.

[413] Ekeus, "UN Biological Inspections in Iraq," p. 249-252; and David A. Kay, "Iraq and U.S. Nonproliferation Policy," in Janne E. Nolan, Bernard I. Finel, and Brian D. Finlay, eds., *Ultimate Security: Combating Weapons of Mass Destruction* (NY: Century Foundation Press, 2003), pp. 111-113.

[414] Pearson, *The UNSCOM Saga*, pp. 203-205; and Black, "Verification Under Duress," p. 127.

While the UNSCOM experience highlighted the value of individual verification measures and the synergy between such measures in uncovering an illicit biological weapons program, the conditions that made this accomplishment possible are not readily generalizable to international biological arms control verification. According to UNSCOM's historian, Stephen Black, "The Special Commission has proven—in a specialized case to be sure—that it is not impossible to detect a concealed BW program, even when it is carefully hidden...UNSCOM has also shown that such verification may require a highly intrusive, prolonged investigation, backed by threats of sanction and military force."[415] The conditions required for UNSCOM's success cast serious doubt on the ability of an international organization to achieve similar results in the context of a multilateral biological verification treaty.

UNSCOM had several advantages that an organization implementing a verification protocol to the BWC would not have. As former UNSCOM advisor Tim Trevan has written, "UNSCOM's success stemmed from a large number of simultaneously propitious factors. If any one of them had been missing, UNSCOM would not have been the success it was."[416] First, UNSCOM was "born under extremely favorable circumstances."[417] UNSCOM was created as a subsidiary organ of the Security Council to implement part of a cease-fire resolution for a nation defeated in a United Nations-authorized military campaign. As a result, the executive chairman of UNSCOM reported directly to the Security Council and served as the Security Council's sole representative for dealing with Iraq on disarmament issues. This arrangement also provided UNSCOM with financial and administrative independence from the rest of the United Nations' bureaucracy. This independence freed UNSCOM from the requirement to have geographic representation and instead allowed UNSCOM to recruit high-quality inspectors based on expertise.

Second, the Security Council authorized a robust carrot-and-stick strategy to ensure Iraqi compliance with its obligations and cooperation with UNSCOM. The Security Council imposed the most comprehensive economic sanctions ever on Iraq for its invasion of Kuwait.[418] These sanctions cost Iraq roughly $20 billion a year in lost oil export revenue and could only be lifted once UNSCOM certified that Iraq had been disarmed of nuclear, biological, and chemical weapons.[419] Since Iraq's disarmament obligations were part of the cease-fire resolution for the Gulf War, military action in response to Iraqi violations was authorized under Chapter VII of the UN charter. Furthermore, Iraq had just been decisively defeated and significant American military forces remained in the region. The magnitude and credibility of the rewards and punishment that Iraq faced are likely to be far greater than those available for enforcing any other arms control agreement.

Third, UNSCOM was given a single clear focus on Iraq, a specific mandate, and extraordinary powers to fulfill this mandate. UNSCOM's charge was to destroy, remove, or render harmless all chemical and biological weapons and missiles with a range over 150 kilometers in Iraq as well as all sub-components and related materials, and to ensure that Iraq did not engage in research, development, production, testing, support, or maintenance of such capabilities. UNSCOM's focus on Iraq and disarmament provided the organization with clarity of purpose usually lacking in international organizations that have multiple competing agendas

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[415] Black, "UNSCOM and the Iraqi Biological Weapons Program," p. 303.
[416] Trevan, *Saddam's Secrets*, p. 380.
[417] Krasno and Sutterlin, *The United Nations and Iraq*, pp. 177-179.
[418] Ibid., p. 42.
[419] Meghan L. O'Sullivan, *Shrewd Sanctions: Statecraft and State Sponsors of Terrorism* (Washington, D.C.: Brookings Institution Press, 2003), p. 168.

and constituencies. As described earlier, UNSCOM was given a broad set of rights within Iraq and provided a range of highly intrusive inspection techniques and technologies. As Ekeus has observed, the extent of UNSCOM's rights demonstrate "how complex and multifarious" an inspection regime must be to detect and deter a state suspected of developing biological weapons.[420] UNSCOM needed every single one of these rights to uncover Iraq's proscribed programs, verify their destruction, and monitor facilities for signs of proscribed activities. Indeed, UNSCOM had to constantly develop new techniques and employ new technologies in response to Iraqi intransigence.[421] The range of techniques, and the rights that UNSCOM had to employ them, were not only unprecedented, but also unpalatable for a voluntary arms control regime due to concerns about the loss of national security information or proprietary information by the inspected country, the financial burden of conducting inspections, and legal rights of inspected parties.[422] In contrast, UNSCOM "was disarmament by decree, not by agreement."[423]

CONCLUSION

Controlling the proliferation of biological warfare capabilities will be virtually impossible because the capabilities for researching, developing, producing and testing biological weapons are based on widely available multi-use technologies.[424] Export controls may slow a national biological weapon program and block access to the most advanced technologies, but they cannot prevent a determined state from acquiring a desired capability.[425] The global diffusion of increasingly sophisticated biotechnologies will continue to erode the effectiveness of these controls. As described in this chapter, preventing the diversion of these technologies to hostile purposes is also extremely difficult. As a result, the means and opportunity for a state to develop biological weapons are already available. The only missing ingredient is motive. As discussed in chapter 2, actors in the international system that are deeply dissatisfied with the status quo have a strong motive to develop biological weapons. These weapons offer tactical and strategic advantages to actors that seek a means of challenging the status quo.

In 2001, negotiations to develop a protocol to strengthen the BWC were halted after the United States announced that it would not accept the draft protocol because it was not intrusive enough to detect clandestine biological weapons activities but was invasive enough to compromise proprietary and classified information.[426] The failure of the negotiations on the BWC protocol demonstrates the difficulty of developing a verification system capable of detecting offensive activities while striking a widely accepted balance between the competing needs of transparency and secrecy.

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[420] Ekeus, "UN Biological Inspections in Iraq," pp. 252-253.

[421] Some UNSCOM inspection innovations included the use of U-2 reconnaissance aircraft, chemical and biological sampling, ground penetrating radar, and equipment to intercept radio communications. Black, "UNSCOM and the Iraqi Biological Weapons Program," pp. 304-305.

[422] Zilinskas, "Detecting and Deterring Biological Weapons," p. 202; and Barton, "The Application of the UNSCOM Experience to International Biological Arms Control," p. 231.

[423] Krasno and Sutterlin, *The United Nations and Iraq*, pp. 177-179.

[424] Brad Roberts, "Rethinking Export Controls on Dual-Use Materials and Technologies: From Trade Restraints to Trade Enablers," *Arena*, No. 2 (June 1995).

[425] David A. Kay, "Denial and Deception Practices of WMD Proliferators: Iraq and Beyond," *Washington Quarterly*, Vol. 18, No. 1 (Winter 1995), pp. 85-105; and Gordon Vachon, "The Australia Group and Proliferation Concerns," *UNIDIR Newsletter*, No. 33 (1996), pp. 59-61.

[426] Ambassador Donald Mahley, "Statement by the United States to the Ad Hoc Group of Biological Weapons Convention States Parties," Geneva, Switzerland, July 25, 2001, http://www.state.gov/t/ac/rls/rm/2001/5497.htm.

Chapter 4. Biological Weapons Undermine Deterrence

Biological weapons undermine deterrence as a security strategy in two ways. First, despite their frequent description as a "poor man's atomic bomb", biological weapons are not well suited to serving as a strategic deterrent.[427] Second, the accessibility of biological weapons and the ability to conduct anonymous biological attacks reduces a state's ability to deter biological attacks. In sum, biological weapons are both difficult to deter *with* and difficult to deter *against*.

BIOLOGICAL WEAPONS ARE POORLY SUITED FOR STRATEGIC DETERRENCE

The comparison of biological weapons with nuclear weapons is not entirely without basis. As described in chapter 2, under the right conditions, a biological attack could kill as many people as a nuclear weapon.[428] This similarity is the basis for most analyses that biological weapons will have similar political effects as nuclear weapons.[429] A comparative analysis of nuclear, biological and chemical weapons by Steve Fetter is typical of this approach. Fetter frames the issue as follows: "Do chemical and biological weapons qualify as "weapons of mass destruction," and should we think about these weapons in the same way that we have come to think about nuclear weapons? Anthrax weapons (or weapons using similarly lethal pathogens) certainly are able to kill enough people to qualify for this dubious distinction, even if they cannot knock over buildings."[430] According to Susan Martin, biological weapons enable even small states to deter threats to their vital interests and intervention by major powers. Since biological weapons are more easily acquired than nuclear weapons, Martin predicts that the benefits of the "biological revolution" will be more widespread and have an even more profound impact on international affairs than the nuclear revolution.[431] I argue that despite their potential lethality, biological weapons do not possess the characteristics necessary for an effective strategic deterrent. Biological weapons may serve to deter biological attacks or contribute to a state's general deterrence posture, but their effectiveness in these roles will be determined by the offense-defense balance and relative capabilities.[432] As a result, these weapons will not eliminate phenomenon such as false optimism, first-move advantage, arms racing, and perceptions of windows of opportunity and vulnerability that have been identified as key contributors to the outbreak of wars.[433] Therefore, the spread of biological warfare capabilities is not likely to exert a stabilizing influence on international peace and security, as asserted by Martin.

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[427] Carus, *The Poor Man's Atomic Bomb?*; Neil C. Livingstone and Joseph D. Douglass Jr., *CBW: The Poor Man's Atomic Bomb* (Cambridge, Mass.: Institute for Foreign Policy Analysis, 1984); H. Lee Buchanan, "Poor Man's A-Bomb?" *U.S. Naval Institute Proceedings*, Vol. 123, No. 4 (April 1997), pp. 83-86; and Al J. Venter, "Biological Warfare: The Poor Man's Atomic Bomb," *Jane's Intelligence Review*, Vol. 11, No. 3 (March 1999), pp. 42-47.

[428] OTA, *Proliferation of Weapons of Mass Destruction*, pp. 53-54.

[429] Fetter, "Ballistic Missiles and Weapons of Mass Destruction," pp. 22-26; and Martin, "The Role of Biological Weapons in International Politics," p. 77.

[430] Fetter, "Ballistic Missiles and Weapons of Mass Destruction," p. 26.

[431] Martin, "The Role of Biological Weapons in International Politics," pp. 81-82, 86-87.

[432] For additional analyses of the utility of biological weapons as deterrents, see SIPRI, *The Problem of Chemical and Biological Warfare*, Vol. 2, pp. 155-159; and Chevrier, "Deliberate Disease," pp. 406-408.

[433] Van Evera, *Causes of War*, pp. 244-245.

The prerequisite for strategic deterrence is the capability of the target of a surprise attack to retaliate by inflicting unacceptable damage against its attacker.[434] During the Cold War, the possession of such forces by both superpowers gave rise to the situation of mutual deterrence described as Mutual Assured Destruction (MAD). The nuclear revolution is not only a function of the destructiveness of nuclear weapons but also of their reliability, the lack of effective defenses, and the availability of survivable delivery systems.[435] Although biological weapons have the potential to inflict unacceptable damage against an adversary, they are unable to offer states an "assured" capability for doing so; this shortfall significantly undermines their suitability as a strategic deterrent. Biological weapons differ from nuclear weapons in two important ways that raise doubts about the applicability of strategic deterrence theory to biological warfare.

The first significant difference involves the level of uncertainty associated with the employment of these weapons. Based on a deep understanding of the fundamental scientific principles underlying nuclear weapons as well as extensive operational and experimental experience with these weapons, experts have been able to document the levels of thermal radiation, nuclear radiation, and blast overpressure that cause specified effects in personnel and materiel.[436] Nuclear weapons deliver instantaneous and overwhelming destruction; the effects of biological weapons, on the other hand, are delayed, variable, and difficult to predict. There are ways to reduce this uncertainty by carefully selecting the agent and delivery system employed and the conditions under which an attack is conducted. States that plan on using their biological weapons as a strategic deterrent, however, may not have the luxury of choosing the time and place for a retaliatory strike.[437] In addition, the lack of operational experience with these weapons and the inability to simulate realistically their effects (short of massive human experimentation) impedes the ability of states to substantially reduce this level of uncertainty.

The second major difference between nuclear and biological weapons concerns the availability of defenses. There are no effective defenses against the effects of a nuclear attack. As discussed earlier, however, there are a number of countermeasures that can be taken prior to or following a biological attack. This creates two problems for relying on biological weapons as a strategic deterrent. First, the availability of defenses that could significantly mitigate the consequences of a biological attack is likely to reduce the confidence of states in their ability to reliably inflict unacceptable damage against an adversary in a retaliatory strike. The full panoply of defenses need not be deployed constantly at full readiness because the very availability of these defenses may be sufficient to dissuade a state from calculating that it can inflict unacceptable damage. Although civilian populations will remain more vulnerable to biological weapons than military forces, damage limitation remains a viable option for larger, more advanced states facing less sophisticated adversaries. The December 2002 initiative by the United States to vaccinate nearly 1 million soldiers, public health officials, and medical workers

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[434] Bernard Brodie, "Implications for Military Policy," in Bernard Brodie, ed., *The Absolute Weapon: Atomic Power and World Order* (New York: Harcourt, 1946), pp. 76-77, 89-91; and Robert Jervis, *The Meaning of the Nuclear Revolution* (Ithaca, N.Y.: Cornell University Press, 1989).

[435] These characteristics are derived from Jervis, *The Meaning of the Nuclear Revolution*; Shai Feldman, *Israeli Nuclear Deterrence: A Strategy for the 1980s* (New York: Columbia University Press, 1982), pp. 32-33; and Van Evera, *Causes of War*, pp. 240-254.

[436] Samuel Gladstone and Dolan J. Philip, eds., *Effects of Nuclear Weapons* (Washington, D.C.: U.S. GPO, 1977).

[437] In contrast, a state contemplating a first strike or surprise attack with biological weapons would have more flexibility in determining when, where, and how to employ these weapons.

against smallpox in advance of the looming war with Iraq illustrated how states can adopt precautionary measures to blunt the effectiveness of an anticipated threat.[438]

The second implication of the availability of defenses against biological weapons is that a successful attack places a premium on surprise. Surprise requires strict secrecy that reduces a state's ability to issue credible threats to inflict unacceptable damage against an adversary.[439] Credible deterrent threats would entail revealing details about the nature of a state's biological weapons capabilities. These revelations could reduce the effectiveness of these weapons by compromising the element of surprise and allowing the defender to mobilize appropriate countermeasures. In addition, since the BWC outlawed biological weapons, openly threatening to use these weapons, even in retaliation, has carried additional costs.[440] The incompatibility between secrecy and deterrence has even been recognized by those who worked on these weapons. During the Cold War, former Soviet biological weapons scientist Igor Domaradskij wondered, "If these activities were undertaken for defense purposes, would it not be better, without giving away any secrets, to inform the world community of our successes?"[441] Regardless of whether a state adopts a strategy of biological deterrence by denial or deterrence by punishment, neither will deter potential adversaries if the intention and capabilities to implement the strategy are unknown. The failure of deterrent strategies based on secret capabilities was experienced by North Korea in the late 1960s and Iraq in the early 1990s.

In the late 1960s, North Korea engaged in an aggressive campaign against South Korea and the United States, including an attempted assassination of South Korea's president in January 1968, the capture of the USS *Pueblo* the same month, and the downing of a Navy reconnaissance aircraft in April 1969. This behavior was reportedly undertaken in the mistaken belief that North Korea's new chemical and biological warfare capabilities would deter a strong U.S. response. The United States was not aware of these capabilities, however, and its forceful reaction led the North Korean leadership to moderate its behavior and reassess the deterrent value of their unconventional weapons.[442] During the 1991 Gulf War, Iraq developed a developed a doctrine and capability to deter a decapitating strike by the United States. The deterrent force fielded by Iraq was a secret strategic reserve of mobile ballistic missiles armed with chemical and biological warheads. Launch authority for these weapons was pre-delegated in the event that a nuclear weapon struck Baghdad or missile commanders lost contact with the leadership in the capital. This policy and the capabilities supporting it, however, were not known to the United States until revealed by Iraqi officials in 1995.[443] As a result, the United States

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[438] As of October 2003, less than 40,000 civilians had been vaccinated against smallpox, far short of the goal of 440,000. The military immunization campaign, however, was successful in vaccinating over 500,000 soldiers and military health personnel. David Ruppe, "U.S. Military Official Praises Army Smallpox Vaccination Program," *Global Security Newswire*, October 23, 2003, http://www.nti.org/d_newswire/issues/2003_10_23.html#1AA0288D.

[439] Cohen and Frankel, "Opaque Proliferation," pp. 31-32; and Feldman, *Israeli Nuclear Deterrence*, p. 19.

[440] It is worth noting that since the BWC entered in force in 1975 no national leader has threatened to use or retaliate with biological weapons.

[441] Igor V. Domaradskij and Wendy Orent, "The Memoirs of an Inconvenient Man: Revelations about Biological Weapons Research in the Soviet Union," *Critical Reviews in Microbiology*, Vol. 27, No. 4 (2001), p. 246.

[442] Joseph S. Bermudez Jr., "The Democratic People's Republic of Korea and Unconventional Weapons," in Lavoy, Sagan, and Wirtz, *Planning the Unthinkable*, pp. 186-187.

[443] McCarthy and Tucker, "Saddam's Toxic Arsenal," in Lavoy, Sagan, and Wirtz, *Planning the Unthinkable*, pp. 72-75; and Amatzia Baram, "An Analysis of Iraqi WMD Strategy," *Nonproliferation Review*, Vol. 8, No. 2 (Summer 2001), pp. 34-36.

made a concerted, albeit unsuccessful, effort to target and kill the Iraqi leadership and sever its communications with military forces in the field.[444]

These incidents illustrate some of the dangers that scholars have associated with opaque nuclear weapon programs. When opacity delays the deployment of a deterrent force until a crisis, the military is unlikely to have a well-developed doctrine or well-trained troops for handling the weapons. In addition, a national emergency is not conducive to deliberation and debate by elites on the merits and drawbacks of competing policies and doctrines. Although covert weaponization prior to a crisis would allow the political and military leadership to confront and resolve operational dilemmas, secrecy would continue to constrain strategic discourse, awareness of operational issues, and the vetting of trade-offs. As Peter Feaver has observed, "The risks of aberrant behavior are greatest precisely because the opacity has inhibited preparing the national leadership for weighing the trade-offs wisely."[445]

Secrecy may be an inexpensive and attractive way for gaining security for strategic forces, but it is also risky.[446] Forces that depend on secrecy for their protection are vulnerable to intelligence breakthroughs by an adversary. The loss of secrecy could be massive and occur without warning. If a defender has inside information about an attacker's capabilities, it would be possible to develop and stockpile new vaccines and treatments, immunize the at-risk population, distribute protective masks and treatments, enhance public health surveillance, and take other precautions that could substantially mitigate the impact of a biological weapon attack. Although such information is difficult to acquire, there have been a number of cases where high-level officials knowledgeable about their nation's biological weapons program have defected.[447]

After many years of research, both the United States and United Kingdom considered biological weapons to present severe drawbacks as retaliatory weapons. According to an influential British arms control study, "It is immediately apparent that CBW agents lack many qualities of an ideal deterrent. The possibilities of effective defence are too great; the adequacy of striking power cannot be made easily manifest. In the case of BW, there is great uncertainty of effect and intolerably slow action."[448] In explaining President Nixon's decision to renounce biological weapons, the U.S. ambassador to the Geneva disarmament conference emphasized that these weapons made poor deterrents due to their unpredictability, delayed effects, and the ability of an attacker to protect his forces and blunt the consequences of retaliation.[449] As National Security Advisor Henry Kissinger explained, "We concluded that bacteriological

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[444] Pape, *Bombing to Win*, pp. 221-223, 226-240.

[445] Peter Feaver, "Proliferation Optimism and Theories of Nuclear Operations," *Security Studies*, Vol. 2, No.3/ 4 (Spring/Summer 1993), p. 177.

[446] Thomas C. Schelling and Morton H. Halperin, *Strategy and Arms Control* (New York: Pergamon, 1985), p. 37.

[447] In 1989 Vladimir Pasechnik, the director of a major Soviet biological weapons research institute, defected to the United Kingdom. In 1992 Ken Alibek, a former deputy director of Biopreparat, the Soviet Union's biological weapons research and development agency, defected to the United States. In 1995 Hussein Kamal, the head of Iraq's weapons of mass destruction programs, defected to Jordan. Mangold and Goldberg, *Plague Wars*, pp. 91-105, 177-195, 293-294.

[448] UK Foreign Office, Arms Control and Disarmament Research Unit, "The Arms Control Implications of Chemical and Biological Weapons: Analysis and Proposals," ACDRU 66(2), 2nd draft, July 4, 1966, p. 18. FO 371/187448

[449] "Statement by the United States Representative (Leonard) to the Conference of the Committee on Disarmament: Chemical and Biological Weapons, March 17, 1970," in ACDA, *Documents on Disarmament 1970* (Washington, D.C.: U.S. GPO, 1971), pp. 102-103.

weapons were really primarily useful for first use; that the effect in retaliation would be long delayed, [and] the consequences would be too uncontrollable."[450]

THE DIFFICULTIES OF DETERRING BIOLOGICAL ATTACKS

The accessibility of biological weapons to a diverse set of actors and the ease of covert attacks complicate efforts to deter their use. The proliferation of biological weapons to nondeterrable actors and the prospect of anonymous attacks could undermine reliance on deterrence as a security strategy and lead states to adopt preventive or preemptive strategies. Susan Martin neglects to include this aspect of deterrence theory in her analysis and this oversight contributes to her overly optimistic conclusion about the pacifying effects of biological weapons proliferation.

The Accessibility of Biological Weapons

Because of the global diffusion of multi-use biotechnology, biological weapons can be developed by a larger and more diverse group of actors than is the case with nuclear weapons. Even states that are incapable of effectively managing the investment of large amounts of human, financial, and physical capital over the ten years typically required to produce nuclear weapons may still be able to develop biological weapons.[451] In 1993, OTA estimated that more than 100 states have the capability to develop biological weapons.[452] This greater accessibility raises the risk that biological weapons could be acquired by an actor that is insensitive to costs, values gains more than the status quo, and grossly misperceives the interests or capabilities of others. Such actors can be difficult to deter because they "due not feel the pain of punishment, or they are willing to take great pain to gain their goals, or they fail to see the punishment coming."[453] While such actors are rare in the international system, the possibility that a state's leadership would fail to meet these conditions cannot be excluded.[454]

The primary actors of concern in this regard, however, are terrorist groups.[455] As discussed in chapter 2, extremist religious groups, particularly those with an apocalyptic worldview, are the most likely type of group to seek these types of weapons. Although no terrorist group has yet succeeded in developing a mass casualty-producing biological weapon, groups such as Japan's Aum Shinrikyo and al-Qaeda have demonstrated the ability to employ sophisticated weapons, the desire to cause mass casualties, and an interest in using disease as a weapon.[456] So far, al-Qaeda's development of chemical and biological weapons appears to have

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[450] "Background Briefing on Chemical and Biological Warfare at the White House with Dr. Henry Kissinger, Assistant to the President for National Security Affairs, and Ron Ziegler, Press Secretary to the President," November 25, 1969, p. 4, Folder 5, Box 310, National Security Council Subject Files, Nixon papers.

[451] On the ten-year rule for nuclear weapon's development, see Leonard S. Spector, "Strategic Warning and New Nuclear States," *Defense Intelligence Journal*, Vol. 3, No. 1 (Spring 1994), pp. 33-52. In contrast, Iraq went from biological weapons research to production in five years. See Wallerstein, "Responding to Proliferation Threats."

[452] OTA, *Technologies Underlying Weapons of Mass Destruction,* p. 85.

[453] Van Evera, *Causes of War*, p. 242.

[454] The best illustration of this is Japan in December 1941. See Scott Sagan, "Origins of the Pacific War," *Journal of Interdisciplinary History*, Vol. 18, No. 4 (Spring 1988), pp. 893-922.

[455] On the difficulty of deterring terrorists, see Paul K. Davis and Brian M. Jenkins, *Deterrence and Influence in Couterterrorism: A Component in the War on al Qaeda* (Santa Monica, Calif.: RAND, 2002), pp. 3-8.

[456] Gavin Cameron, "Multi-Track Microproliferation: Lessons from Aum Shinrikyo and Al Qaeda," *Studies in Conflict and Terrorism*, Vol. 22, No. 4 (November 1999), pp. 277-309.

been relatively crude.[457] However, interrogations of captured al-Qaeda operatives and analysis of recovered documents, materials, and equipment indicates an ongoing effort and increasing capability to develop nerve agents and more deadly toxins and pathogens.[458] The difficulties faced by Aum Shinrikyo and al-Qaeda illustrate the significant hurdles that terrorists face in progressing beyond crude weapons suitable for assassination and the contamination of food or water to biological weapons based on aerosol dissemination technology.[459]

A potential shortcut is for terrorists to obtain direct or indirect assistance from a state-sponsored biological weapons program. As discussed in chapter 6, organizations that develop biological weapons tend to be endowed with a high level of autonomy that complicates civilian efforts to exercise effective oversight. This autonomy can lead to corruption and heightens the risk of proliferation of biological weapons materials and expertise. In both Russia and South Africa, former biological weapons scientists have offered such resources on the international market and to states known to be pursuing biological weapons. Although al-Qaeda is believed to have recruited a Pakistani microbiologist, there is no indication that the group has penetrated Pakistan's chemical and biological weapons program.[460] The most worrisome possibility is the emergence of a biological weapon scientist similar to the Pakistani nuclear scientist Dr. Abdul Qadeer Khan who is willing to aid terrorists groups in the development of biological weapons for ideological or financial reasons.

The Prospect of Anonymous Use

Biological weapons are relatively easy to develop in secret, are well suited for covert delivery, and do not provide signatures that can be used to identify the attacker. Given the mutit-use nature of biotechonology, it is extremely difficult to detect preparations for a bioterrorism attack.[461] As discussed in chapter 6, intelligence and law enforcement agencies have only been able to detect bioterrorism preparations due to informants or defectors. Unlike nuclear weapons and high explosives, which emit either radioactive or chemical signatures that can be detected

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[457] Plots by al-Qaeda cells to employ the poison cyanide to contaminate water supplies and the toxin ricin to contaminate food supplies have been uncovered in Europe. Tim Golden, Desmond Butler, and Don Van Natta, Jr., "As Europe Hunts for Terrorists, The Hunted Press Advantages," *New York Times*, March 22, 2004, p. A1; Joby Warrick, "An Al Qaeda 'Chemist' and the Quest for Ricin," *Washington Post*, May 5, 2004, p. A1; and CIA, *Terrorist CBRN: Materials and Effects* (Langley, V.A.: CIA, May 2003), http://cia.gov/cia/reports/terrorist_cbrn/CBRN_threat.pdf.

[458] Barton Gellman, "Al Qaeda Near Biological, Chemical Arms Production," *Washington Post*, March 23, 2003, p. A1; Warrick, "An Al Qaeda 'Chemist' and the Quest for Ricin," p. A1; and CIA, *Terrorist CBRN.*

[459] On the difficulties of developing biological weapons outside of a state-run program, see GAO, *Need for Comprehensive Threat and Risk Assessments of Chemical and Biological Attacks,* GAO-NSIAD-99-163 (Washington, D.C.: GAO, September 1999).

[460] On al-Qaeda's recruitment of a Pakistani bacteriologist, see Gellman, "Al Qaeda Near Biological, Chemical Arms Production." Although the United States has not publicly accused Pakistan of pursuing biological weapons, leaked intelligence reports indicate that Pakistan has an offensive biological program. See DIA, *A Primer on the Future Threat: The Decades Ahead, 1999-2020*, July 1999, p. 36 in Rowan Scarborough, *Rumsfeld's War: The Untold Story of America's Anti-Terrorist Commander* (Washington, D.C.: Regnery Publishing, 2004), p. 196; and Douglas Jehl, "U.S. Intelligence Review is Softening Some Judgments About Illicit Arms Abroad," *New York Times*, November 18, 2003, p. A6. Following Pakistan's nuclear tests in 1998, the United States imposed sanctions on six Pakistani entities engaged in military-related chemical and biological research. See Department of Commerce, "India and Pakistan Sanctions and Other Measures," *Federal Register*, Vol. 63, No. 23 (November 19, 1998), pp. 64337-64341.

[461] In 1999-2000, the Defense Threat Reduction Agency built a small-scale facility that could be used to produce small quantities of biological warfare agent. The procurement of the plant's commercially available equipment went undetected by law enforcement and intelligence agencies. Miller, Engelberg, and Broad, *Germs*, pp. 297-298.

remotely, there are no sensors that can detect the presence of a biological warfare agent inside a munition or storage container. In addition, biological agent disseminated as an aerosol is invisible to the human senses. Aum Shinrikyo's dissemination of biological agents in Japan on a dozen separate occasions in the early 1990s went undetected at the time, as did the contamination of salad bars in an Oregon town in 1984 by the Rajneeshee cult.[462]

The forensic capabilities to identify the perpetrator of a biological attack are extremely limited. The fissile material used in nuclear weapons has a unique "fingerprint" that can be used to determine its source.[463] Likewise, the United States can determine the launching location of a ballistic missile fired from virtually anywhere in the world.[464] In contrast, the only known return address of the anthrax letter sent to Senator Thomas Daschle is a fictional New Jersey elementary school. Determining the origins of a biological agent used in an attack is complicated by the availability of most pathogens from multiple sources, including laboratories, culture collections, and nature, and the inability to fully characterize this availability.[465] The difficulties in this field are highlighted by the FBI's inability to identify the perpetrator of the 2001 anthrax letter attacks or the sender of the ricin letters to government facilities in 2003 and 2004.[466] As one knowledgeable expert commented with regard to the anthrax letter attacks, "They can't crack it because there's no forensic trail. It was a perfect crime."[467] The potential accessibility of biological weapon capabilities to a large number of actors also complicates efforts to identify the perpetrator of a biological attack. If a state or terrorist group believed that it could conduct an attack anonymously, and thereby escape retaliation, deterrence would be ineffective.

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[462] None of the Aum Shinrikyo attacks were successful because the group inadvertently used harmless versions of *B. anthracis* and botulinum toxin. The failed attacks were not revealed until years later during the trial of cult's leadership. Sheryl Wu Dunn, Judith Miller, and William J. Broad, "How Japan Germ Terror Alerted the World," *New York Times*, May 26, 1998, p. A1. The source of the contamination in Oregon was not determined to be the Rajneeshee cult until over a year later. W. Seth Carus, "The Rajneeshees (1984)," in Tucker, *Toxic Terror,* pp. 115-137.

[463] Lothar Koch, "Traces of Evidence: Nuclear Forensics and Illicit Trafficking," *IAEA Bulletin*, Vol. 45, No. 1 (June 2003), pp. 21-23. Forensic analysis following a nuclear detonation, however, is more difficult. See Jay Davis, "The Attribution of WMD Events," *Journal of Homeland Security*, April 2003, http://www.homelandsecurity.org/journal/articles/davis.html

[464] On the capabilities of the U.S. missile launch detection system, see Jeffrey Richelson, *America's Space Sentinels: DSP Satellites and National Security* (Lawrence, Kan.: University of Kansas Press, 1999).

[465] For example, the strain of *B. anthracis* used in the anthrax letter attacks, called Ames, was initially isolated from a dead cow in Texas in 1981. It was also isolated from a dead goat in a 1997 anthrax outbreak in Texas hundreds of miles away from the original site. In addition, at least nine laboratories in three countries had received samples of the original Ames strain by September 2001. Due to security concerns, in October 2001 the University of Iowa destroyed it large anthrax collection, which may have also contained the Ames strain. Thus, the anthrax letter mailer could have acquired the Ames strain from any of these labs, other labs that held samples of *B. anthracis* that had not been genetically characterized as Ames strain, or from natural sources. Steve Fainaru and Joby Warrick, "Ames Strain of Anthrax Limited to Few Labs," *Washington Post*, November 30, 2001, p. A1; Rick Weiss and Susan Schmidt, "Capitol Hill Anthrax Matches Army's Stocks," *Washington Post*, December 16, 2001, p. A1; and William J. Broad, "Geographic Gaffe Misguides Anthrax Inquiry," *New York Times*, January 30, 2002, p. A13.

[466] On the forensic investigation of the anthrax letters, see Martin Enserink, "Taking Anthrax' Genetic Fingerprint," *Science*, November 30, 2001, pp. 1810-1812; Martin Enserink, "Useful Data But No Smoking Gun," *Science*, May 10, 2002, pp. 1002-1003; Laura Meckler, "Genetics Not Helping Anthrax Probe," *Associated Press*, June 19, 2002. On the forensic investigation of the ricin letters, see Spencer S. Hsu and Allan Lengel, "Tests Reveal Little About Ricin's Potency," *Washington Post*, February 10, 2004, p. A3; and Allan Lengel, "Ricin Investigation Still Wide Open," *Washington Post*, April 6, 2004, p. B1.

[467] Jeff Mohr, the head of life sciences at the U.S. Army's Dugway Proving Ground, quoted in Paul Foy, "Chief Government Scientist: Anthrax Case Was 'Perfect Crime'," *Associated Press*, June 13, 2003.

A second potential consequence of the anonymous use of biological weapons is catalytic war: a war between two states secretly initiated by a third party. The spread of nuclear weapons in the 1960s created concern that a third party could attack either superpower and make it appear to be the work of its rival, sparking a crisis or war.[468] This worry faded in the 1970s with the signing of the nuclear Nonproliferation Treaty, which helped to forestall the spread of nuclear weapons, and the advent of advanced early warning systems that allowed the superpowers to detect and track aircraft and ballistic missiles, the primary delivery systems for nuclear weapons. No such measures exist today with regards to biological weapons, so the prospect of a catalytic war sparked by the use of these weapons remains a possibility. For example, a hostile state or terrorist group in the Middle East could stage an attack on U.S. forces in the region that points to another state as the culprit.

Prevention and Preemption

States may adopt preventive or preemptive strategies to neutralize perceived threats posed by the prospect of anonymous biological attacks or the acquisition of biological weapons by nondeterrable actors.[469] After the September 11 terrorist attacks, preventive and preemptive strategies became central to U.S. national security planning under the Bush Administration.[470] These strategies, however, first emerged during President Bill Clinton's administration in response to the threat of mass casualty terrorism. In response to Aum Shinrikyo's nerve gas attack in the Tokyo subway system in March 1995 and the Oklahoma City bombing the following month, the White House issued a presidential decision directive stating that acquisition of nuclear, biological, or chemical weapons by terrorists was "unacceptable." According to the directive, "There is no higher priority than preventing the acquisition of this capability or removing this capability from terrorist groups potentially opposed to the U.S."[471] This policy was first implemented on August 20, 1998, when the United States launched cruise missiles at a pharmaceutical plant in Sudan that it believed was linked to the development of chemical weapons for al-Qaeda.[472] Despite concerns within the administration about the legal and intelligence justifications for the attack, "the perception of imminent danger was powerful enough to overcome these concerns. At the Principals meeting, [National Security Adviser] Sandy Berger asked, 'What if we do not hit it [al-Shifa] and then, after an attack, nerve gas is released in the New York City subway? What will we say then?'"[473] Although this incident involved terrorist acquisition of chemical (not biological) weapons, it indicates how states may respond to the specter of terrorist acquisition of even more lethal weapons. Preventive and preemptive attacks against suspected biological weapons facilities present significant

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[468] Henry S. Rowen, "Catalytic Nuclear War," in Graham T. Allison, Albert Carnesale, and Joseph S. Nye Jr., eds., *Hawks, Doves, and Owls: An Agenda for Avoiding Nuclear War* (New York: W. W. Norton, 1985), pp. 148-163.

[469] The goal of a preventive attack is to thwart a state or terrorist group from developing or obtaining a threatening capability. Preemptive strikes are conducted when an enemy attack appears imminent. Richard K. Betts, *Surprise Attack: Lessons for Defense Planning* (Washington, D.C.: Brookings Institution, 1982), p. 145.

[470] Bush, *National Security Strategy of the United States of America*, pp. 15-16. See also Robert S. Litwak, "The New Calculus of Pre-emption," *Survival*, Vol. 44, No. 4 (Winter 2002-03), pp. 53-80; and James J. Wirtz and James A. Russell, "U.S. Policy on Preventive War and Preemption," *Nonproliferation Review*, Vol. 10, No. 1 (Spring 2003), pp. 113-123.

[471] Memorandum for the Vice President, Subject: "U.S. Policy on Counterterrorism," Presidential Decision Directive 39, June 21, 1995, http://www.fas.org/irp/offdocs/pdd39.htm.

[472] Koblentz, "Countering Dual-Use Facilities," pp. 48-53.

[473] Quoted in Daniel Benjamin and Steven Simon, *The Age of Sacred Terror* (New York: Random House, 2002), p. 260.

intelligence, military, and diplomatic challenges. The potential consequences of a biological attack and the limitations of defensive and deterrent strategies, however, may influence a decision-maker's calculation that the risks of inaction outweigh the costs of action.

The adoption of preventive and pre-emptive strategies to combat the threat of biological weapons would have several important implications. First, on the international level, such strategies would favor unilateral action and relegate respect for the sovereignty of other states to a position of secondary importance compared with preventing attacks on one's own citizens. This may be acceptable in extraordinary circumstances, but runs the risk of undermining the current international system based on multilateral institutions and respect for national sovereignty. Second, on the domestic level, these strategies would entail providing more powers to law enforcement agencies with a concomitant restriction of civil liberties. Again, this trade-off may be seen as a necessary evil in an emergency, but it creates the potential for abuse in less critical situations. A third implication is that both of these outcomes could be aggravated by the difficulty of obtaining high-quality intelligence on emerging biological threats (as described in chapter 5) and the lower standard of evidence required by preventive and preemptive strategies. This combination creates the serious risk that states will take preventive and preemptive actions that are unnecessary, ineffectual, counterproductive, or have adverse unintended consequences.

CONCLUSION

The unsuitability of biological weapons as a strategic deterrent has two implications. First, states that pursue biological weapons do so for their offensive potential, not their value as strategic deterrents. This supports the finding in chapter 2 that only dissatisfied states that seek a means of challenging the status quo will develop these weapons. Second, attempts to wield biological weapons as a strategic deterrent will fail in most cases. The difficulty of making credible threats and the potential for defensive countermeasures would blunt the effectiveness of such a deterrent. In addition, it is unlikely that such a biological strategic deterrent would make conventional conflict more likely. Some scholars believe that non-Western nations may view unconventional weapons as a shield that enables them to wield the sword of conventional forces.[474] The logic of this perspective is based on the "stability-instability paradox" developed during the Cold War to explain how stability at the nuclear level could encourage conflict at the conventional level.[475] This logic does not apply to biological weapons, however, because these weapons do not provide the same sort of stable strategic deterrence as nuclear weapons.

The second implication is that the weakness of deterrence as a security strategy will become more evident as terrorists demonstrate greater interest in and capability to employ biological weapons. Although terrorists have not yet managed to develop a mass-casualty producing biological weapon, al-Qaeda is known to be actively pursuing such a capability. Given the challenges in tracking terrorist groups and detecting activities to develop biological weapons (discussed in chapter 6), it is possible that a group with the motivation and capability to use biological weapons to cause mass casualties will arise with little or no warning. The emergence of such a group would pose the novel threat of a non-state actor capable of inflicting catastrophic damage against a nation. Due to the difficulties in deterring biological terrorism and defending

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[474] Lewis Dunn, Peter Lavoy and Scott Sagan, "Conclusions: Planning the Unthinkable," in Lavoy, Sagan, and Wirtz, *Planning the Unthinkable*, pp. 234-235.

[475] Glenn Snyder, *Deterrence and Defense* (Princeton, N.J.: Princeton University Press, 1961), p. 226; and Jervis, *The Meaning of the Nuclear Revolution*, pp. 19-23.

against such an attack, the emergence of such a group would provide states with a strong incentive to adopt or strengthen preventive and pre-emptive counterterrorism strategies.

Chapter 5. Obstruction of Civilian Oversight

The intense secrecy that shrouds biological warfare programs obstructs civilian oversight and distorts decision-making by military and political leaders. In addition, secrecy allows biological warfare organizations to achieve a high degree of autonomy. This autonomy increases the risk of corruption, insubordination, and proliferation. Although all weapons programs are subject to some level of secrecy to prevent adversaries from learning about capabilities and vulnerabilities, the secrecy surrounding biological weapons programs has been unusually high.[476] Even within the obsessively secretive Soviet Union, the biological weapons program was "one of the best-guarded secrets."[477] The Soviet Union developed biological weapons under the highest security classification in the Soviet system, even higher than the nuclear weapons program.[478] According to the United Nations Monitoring, Inspection, and Verification Commission (UNMOVIC), the biological weapons program was the most secretive of Iraq's prohibited weapons programs.[479]

The intense secrecy surrounding biological weapons programs is inimical to effective decision-making and oversight. As described in the literature on opaque proliferation, the strict secrecy surrounding covert nuclear weapons programs leads to compartmentalization that restricts the information available to senior officials about the nature and conduct of these programs and limits the range and knowledge of participants involved in such oversight.[480] In addition, secrecy exacerbates the existing information asymmetries between political leaders and military officers or scientists who run biological weapons programs. According to principal-agent theory, large information asymmetries may enable program managers to take actions for the benefit of themselves or their organization that are against the interests of their superiors.[481] Such asymmetries enable subordinates to operate with too much autonomy, avoid accountability by concealing potentially embarrassing or damaging information from their superiors, and hinder the implementation of new policies they disagree with. Thus, programs escape review, decisions are made with incomplete or inaccurate information, and the exercise of appropriate oversight is hindered. Such behavior can even complicate or prevent governments from complying with international arms control and disarmament obligations. Program managers may also exploit their autonomy to engage in unethical or illegal behavior.

These problems are particularly acute for organizations that already operate under a high degree of secrecy and compartmentalization for security reasons. National security organizations have a noted tendency to use secrecy to increase their autonomy.[482] In addition, the multi-use nature of technology and the overlap between offensive, defensive and civilian activities

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[476] SIPRI, *The Problem of Chemical and Biological Warfare*, Vol. 5, p. 138.

[477] Russian Deputy Foreign Minister Grigory Berdennikov quoted in John Barry, "Planning a Plague," *Newsweek*, February 1, 1993, p. 40.

[478] According to two defectors, Vladimir Pasechnik and Ken Alibek, the Soviet program was classified at the level of "Special Importance" which was even higher than the classification of "Top Secret" accorded to the nuclear weapons program. Mangold and Goldberg, *Plague Wars*, p. 182.

[479] Iraq has stated that knowledge of this program was kept to only a select few officials and that special security measures were taken before and after the 1991 Gulf War to conceal the program. UNMOVIC, *Unresolved Disarmament Issues*, p. 151.

[480] Cohen and Frankel, "Opaque Proliferation," pp. 22, 34; and Feaver, "Proliferation Optimism and Theories of Nuclear Operations," pp. 175-178.

[481] Peter D. Feaver, *Armed Servants: Agency, Oversight, and Civil-Military Relations* (Cambridge, Mass.: Harvard University Press, 2003), pp. 68-71.

[482] Posen, *The Sources of Military Doctrine*, p. 45.

facilitates the establishment of biological weapons program in ostensibly civilian institutions or outside the traditional military chain of command in order to shield the true nature of the program.[483] Such arrangements involve an implicit trade-off in favor of maintaining secrecy at the expense of exercising effective oversight. Each of the three cases discussed in this chapter feature such organizations. Biopreparat was created in 1973 by the Soviet Union as a civilian biotechnology agency. The agency's true mission was to develop new and improved biological weapons. Although Biopreparat's management drew heavily from the military and its only customer was the Ministry of Defense, it enjoyed "virtually autonomous authority" as the principal agency for Soviet biological weapons research and development.[484] Likewise, South Africa's chemical and biological weapons program was officially defensive and managed by the Surgeon General, but in reality it was offensive and intimately tied to the military's highly secretive Special Forces Command. The clandestine nature of the program allowed it to engage in illegal behaviors such as fraud, corruption, drug trafficking, and the mass murder of suspected enemies of the state.

Japan's biological warfare program in the 1930s and 1940s illustrates the connection between secrecy, autonomy, and the aggressive development of biological weapons. This program was the largest in the world at the time, featured the use of biological weapons against China and the Soviet Union, and engaged in large-scale and gruesome human experimentation. The program flourished under the Japanese Kwantung Army in Manchuria despite its unscientific methodologies and failure to develop effective biological weapons. As Sheldon Harris, the foremost Western expert on the program, has observed, "A largely autonomous programme functioned within a largely autonomous region, insulated with the self-sufficient and powerful command of a military service which civil authority could not control."[485]

SOURCES OF SECRECY

States pursuing biological weapons have normative, legal, and strategic reasons to subject these programs to stringent secrecy. The general revulsion against biological warfare has motivated states to conceal their research into these weapons. The stigma that has long surrounded these weapons was summarized by a disarmament committee of the League of Nations that concluded that biological warfare was "so particularly odious that it revolted the conscience of humanity more than any other form of warfare."[486] In his April 1942 request to President Franklin Roosevelt to launch a biological weapons program, Secretary of War Henry Stimson wrote that biological warfare was a "dirty business" and that "the matter must be handled with great discretion and for the most part with great secrecy." As a result of the desire for secrecy and to avoid domestic and international concern that the military was preparing for offensive biological warfare, the program was initially located in an obscure civilian agency.[487]

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[483] Koblentz, "Countering Dual-Use Facilities," pp. 48-53.
[484] Alibek, *Biohazard*, p. 298.
[485] Sheldon Harris, "The Japanese Biological Warfare Program: An Overview," in Geissler and Moon, *Biological and Toxin Weapons*, p. 129.
[486] Cited in SIPRI, *The Problem of Chemical and Biological Warfare,* Vol. 5, pp. 78-79. The vehemence of this condemnation of biological warfare is particularly striking given the lack of experience with this form of warfare. In contrast, the lethal and crippling effects of chemical weapons had been graphically demonstrated on a massive scale during World War I.
[487] Barton J. Bernstein, "America's Biological Warfare Program in the Second World War," *Journal of Strategic Studies*, Vol. 11, No. 3 (September 1988), p. 294.

As a British study of chemical and biological weapons (CBW) policy noted, "For in order to avoid provoking the critics of CBW in peacetime, while forearming itself against charges of shortsightedness in case war should find the country unable to retaliate against CBW, a responsible government can hardly be blamed for procuring the weapons but keeping them dark."[488] The stigma against these weapons can also lead to its benign neglect or intentional avoidance by policymakers. In announcing the results of a review of U.S. chemical and biological warfare programs in 1969, President Richard Nixon stated, "This has been the first thorough review ever undertaken of this subject at the Presidential level. ...I recall during the eight years that I sat on the National Security Council in the Eisenhower Administration that these subjects, insofar as an appraisal of what the United States had, what our capability was, what other nations had, were really considered taboo."[489]

Secrecy became even more important for states developing biological weapons with the creation of the BWC in 1972. The BWC was a groundbreaking treaty, the first to outlaw an entire class of weapons. Prior to the advent of the BWC, the only controlling legal authority for biological weapons was the 1925 Geneva Protocol. The protocol, however, outlaws only the use of chemical and biological weapons and even this prohibition is not absolute since many states reserved the right to retaliate in kind if an opponent violated the treaty first. By prohibiting the development, production, stockpiling, or acquisition of biological weapons, the BWC reinforced the long-standing norm against these weapons. Although the treaty lacks verification or enforcement measures, its widespread adoption (163 parties and signatories) raises the political costs of the discovery of a weapons program. Since the treaty's entry into force, no government leader has openly proclaimed the development or production of biological weapons.

Finally, there is a strategic motivation for wrapping biological weapon programs in secrecy. Military capabilities that strongly favor the offense, particularly those that rely on surprise for their effectiveness, engender higher levels of secrecy.[490] Due to the availability of countermeasures against specific biological agents and other defensive measures that can mitigate the effect of a biological attack, biological weapons rely heavily on the element of surprise for their effectiveness. In addition, the potential for an adversary to develop new countermeasures places a premium on safeguarding the details of an offensive biological warfare program. As a result, states pursuing biological weapons engage in extensive deception and denial operations to conceal the existence and capabilities of offensive programs.[491]

This chapter examines three cases—the Soviet Union, Russia, and South Africa—that illustrate the adverse effects of secrecy on the management of major biological warfare programs.[492] These cases demonstrate the range of pathologies that secrecy can introduce into the

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[488] United Kingdom Foreign Office, Arms Control and Disarmament Research Unit, "The Arms Control Implications of Chemical and Biological Weapons: Analysis and Proposals," ACDRU 66(2), 2d draft, July 4, 1966, p. 25, FO 371/187448, PRO.

[489] "Remarks of the President on Announcing the Chemical and Biological Defense Policies and Programs," Office of the White House Press Secretary, The White House, November 25, 1969, p. 1, Folder 5: Chemical, Biological Warfare (Toxins, etc.), Vol. 1, Box 310, National Security Council Subject Files, Nixon papers.

[490] Van Evera, *Causes of War,* p. 137.

[491] Denial refers to attempts to prevent an adversary from learning accurate information. Deception refers to efforts to cause an adversary to believe false information. For example, camouflage is a form of denial while decoys are a means of deception. Roy Godson and James J. Wirtz, "Strategic Denial and Deception," Roy Godson and James J. Wirtz, eds., *Strategic Denial and Deception: The Twenty-First Century Challenge* (New Brunswick, N.J.: Transaction Publishers, 2002), pp. 1-2.

[492] For a brief review of the impact of secrecy on U.S. offensive and defensive biological programs, see Koblentz, "Pathogens as Weapons," pp. 111-112.

decision-making and oversight of biological weapons programs. In each case, secrecy adopted by bureaucracies engaged in biological warfare activities to foil external enemies was turned against civilian leaders perceived to be internal threats to the organization's autonomy or the benefits enjoyed by the organization's management.

SOVIET UNION

By the 1980s, the Soviet biological weapons program was the largest and most advanced in the world. The program incorporated about 65,000 personnel at over 60 research, development, production, and testing facilities sponsored by the Ministry of Defense, Ministry of Agriculture, Ministry of Health, Biopreparat, Soviet Academy of Sciences, and Committee of State Security (KGB).[493] As part of this program, the Soviet Union established a quasi-civilian organization, called Biopreparat, to administer a massive new effort to harness advances in molecular biology, genetics, and biotechnology to develop new and improved biological warfare agents.[494] Biopreparat and the other organizations responsible for biological weapons development enjoyed a great deal of autonomy and a steady stream of funding.

In the late 1980s, President Mikhail Gorbachev and Foreign Minister Eduard Shevardnadze attempted to rein in the Soviet biological warfare program and make it more transparent as part of their broader initiative to ease tensions with the West and reduce the burden of defense spending on the Soviet economy.[495] However, they experienced problems in obtaining accurate information from the military regarding biological warfare activities, making informed decisions about the future of the program, and ensuring the implementation of new policies. These problems were due in large part to the program's extreme level of compartmentalization and the autonomy that it enjoyed within the Soviet system.

Those who have studied the Soviet program cannot help but be impressed by its devotion to secrecy. According to a trio of *New York Times* reporters, "The program had been a deliberate maze of false fronts, secret projects, and parallel organizations that often conducted both military and peaceful research. The structure was designed to enhance secrecy."[496] As Mangold and Goldberg observe, "One must nevertheless pay tribute to The System [Biopreparat was informally called Ogarkov's System after the organization's first director, General Vesvolod I. Ogarkov] that it stayed as secret as it did, for as long as it did. This is partly because The System was marked by the strictest need-to-know compartmentalization and patrolled by Soviet intelligence officers. Even The System's own scientists were kept isolated from their colleagues—it was need to know or ignorance."[497] The elaborate security measures stemmed in part from the close association of the biological weapons program with the Soviet internal security services. Beginning with the program's establishment in 1928, it was under the supervision of the United State Political Administration (OGPU) followed by the People's

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[493] Alibek, *Biohazard,* pp. 310-313; and Amy Smithson, *Toxic Archipelago: Preventing Proliferation from the Former Soviet Chemical and Biological Weapons Complexes* (Washington, D.C.: Henry L. Stimson Center, December 1999), p. 9.

[494] Alibek, *Biohazard,* pp. 41-42; and Rimmington, "The Soviet Union's Offensive Program," pp. 108-112.

[495] On the struggle of Gorbachev and Shevardnadze to impose greater civilian control over the military and the defense industrial complex, see Carolyn M. Ekedahl and Melvin A. Goodman, *The Wars of Eduard Shevardnadze* (University Park, Penn.: Pennsylvania State University Press, 1997); and William C. Green and Theodore Karasik, eds., *Gorbachev and His Generals: The Reform of Soviet Military Doctrine* (Boulder, Colo.: Westview Press, 1990).

[496] Miller, Stephen, and Broad, *Germs*, p. 222.

[497] Mangold and Goldberg, *Plague Wars*, p. 65.

Commissariat of Internal Affairs (NKVD).[498] Even after responsibility for the program was transferred to the 15th Main Directorate of the General Staff in 1953, the KGB continued to play a key role in providing security for the program and conducting oversight over some of its activities.[499] According to one former high-level participant, the Soviet biological warfare program had been "plunged into the deepest possible obscurity since its inception."[500]

As a result of this desire for secrecy, the Soviet biological weapons program was heavily compartmentalized. There were at least four levels of security within the program that controlled access to increasingly sensitive information.[501] At the first level, the "open legend" was that there was no biological weapons program and that the agency's research on genetic engineering and biotechnology was completely civilian and open. To provide some legitimacy to this legend, at the same time that the Soviets created Biopreparat, they also issued a public decree on enhancing the development of molecular biology and genetics. The Interdepartmental Science and Technology Council for Molecular Biology and Genetics at the USSR Academy of Sciences was created to oversee its implementation. This council was headed by Yuri Ovchinnikov, a molecular biologist and vice president of the Soviet Academy of Sciences.[502] At the second level, there was a "closed legend" that explained that Biopreparat's research was strictly defensive and the purpose was to produce vaccines and antibiotics. This closed legend was also false, but it was supported by the existence of a biological defense program called Problem No. 5. Soviet civilian microbiological institutes had been engaged in Problem No. 5 since at least the 1950s, but by the 1970s this project was being used as a smokescreen for offensive research.[503] At the third level, the offensive nature of the research was acknowledged. However, this research on dangerous pathogens was justified as an investigation of the potential threat posed by the U.S. biological weapons program.[504] Only the managers and senior scientists at civilian institutes would have access to this information.[505] At the fourth level, the purpose of specific projects, such as the creation of genetically modified biological weapons, and the interconnections between projects was revealed.[506] There was probably also a fifth level of security that provided a full description of all of the biological weapons projects. This information was likely only available to the most senior members of the directorates and ministries involved in the biological weapons program.[507]

This compartmentalization severely restricted the range of political leaders who were knowledgeable about the Soviet biological weapons program. Only members of the senior leadership who were directly responsible for agencies involved in the biological warfare program

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[498] Alibek, *Biohazard*, pp. 33-35; Rimmington, "The Soviet Union's Offensive Program," p. 122; Jonathan B. Tucker and Raymond A. Zilinskas, "Introduction," in Jonathan B. Tucker and Raymond A. Zilinskas, eds., *The 1971 Smallpox Epidemic in Aralsk, Kazakhstan and the Soviet Biological Warfare Program*, Occasional Paper No. 9 (Monterey, Calif.: Center for Nonproliferation Studies, 2002), p. 7.

[499] Alibek, *Biohazard*, pp. 37, 92-93; and Rimmington, "The Soviet Union's Offensive Program," p. 123.

[500] Igor V. Domaradskij and Wendy Orent, *Biowarrior: Inside the Soviet/Russian Biological War Machine* (Amherst, N.Y.: Prometheus Books, 2003), p. 135.

[501] "Interview with Sergeui Popov," *Journal of Homeland Defense*, November 1, 2000, http://www.homelandsecurity.org/journal/Interviews/PopovInterview_001107.htm

[502] Ovchinnikov also served on the secret Interagency Science and Technology Council for Molecular Biology and Genetics that served as the nerve center for the Soviet effort to apply these emerging technologies to biological weapons. Domaradskij and Orent, *Biowarrior*, p. 151.

[503] Ibid., p. 111.

[504] Interview with Sergeui Popov, Manassass, Virginia, July 25, 2002.

[505] Domaradskij and Orent, "The Memoirs of an Inconvenient Man," p. 251; and Tucker, *Scourge*, p. 151.

[506] Interview with Sergeui Popov.

[507] "Interview with Sergeui Popov," *Journal of Homeland Defense*.

and provided funding to the program were fully briefed on the program. In the late 1980s, this small coterie included President Gorbachev, KGB chairman Vladimir Kryuchkov, Defense Minister Dmitry Yazov, and Lev Zaikov, the Politburo member responsible for military industries.[508] Even Politburo member and Foreign Minister Shevardnadze was not privy to this information.[509] This compartmentalization also excluded regional Communist party leaders whose jurisdictions included biological weapons facilities. Although the republic of Kazakhstan hosted two research institutes, a production facility, and the primary testing ground, local Kazak Communist party officials did not know of their existence.[510] Likewise, at the time of the anthrax outbreak in Sverdlovsk in 1979, the regional Communist Party leader, Boris Yeltsin, was ignorant of the existence of the military facility responsible for the outbreak.[511] This compartmentalization not only prevented significant penetration of the program by foreign intelligence agencies, but also shielded the program from internal scrutiny. According to Mangold and Goldberg, "This Mafia-like secrecy, a kind of military/political omerta, ensured that only a tiny handful of very senior officers and their immediate aides and juniors, men like Yevstigneev [head of the 15th Directorate] and Kalinin [head of Biopreparat], had the knowledge and were able to administer the whole program. That alone helped explain Gorbachev and Yeltsin's confusions, hesitancies, and contradictions when talking to the West about BW treaty violations."[512]

The initial difficulty presented by the secrecy and autonomy of the biological warfare program was how to respond to American and British allegations of Soviet violations of the BWC. Throughout the 1980s, the United States sought additional information regarding the 1979 anthrax outbreak in Sverdlovsk and facilities suspected of being related to the Soviet biological weapons program.[513] In January 1987, the Soviet Union created an interagency commission to coordinate responses to the American allegations and submit declarations on biological weapon-related facilities required by a new confidence-building measure adopted at the 1986 Review Conference of the BWC. The commission was chaired by the Ministry of Foreign Affairs and its members included the deputy ministers of the Ministry of Defense, Ministry of Health, Ministry of Agriculture, as well as representatives of the 15th Directorate, Military-Industrial Commission, Soviet Academy of Sciences, and Biopreparat.[514] Through 1990, the responses drafted by the commission flatly denied that the Soviet Union was engaged in offensive biological warfare or that the 1979 Sverdlovsk anthrax outbreak was caused by anything other than tainted meat. Ken Alibek served as Biopreparat's representative to the commission when he became the organization's deputy director in 1988. According to Alibek, these responses crafted by the

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[508] Alibek, *Biohazard*, pp. 149-150; Mangold and Goldberg, *Plague Wars*, p. 183. The ministers of health and agriculture may also have been included in this select group since these ministries were also part of the Soviet biological warfare program.

[509] Alibek, *Biohazard*, p. 146.

[510] Likewise, many of the directors and personnel at these facilities did not know about the existence of the other biological warfare facilities within Kazakhstan. Sonia Ben Ouagrham and Kathleen M. Vogel, *Conversion at Stepnogorsk: What the Future Holds for Former Bioweapons Facilities*, Occasional Paper No. 28 (Ithaca, N.Y.: Cornell University Peace Studies Program, February 2003), p. 5.

[511] R. Jeffrey Smith, "Yeltsin Blames '79 Anthrax On Germ Warfare Efforts," *Washington Post*, June 16, 1992, p. A1.

[512] Mangold and Goldberg, *Plague Wars*, p. 183.

[513] Between 1984 and 1989, Washington submitted six demarches to Moscow regarding suspected Soviet violations of the BWC. Mangold and Goldberg, *Plague Wars*, p. 86.

[514] Interview with former Ministry of Foreign Affairs official, Cambridge, Massachusetts, January 12, 2000; Alibek, *Biohazard*, p. 151.

commission for response to the United States were "precise, professional, and unequivocal—and each was a lie from top to bottom."[515] According to Alibek, "Neither he [Deputy Foreign Minister Vlaidmir Petrovsky, first chair of the commission] nor anyone else at the foreign ministry was officially told of the existence of our program....It was obvious that Soviet diplomats couldn't be told that they were being used to stage an elaborate cover-up."[516] However, it was also clear that the diplomats were not completely naïve. Deputy Foreign Minister Viktor Karpov, head of the ministry's disarmament department, told Alibek during a meeting regarding the Soviet response to the latest American accusation of a BWC treaty violation that, "I know who you are and I know what you do. And I know that none of what's written here is true."[517] Likewise, a former Soviet diplomat in the disarmament department admitted that although he did not "officially" know about the nature of the Soviet biological weapon program, he was aware of it through unofficial channels.[518] Furthermore, this former diplomat believes that Schedvardnadze's status as a Politburo member gave him access to all of the relevant information on the biological weapons program.[519]

This assessment was also shared by Western governments, which cast a shadow over their dealings with Shevardnadze. According to the second-hand account from Vladimir Pasechnik, the Soviet biological weapons scientist who defected to the United Kingdom in 1989, Shevardnadze had chaired a high-level Kremlin meeting in 1988 that approved Biopreparat's plans and budget. In 1990, a new informant in Moscow reported that Shevardnadze had also approved the 1991 funding for Biopreparat. These revelations created serious doubts among senior Bush Administration arms control officials about Shevardnadze's trustworthiness. According to a former State Department official, "Frankly, the US did not know what Gorbachev and Shevardnadze were hearing behind the scenes in their own government. Initially, in 1990, it seemed that Gorbachev and Shevardnadze were lying to us. We believed they knew about the BW program. But we were just guessing."[520] Information gathered later, however, strongly suggested that Shevardnadze's meetings with military officials, including Kalinin, regarding the biological weapons program were attempts by Shevardnadze to discover what the military was doing and how it was spending its money. Based on long-standing Ministry of Defense policy to keep the Foreign Ministry out of the loop on biological weapons, Shevardnadze was not in a position to approve the program or even have any influence over it.[521] Although this conclusion assuaged worries in Washington about Shevardnadze's sincerity and honesty, it raised the equally troubling implication that the Soviet political leadership did not have complete control over the military and the biological weapons program. This concern was well founded as illustrated by the Soviet response to the intense Anglo-American diplomacy following the defection of Pasechnik in October 1989.

Defection and Deception

Pasechnik's defection to the United Kingdom was a major blow to the secrecy of the Soviet biological weapon project, especially the portion managed by Biopreparat. Pasechnik had

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[515] Alibek, *Biohazard*, p. 148.
[516] Ibid., p. 146.
[517] Ibid., p. 151.
[518] Interview with former Ministry of Foreign Affairs official.
[519] Ibid.
[520] Cited in Mangold and Goldberg, *Plague Wars*, p. 108.
[521] Ibid., pp. 111-113.

been in charge of three research institutes and two manufacturing plants under Biopreparat.[522] His Institute for Ultra-Pure Biological Preparations in Leningrad developed recipes, techniques and equipment for stabilizing, drying, milling and disseminating several pathogens, including *Y. pestis* and *F. tularensis*.[523] He was also on the board of directors for Biopreparat, a position that afforded him an overview of the highly compartmentalized and classified program.[524] As a result of his revelations, British and American intelligence agencies were able to double their estimates of the number of Soviet biological warfare facilities and gain direct evidence of Soviet violations of the BWC, including the application of genetic engineering to biological weapons.[525]

The defection of Pasechnik also marked the beginning of the military's efforts to deceive the civilian leadership in the Kremlin. In an attempt to limit the internal political fallout from the defection, the military sent a memo to Gorbachev minimizing the seriousness of the incident and the security risk posed by the defection.[526] On April 30, 1990 U.S. Ambassador Jack Matlock and British Ambassador Sir Curtis Keeble presented a joint demarche on Soviet violations of the BWC to Anatoly Chernyaev, Gorbachev's senior foreign policy advisor. The demarche was a product of the information supplied by Pasechnik. On May 2, 1990, during a meeting in Moscow, U.S. Secretary of State James Baker gave Shevardnadze a two-page memo laying out in more detail than the April 30 demarche the information that the United had on Soviet violations of the BWC. After reading the document, Shevardnadze appeared shocked and said he "didn't think they could be doing that." He also promised to respond to Baker as soon as possible.[527]As a result of these demarches, Gen. Yuriy Kalinin, the head of Biopreparat, was asked to prepare a response for the Kremlin. Based on what it was believed Pasechnik would be able to tell the British, Kalinin and his staff decided that the best strategy was to continue denying any wrongdoing. The one-page memo sent to Gorbachev stated that the Soviet Union was not in violation of the BWC and had only a defensive program that worked on vaccines and tested defensive equipment.[528] The lie that had served the military so well for use against the Americans now also served a new role: deceiving the leadership in the Kremlin.

Perhaps sensing that the Pasechnik defection would give the West the leverage they needed to force Gorbachev and Shevardnadze to put pressure on the biological weapons program, Kalinin and his allies in the military also sought to further insulate the program from civilian oversight. On May 5, 1990, under pressure from the United States and United Kingdom, Gorbachev issued a secret decree halting the research, development, and testing activities of Biopreparat, effectively ending its role in offensive biological warfare. The formulation of the decree, however, had been manipulated by Kalinin, to preserve as much of the program as possible. The final decree included a loophole inserted by Kalinin that allowed the continued funding of the full range of Biopreparat's activities. The final paragraph instructed Biopreparat "to organize the necessary work to keep all of its facilities prepared for further manufacture and development."[529] These production facilities would be retained as mobilization plants in the

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[522] James Adams, *The New Spies: Exploring the Frontiers of Espionage* (London: Hutchinson, 1994), pp. 272-273.
[523] Tucker, *Scourge*, p. 160.
[524] Adams, *The New Spies*, pp. 272-273: and Simon Cooper, "Life in the Pursuit of Death," *Seed*, January/February 2003, p. 104.
[525] Bill Gertz, "Defecting Russian Scientist Revealed Biological Arms Efforts," *Washington Times*, July 4, 1992, p. A4; and R. Jeffrey Smith, "Russia Fails to Detail Germ Arms," *Washington Post*, August 31, 1992, p. A1.
[526] Mangold and Goldberg, *Plague Wars*, p. 415 fn 10.
[527] Ibid., pp. 106-107.
[528] Ibid., pp. 107-108.
[529] Alibek, *Biohazard*, p. 189.

event that a "special period" was declared prior to a war.[530] Kalinin also undermined implementation of the decree. According to Alibek, "The memo was never sent to institute directors. They knew of its existence but were not in a position to act on it without receiving an order from headquarters."[531] Alibek, who by this time had grown disillusioned with the Soviet biological warfare program, was able to use the decree to close the explosive aerosol test chamber at Stepnogorsk and convert some buildings at Vector to civilian use. However, he also learned that Vector continued to build a new viral agent production plant and that Biopreparat continued to develop railcars for use as mobile biological agent production plants.[532] In effect, the decree allowed Gorbachev to believe that he had terminated the offensive program while allowing the program to continue virtually undisturbed. As a result, the decree had a limited impact on Biopreparat's activities except to conceal it better from the civilians in the Kremlin.[533]

In response to continued Anglo-American diplomatic pressure to resolve concerns regarding Soviet compliance with the BWC, the Soviets agreed to allow an Anglo-American team to visit four Biopreparat sites in January 1991. Gorbachev and Shevardnadze, however, continued to deny that the Soviet Union had an offensive program.[534] Behind the scenes, Biopreparat was busily preparing for the inspections by hiding or sanitizing as much evidence as possible of its role in the development of biological weapons. Following the Anglo-American visit, Biopreparat reported to the Kremlin that although the visitors had seen enough to be suspicious, they had found no evidence of an offensive program and couldn't prove anything.[535] Between March and July, Washington and London made numerous attempts to obtain a response from Moscow that addressed their continued concerns about Soviet non-compliance with the BWC.[536] Gorbachev and Alexander Bessmertnykh, the new Soviet Foreign Minister, continued to deny that the Soviet Union had an offensive program. Shortly after the failed coup in August, Soviet compliance with the BWC was a major topic at a summit between Gorbachev and British Prime Minister John Major. Major is reported to have forcibly confronted Gorbachev on the issue, angrily waved a finger in his face, and exclaimed, "We've got the goods on you."[537] Instead of denying the existence of an offensive program as he had done before, Gorbachev blamed the coup plotters, including Minister of Defense Dmitry Yazov, for misleading him about the true nature of the program and promised to get to the bottom of it and establish mutual confidence with the West.[538] On November 18, 1991, the Kremlin informed the British Ambassador to Moscow that an order had been issued to terminate the Soviet biological warfare program, but by this time the feeling in Washington and London was that Gorbachev was too weak to take effective action anyway.[539] The legacy of the Soviet biological weapons program, and the difficulty in establishing civilian oversight, would be inherited by Russia and its new president, Boris Yeltsin.

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[530] Alibek cited in Mangold and Goldberg, *Plague Wars*, p. 417 fn 20

[531] Alibek, *Biohazard*, pp. 187-191.

[532] Alibek also claims that under this decree, production lines at Omutninsk, Berdsk, Stepnogorsk, Kurgan and Penza were destroyed. However, this was not confirmed by subsequent Anglo-American inspections of these facilities. Alibek, *Biohazard*, pp. 190-191, 263.

[533] Mangold and Goldberg, *Plague Wars*, pp. 109-110, 417 fn 20; Alibek, *Biohazard*, pp. 190-191

[534] Mangold and Goldberg, *Plague Wars*, pp. 113-114.

[535] Alibek, *Biohazard*, p. 204; Mangold and Goldberg, *Plague Wars*, p. 140.

[536] Mangold and Goldberg, *Plague Wars*, pp. 141, 425 fn 2.

[537] Adams, *The New Spies*, p. 277.

[538] Mangold and Goldberg, *Plague Wars*, pp. 141-142.

[539] Ibid.,, p. 142.

Conclusion

It remains unclear how much Gorbachev knew about the offensive program and how hard he tried to halt and rollback the program. Alibek claims that Gorbachev was in the small circle of senior officials who were fully informed about the Soviet offensive program and that he has seen Gorbachev's signature on key documents authorizing offensive activities.[540] In addition, Gorbachev authorized measures to eliminate some aspects of the biological weapon program such as a biological warfare agent production plant at Sverdlovsk and the large stockpile of *B. anthracis* maintained at Sverdlovsk.[541] Whether the intent of these measures was to rollback the offensive program or simply to hide it better from inspectors is unknown. When asked in a 1995 interview if he had been deceived by his generals on the issue of chemical and biological weapons, Gorbachev replied that these men had been "in no great hurry to introduce conversion [to civilian production], rather they preferred to preserve their military industrial complex." However, he added, that ultimately they had followed his lead on arms control.[542] This response implies that Gorbachev was aware of the military's resistance to his efforts to reduce and open up the offensive program, but his power to compel their compliance was limited. The misleading reports sent to Gorbachev and the subterfuge of Biopreparat and the military regarding the May 5 decree indicate that these organizations perceived Gorbachev's desire to halt, if not rollback, the offensive program as genuine. It appears that Gorbachev was playing a two-level game. He persisted in denying the existence of an offensive program to the West to avoid embarrassment and a confrontation with the military while he and Shevardnadze were engaged in a bureaucratic struggle to rein in the offensive program.

Within the British government, Prime Minister Margaret Thatcher believed Gorbachev's desire to end the biological weapon program was sincere and that he was being deceived by his generals. Sir Percy Cradock, then chairman of Britain's Joint Intelligence Committee, thought that as likely as Thatcher being deceived by her generals.[543] Cradock believed that the program was so large Gorbachev would have to have known about it and known that it was not defensive.[544] According to Jack Matlock, U.S. ambassador to Moscow from 1987 to 1991, "From their behavior, I think the people at the top [in the Kremlin] probably did not know everything. There is plenty of evidence that shows these people were not able to get the information they wanted, because the system was so secret and the political authorities had so little control over the military and KGB. And they had no reliable way to check up on the information they did get."[545] What is clear, however, is that the military took advantage of the intense secrecy surrounding the biological weapons program, and the autonomy it offered, to shield it not only from foreigners but also from perceived domestic threats.

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[540] Alibek, Biohazard, pp. 117, 145, 150.

[541] In 1997, Major General Anatoly Khorechko, the director of the military biological institute in Sverdlovsk, told an internal newspaper that he was now rebuilding the vaccine production plant that had been dismantled in the mid 1980s under Gorbachev's orders. Alibek, *Biohazard*, p. 263; Paul Quinn-Judge, "The Breeding of Death," *Time*, February 16, 1998.

The stockpile of *B. anthracis* spores, estimated at between 100 and 200 tons, was transferred to Vozrozhdeniye Island in 1988 for sterilization and burial. Judith Miller, "At Bleak Asian Site, Killer Germs Survive," *New York Times*, June 2, 1999, p. A1; Miller, Engelberg, and Broad, *Germs*, p. 178; and Tucker, "Biological Weapons in the Former Soviet Union," p. 6.

[542] Mark Urban, *UK Eyes Alpha: Inside British Intelligence* (London: Faber and Faber, 1996), p. 134.

[543] Urban, *UK Eyes Alpha*, pp. 132-133.

[544] Mangold and Goldberg, *Plague Wars*, p. 108.

[545] Quoted in ibid., p. 109.

RUSSIA

After the collapse of the Soviet Union, Russian President Boris Yeltsin was plagued by problems similar to those that confronted Gorbachev and Shevardnadze in their bid to dismantle the former Soviet biological weapons program. Although Yeltsin declared early on his resolve to bring Russia into compliance with the BWC and cooperate with the West, he faced great difficulties in implementing these pledges.

Revelation, Reassurance, and Resistance

Soon after entering office, Yeltsin took the diplomatic offensive to assure the United States and United Kingdom that Russia would comply with the BWC and not engage in offensive biological warfare activities. Throughout January and February 1992, Yeltsin acknowledged past violations of the BWC and vowed to halt such activities. Yeltsin even appeared on Russian television in late January to announce the government's new policy on biological weapons. He publicly renounced the use of biological weapons, even if in retaliation, and vowed "rigorous implementation" of the BWC.[546] However, Yeltsin was also telling these officials in private that his office was having trouble penetrating the secrecy that surrounding the biological program and that he was still being deceived by the military. Yeltsin told British Foreign Secretary Douglas Hurd that when Gorbachev and his former Defense Minister handed over the reins of power, they had promised him that the Soviet biological warfare program had been terminated. Yeltsin then admitted that this claim was not true and that he had discovered that the program was continuing in secret. Yeltsin called the generals in charge of the biological weapons program "fanatics" and "misguided geniuses."[547] In late January, Yeltsin told Baker that in the past he had been deceived on the existence of the Soviet BW program.[548] During his first meeting with President Bush in early February 1992, Yeltsin again reiterated his commitment to shutting down the BW program, but he also warned Bush that his aides were having a hard time finding out from the military what was actually going on inside the program. Since the offensive program was so compartmentalized, there were very few knowledgeable officials who were also forthcoming. He also indicated that the military was moving and hiding certain facilities.[549] Yeltsin later recounted his conversation with Bush, "I said I could not give him firm assurances of cooperation. Certainly, this is not acceptable among politicians, but I said this: "We are still deceiving you, Mr. Bush. We promised to eliminate bacteriological weapons. But some of our experts did everything possible to prevent me from learning the truth. It was not easy but I outfoxed them."[550] Although Yeltsin's statements were highly encouraging, the Kremlin's lack of control over Biopreparat and the military became increasingly evident. As a result, Yeltsin was forced to keep extending the amount of time he told Western leaders would be required to dismantle the former Soviet program.[551]

Furthermore, the British soon learned that the military and Biopreparat remained committed to continuing the biological weapons program and were lying to Yeltsin in order to

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[546] Ibid.,, pp. 158-159.
[547] Ibid., pp. 158-159.
[548] James A. Baker III, *The Politics of Diplomacy: Revolution, War, and Peace, 1989-1992* (New York: Putnam, 1995), p. 621.
[549] Mangold and Goldberg, *Plague Wars*, pp. 158-160.
[550] M. Zahkarov, "A Visit with the President," *Izvestiya*, April 22, 1992, in JPRS-TND-92-104, May 4, 1992.
[551] In January, Yeltsin told Baker that he would need a month to dismantle the program. By mid-February, the Russians claimed that they still needed another one or two months. Mangold and Goldberg, *Plague Wars*, pp. 159-160.

justify the program.[552] In December 1991, the Soviet Union had dispatched a team to visit former offensive and current defensive biological warfare sites in the United States as part of a reciprocal confidence-building exercise. By the time the team returned to Moscow, the Soviet Union had been replaced by Russia and fourteen other independent states. In order to ensure the continuation of their program, Biopreparat and military officials reported to the Kremlin that their visit had uncovered evidence that the Untied States continued to maintain a biological weapons program, including mothballed production and testing facilities. Therefore, the 15th Main Directorate recommended that Russia's offensive program should continue.[553] In fact, there was no such evidence and the outcome of the visit had been pre-ordained. Both General Valentin Yevstigneev, head of the military biological weapons program, and Yuriy Kalinin, head of Biopreparat, told members of the team before their departure to find evidence of an American biological weapons program or else.[554] The decrepit nature of the former offensive sites, the limited size of the defensive facilities, and the openness of the American scientists convinced one of the team members, Ken Alibek, that the United States no longer had an offensive program. As a result, he defected to the United States later that year and revealed the full extent of the former Soviet biological weapons program and its struggle to survive in Russia.[555]

Throughout 1992, the military succeeded in undermining Yeltsin's major efforts to increase civilian control over the weapons program, make the former Soviet program more transparent, and cooperate with Anglo-American efforts to verify Russian compliance with the BWC. On February 28, Yeltsin announced the creation of the Committee on the Convention Problems of Chemical and Biological Weapons to implement Russia's commitments not to develop, produce or stockpile these weapons. While on paper this was a promising development, reliable sources in the Russian Foreign Ministry warned the British that the military still controlled biological weapons decision-making and was seeking to hijack the committee.[556] Indeed, the membership of the committee left much to be desired and caused a great deal of concern in Washington and London. Retired Army general Anatoly Kuntsevich was appointed chairman of the committee and he also served as a presidential advisor on chemical and biological disarmament. One of his deputies would be General Valentin Yevstigneev, head of the 15th Main Directorate in the Ministry of Defense. These generals were old-guard conservatives who had been at the forefront of Soviet efforts to secretly develop new chemical and biological weapons in contravention of international treaties.[557] Kuntsevich had been an architect of the Soviet chemical weapons program that continued developing new agents even after Gorbachev announced the termination of all offensive chemical weapons research in 1987.[558] He was awarded a Lenin Prize in 1991 for supervising the development of a new binary chemical nerve agent designed to circumvent the forthcoming Chemical Weapon Convention.[559] Kuntsevich's appointment was akin to placing the fox in charge of the hen house and appeared to confirm the

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[552] Ibid., pp. 160-161.
[553] Alibek, *Biohazard*, pp. 242-243.
[554] Ibid., p. 227; and Mangold and Goldberg, *Plague Wars*, p. 157.
[555] Mangold and Goldberg, Plague Wars, pp. 193-194.
[556] Ibid., pp. 160-161.
[557] Yevstigneev was one of the generals who had long resisted inspections of the Soviet biological program and had ordered the Soviet team that visited the United States in December 1991 to return with evidence of American work on biological weapons. Mangold and Goldberg, *Plague Wars*, p. 162.
[558] Adams, *The New Spies*, p. 280.
[559] Mangold and Goldberg, *Plague Wars*, p. 162.

warnings from the British sources about the military's domination of decision-making on chemical and biological weapons.[560]

On April 11, Yeltsin took his most significant step to date in bringing Russia into compliance with the BWC. The Kremlin issued a formal decree, Edict 390, "On Ensuring the Implementation of International Obligations Regarding Biological Weapons," that prohibited all biological warfare activities on Russian territory that violated the BWC. The decree also placed the Committee on Convention Problems of Chemical and Biological Weapons under the office of the President to oversee the fulfillment of the requirements of the decree and international treaty obligations. Although this decree codified the BWC's prohibition against development, production, and stockpiling of biological weapons, it did not regulate research or defensive activities. The British Joint Intelligence Committee later concluded that the Russian military was circumventing the decree by classifying all of its ongoing offensive scientific research as "defensive." The generals reportedly argued to the Kremlin that the defensive research was necessary in case Russia was ever attacked from the west (NATO) or east (China).[561] As Alibek observed after his defection, "After Yeltsin signed a decree in April 1992 to stop all offensive biological work, suddenly all [of the] offensive biological facilities overnight became defensive facilities. And, you know, dozens of thousands of people who were involved in offensive programs became expert in defensive issues."[562]

In late April, Russia shared with the United States and United Kingdom its draft declaration on past and present biological warfare activities required by a BWC confidence-building measure. In a presentation to American and British officials, Grigoriy Berdennikov, who had led the Russian delegation to the United States in December 1991 and had since been promoted to Deputy Foreign Minister, tried to put a positive spin on the document: the declaration admitted that the Soviet Union had violated the BWC and pledged that all such work had been halted. However, Berdennikov told the officials that producing the document had been difficult due to the resistance of the military who did not want to disclose any previous offensive activity and the inability of the Ministry of Foreign Affairs and Yeltsin's civilian advisors to acquire accurate information.[563]

The Russian declaration acknowledged that an offensive biological weapon program had been maintained from 1946 to March 1992. However, it claimed that munition development never proceeded past the prototype stage and that no biological weapons were produced or stockpiled. While the declaration listed the known Soviet military biological weapons sites, it listed only the four Biopreparat facilities previously visited by the United States and United Kingdom. A dozen other Biopreparat facilities involved in biological weapon activities were not listed. Furthermore, the activities of the Biopreparat facilities were marginalized and

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[560] Kuntsevich would be fired from his post as chairman of the committee in April 1994 due to "numerous and gross violations" of his duties, including allegations that he sold chemical weapon precursors to Syria. R. Jeffrey Smith, "U.S. Officials Allege That Russians Are Working on Biological Arms," *Washington Post*, April 8, 1994, p. A28; and Sergei Shargorodsky, "Former Chemical Weapons Chief Investigated For Chemical Smuggling," *Associated Press, October* 23, 1995.

In November 1995, Kuntsevich was sanctioned by the United States government for engaging in chemical weapons proliferation activities. Department of State, "Imposition of Chemical and Biological Weapons Proliferation Sanctions on a Foreign Person," *Federal Register*, Vol. 60, No. 234 (December 6, 1995), pp. 62526-62527.

[561] Mangold and Goldberg, *Plague Wars*. pp. 196-197.

[562] Potomac Institute for Policy Studies, *Conference on Countering Biological Terrorism: Strategic Firepower in the Hands of Many?*, PIPS-97-2 (Arlington, V.A.: Potomac Institute for Policy Studies, August 1997), p. 67.

[563] Mangold and Goldberg, *Plague Wars*, p. 165.

downplayed. Although the declaration listed a number of bacterial agents that the Soviet Union worked on, there was no mention of work with viral agents such as smallpox, Marburg, Ebola or Lassa fever. The declaration also contained no information on Soviet research on anti-crop or anti-animal biological agents. The declaration did not mention the biological warfare programs and facilities associated with the Academy of Sciences, Ministry of Health, Ministry of Agriculture, or KGB. The declaration also failed to address several outstanding issues regarding the former Soviet program such as evidence of Soviet genetic engineering for offensive purposes, the 1979 anthrax outbreak at Sverdlovsk, the defection and revelations of Vladimir Pasechnik, and the findings of the January 1991 Anglo-American visit.[564] Clearly, Yeltsin and the Ministry of Foreign Affairs had lost this round to the military and Kuntsevich's committee. Equally disturbing was that many of the details, denials, and shortcomings in the declaration appeared to match those found in a report on the former Soviet biological warfare program submitted by Kuntsevich to Yeltsin in March.[565] As in the Soviet era, the military was telling the same lies to both the United States and the civilian leadership in the Kremlin.

During a follow-up meeting with Ambassador Reed Hammer, Deputy Director of the Arms Control and Disarmament Agency (ACDA), Kuntsevich refused to answer Hammer's questions about specific omissions from the declaration and maintained that the declaration met all legal requirements. In response to a question about Russia's continued research on plague for offensive purposes, Kuntsevich replied that Russia had 100 facilities conducting research on plague and that they were all defensive.[566] In fact, the United States had intelligence from a recent defector that Pasechnik's old institute was still involved in a project to develop the means to mass produce a new strain of antibiotic-resistant *Y. pestis* (the bacteria that causes plague).[567] Kuntsevich's report to Yeltsin in March, the Russian declaration in April, and Kuntsevich's response to Hammer's inquiries in June demonstrated that the Russian military was willing to concede only what it believed that the White House, 10 Downing Street, and the Kremlin already knew about the biological warfare program. Given these signs of military insubordination and cover-up, Secretary of State Lawrence Eagleburger and British Foreign Secretary Hurd raised their concerns directly with Russian Foreign Minister Andrei Kozyrev. In an August 24, 1992 letter, they wrote that, "We are very concerned that some aspects of the offensive biological warfare program, which President Yeltsin acknowledged as having existed and which he then banned in April, *are in fact being continued covertly and without his knowledge.*"[568]

In September, an Anglo-American team traveled to Moscow for a trilateral meeting on establishing a process for bringing Russia into compliance with the BWC. The trip was prompted not only by continuing American and British concerns with Russian noncompliance, but also the possibility that problems in this area would jeopardize a pending strategic nuclear arms control agreement. The meeting resulted in a joint statement by the United States, United Kingdom, and Russia called the Trilateral Agreement. The overall goal of the agreement was to increase the transparency of the former Soviet biological warfare program through information sharing, visits to military and non-military sites, and cooperative measures to engage in research and convert

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[564] Russian Federation, "Declaration of Past Activity in Regard to Offensive and Defensive Programs of Biological Research and Development," United Nations Form F, DDA/4-92/BWIII, 1992. Kindly provided by Jeff Mangold.
[565] Adams, *The New Spies*, p. 278; and R. Jeffrey Smith, "Russia Fails to Detail Germ Arms," *Washington Post*, August 31, 1992, p. A1.
[566] Mangold and Goldberg, *Plague Wars*, p. 430 fn 38.
[567] Ibid.,, p. 163-164.
[568] Letter from U.S. Secretary of State Lawrence Eagleburger and British Foreign Minister Douglas Hurd to Russian Foreign Minister Andrei Kozyrev, August 24, 1992 (emphasis added). Kindly provided by Mark Urban.

weapons facilities. The main benefit from the Anglo-American perspective was that Russia agreed to allow visits to its previously closed military biological weapons sites. However, the Russian military torpedoed this aspect of the agreement by insisting on several unreasonable demands. For example, the Russian military sought to expand the scope of facilities subject to visits from sites engaged in military biological activities since 1975 (the year the BWC entered into force) to any military sites engaged in such activities since 1946. This would have significantly increased the number of American military facilities subject to visits despite the fact that the United States had abandoned its offensive program in 1969 and these sites no longer conducted biological research.[569] The Russians also demanded access to American military facilities outside of the United States conducting research on infectious diseases. The United States refused to agree to this expansion of the scope of the Trilateral Agreement out of respect for the sovereignty of the nations hosting these facilities and a desire not to jeopardize relations with these nations given the previous Russian attempts to portray defensive and civilian facilities in the U.S. as part of an offensive program.[570] The inability to reach an agreement on guidelines for visits to military sites and the poor experience with previous Russian visits led the United States and United Kingdom to allow the trilateral process to stall. The United States was unable to persuade Yeltsin to intervene further on this issue. During a January 1993 meeting, Yeltsin assured President William Clinton that the Russian offensive program had been halted despite new evidence presented by Clinton that this was not the case.[571] One of the last major diplomatic initiatives in support of the Anglo-American effort to ensure Russian compliance with the BWC took place during a Clinton-Yeltsin summit in May 1995. At the summit, Clinton successfully pressed Yeltsin to accept visits to Russian military biological facilities by August 1995.[572] The visits never took place and the military sites remained off-limits to foreigners.

Corruption and Proliferation

Although Biopreparat had been transferred to federal civilian control under the Russian Ministry of Health, "it would appear that these changes were cosmetic in nature and that, despite its official incorporation within this ministry, Biopreparat continued to operate autonomously with little or no government control."[573] Biopreparat's ability to maintain its autonomy and elude civilian control resulted in corruption and possibly proliferation. In mid-1992, after Yeltsin's decree banning work on biological weapons, Biopreparat attempted to enlist the Ministry of Defense in the newly independent republic of Kazakhstan in a cooperative arrangement to continue running the plant at Stepnogorsk and other former Soviet biological weapons facilities in Kazakhstan.[574] In 1995, Yuri F. Doshchitsyn, head of medical industry within the Russian

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[569] Naval Treaty Implementation Program, *U.S./U.K./Russian Joint Statement on Biological Weapons* (Washington, D.C.: Department of the Navy, October 2000), http://www.nawcwpns.navy.mil/~treaty/BWT.html.

[570] Michael Moodie, "The Soviet Union, Russia, and the Biological and Toxin Weapons Convention," *The Nonproliferation Review*, Vol. 8, No. 1 (Spring 2001), p. 64.

[571] The new information was provided by Ken Alibek, the former first deputy director of Biopreparat who defected to the United States in October 1992. James Adams, "Russia's Secret Weapons for Germ Warfare," *Sunday Times* (London), March 27, 1994.

[572] R. Jeffrey Smith, "U.S. Aides Report Progress With Russia on Inspections," *Washington Post*, May 17, 1995, p. A2.

[573] Anthony Rimmington, "Fragmentation and Proliferation? The Fate of the Soviet Union's Offensive Biological Weapons Programme," *Contemporary Security Policy*, Vol. 20, No.1 (April 1999), p. 91.

[574] Alibek saw the document outlining joint operations at Stepnogorsk and was offered command over the proposed new system. He rejected the offer. Kazakhstan has subsequently cooperated with American efforts to dismantle Stepnogorsk and employ former weapons scientists in peaceful research. Alibek, *Biohazard*, pp. 248-249.

Ministry of Health and Medical Industry (also known as *Minzdravmedprom*) and the official with direct responsibility for Biopreparat reported that his agency had "been unable to sort out its relation with Biopreparat. The reason for this is that Biopreparat has recently succeeded in securing budget finance outside of *Minzdravmedprom* and, having acquired economic independence, it's attempting to take factories of the same profile with it."[575] The bulk of this outside finance likely came from the Ministry of Defense while corruption and black market activities played a smaller role. Stories of corruption within the chemical and biological weapons communities circulated in Russia throughout the 1990s.[576] Around thirty private companies created on the basis of organizations and facilities that contributed to the Soviet biological weapons program have been identified. For example, the firm Binom has advertised its role in the design and construction of several major biological weapons factories.[577] Throughout the 1990s, Iranian officials sought to recruit Russian scientists, with some success, from institutes formerly engaged in biological weapons research and production.[578]

The most alarming example of how overly autonomous organizations can contribute to proliferation is a deal struck in June 1995 between Iraq's Military Industrialization Corporation and Biopreparat for a 50,000-liter biological weapons factory. Iraq and Russia claimed that the fermenters were for a single cell protein factory. This was the same cover story used by Iraq to hide its first biological weapons factory at Al Hakam from UNSCOM.[579] Indeed, the key Iraqi negotiators were affiliated with Al Hakam and had previously worked on Iraq's biological weapons program.[580] In addition, Iraq was negotiating for five 10,000-liter fermenters, not one 50,000-liter fermenter as might be expected for a legitimate single cell protein factory.[581] One of the Russian involved in the negotiations was reportedly Vilen Matveyev, formerly with the 15th Directorate and later a senior deputy at Biopreparat, who specialized in the development of weapons-manufacturing equipment.[582] Russia has assured UNSCOM that no contract was concluded and no attempt was made to export the equipment in 1995 or after.[583] However, since the negotiations were not discovered by UNSCOM until 1997 and other cases of Iraqi smuggling of Russian strategic technology have emerged, it is not possible to determine the ultimate fate of the fermenter deal.[584] The episode serves to illustrate the dangers that highly autonomous

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[575] Quoted in Rimmington, "Fragmentation and Proliferation?" p. 91.
[576] Smithson, *Toxic Archipelago*, p. 14.
[577] Rimmington, "The Soviet Union's Offensive Program," p. 119.
[578] Judith Miller and William J. Broad, "Iranians, Bioweapons in Mind, Lure Needy Ex-Soviet Scientists," *New York Times*, December 8, 1998, p. A1.
[579] Judith Miller, "Official Confirms 1995 Russian-Iraq Deal," *New York Times*, February 18, 1998, p. A8; R. Jeffrey Smith, "Russians Admit Firms Met Iraqis," *Washington Post*, February 18, 1998, p. A16; and R. Jeffrey Smith, "Did Russia Sell Iraq Germ Warfare Equipment?" *Washington Post*, February 12, 1998, p. A1.
[580] Ritter, *Endgame*, p. 220; Statement of Richard O. Spertzel Before the House Armed Services Committee, *State of the Iraqi Weapons of Mass Destruction Program*, September 10, 2002, http://armedservices.house.gov/openingstatementsandpressreleases/107thcongress/02-09-10spertzel.html.
[581] Spertzel, *State of the Iraqi Weapons of Mass Destruction Program.*
[582] Alibek, *Biohazard*, p. 275.
[583] United Nations Security Council, *Report of the Executive Chairman on the activities of the Special Commission established by the Secretary General pursuant to paragraph 9 (b) (i) of resolution 687 (1991)*, S/1998/332 (New York: United Nations, April 16, 1998), p. 17.
[584] In 1995, UNSCOM found 200 missile guidance components from dismantled Russian SS-18 strategic missiles in Iraq and intercepted another 240 in Jordan before they reached Iraq. Vladimir Orlov and William C. Potter, "The Mystery of the Sunken Gyros," *Bulletin of the Atomic Scientists*, Vol. 54, No. 6 (November/December 1998), http://www.thebulletin.org/issues/1998/nd98/nd98orlovpotter.html

biological weapons organizations can pose if they choose to place their own material interests above the political interests of their superiors.

Conclusion

Although Yeltsin's actions in 1992 initially held great promise for bringing Russia into compliance with the BWC, for every two steps forward on this issue, the military and Biopreparat succeeded in forcing Russia back one step. After the initial breakthroughs in 1992, even less progress was made thereafter. Russia refused to clarify omissions and falsehoods in its UN declaration, address issues raised in Anglo-American visits to former biological weapons sites as part of the trilateral process, or grant the promised access to military sites. In addition, the continued presence of Kuntsevich, Yevstigneev and Kalinin in senior positions reinforced concerns in the West about the alternate dangers of Kremlin complicity in the offensive program or lack of control over the military. In January 2000, the Department of Defense reported to Congress, "We have little information on the extent of control and oversight by the Government of Russia over the military and civilian-military biological warfare programs formerly controlled or overseen by the Soviet Union. We are concerned, however, that the same generals who led the former Soviet offensive BW program are still in charge at military institutes that are said to be part of the greatly reduced defensive program."[585] The consensus among Western nations appears to be that Yeltsin's desire to comply with the BWC was genuine, but that his ability to implement this pledge and establish the level of transparency necessary to demonstrate compliance was limited. According to a Western intelligence official, "Yeltsin is certainly telling us what he believes. But that is not what is actually happening. If the military are really able to defy him in this way, it tells us a lot about the power structure in Russia."[586] As one senior American official observed, "It's really a debate about whether Russian biowarfare research is a national policy or run by entrenched interests that are out of control. Did Yeltsin mean what he said? Probably yes. Did he have the ability to tear it down? Probably no."[587]

SOUTH AFRICA

Similar problems of control and oversight beset the South African chemical and biological weapons program, called Project Coast, which ran from 1981 to 1995. The Truth and Reconciliation Commission (TRC) that investigated the program in 1997-1998 found that the military committee charged with oversight was "grossly negligent in approving programmes and allocating large sums of money for activities of which they had no understanding, and which they made no effort to understand."[588] This mismanagement resulted in scientific and financial fraud by a "nepotistic, self-serving and self-enriching group of people, misled by those who had a technical grasp of what was happening."[589] Furthermore, the program managers misled President F.W. De Klerk and later President Nelson Mandela about the offensive orientation of

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[585] DOD, *Report to Congress on Biological Weapons Programs in Russia* (Washington, D.C.: DOD, January 11, 2000), p. 2.
[586] Quoted in James Adams, "Russia's Secret Weapons for Germ Warfare," *Sunday Times* (London), March 27, 1994.
[587] Unidentified senior American official quoted in Wendy Orent, "Escape From Moscow," *The Sciences*, Vol. 38, No. 3 (May/June 1998), p. 30.
[588] Truth and Reconciliation Commission (TRC). *Truth and Reconciliation Commission of South Africa Report*, Vol. 2 (Basingstoke, UK: Macmillan Reference Limited, March 1999), p. 522.
[589] Ibid., p. 520.

the program and its role in assassination operations.[590] As a result of this lack of oversight, the program's documents and pathogens were not properly destroyed or accounted for when the program was terminated and continued to present a proliferation risk many years later.[591] In 1997, Wouter Basson was arrested for drug trafficking and in 1999 he went on trial in Pretoria for 67 charges of possession of illegal narcotics, murder, attempted murder, conspiracy to murder, and fraud. All of these charges stemmed from his actions as the head of Project Coast from 1981 to 1993.

Origins of Project Coast

Project Coast was created in 1981 under Prime Minister P.W. Botha as part of South Africa's response to the perceived "total onslaught" by Communists and black Africans against the white-ruled nation. The focus of the chemical program was on agents for use in crowd control while the biological program emphasized the development of covert means of assassination and sabotage. Many of the problems in oversight and corruption that characterized Project Coast can be traced back to the secrecy with which the program was shrouded from its inception and the program's organizational placement.

When South Africa initiated Project Coast, it was party to both the 1925 Geneva Protocol and the 1972 Biological Weapons Convention. It was also already subject to a United Nations arms embargo and strong international criticism for its apartheid policies. The operational advantage that accrued from secrecy and surprise was also recognized. As one high-ranking official justified the need for continued secrecy regarding the products developed by Project Coast, "If the nature of these products is announced at this stage, the instigators and people who promote these riots will be able to use it for propaganda against the use of such agents and to develop efficient precautions. The fact that the SADF is at the same time the developing agent as well as the client for these products, will undoubtfully [sic] have to be protected in order for the SADF to maintain the 'tactical higher ground'."[592] As a result of these considerations, the program was cloaked in secrecy and structured in a highly compartmentalized fashion in order to minimize the risk that the South African Defense Forces (SADF) could be linked to the development of chemical and biological weapons. A young medical officer in the SADF, Lieutenant-Colonel Wouter Basson, was charged with establishing the program. His first task was to travel abroad to gather as much information as possible on foreign chemical and biological warfare developments in order to inform decision-makers on what direction the South African program should take. Basson's orders implicitly included the need for plausible deniability since the SADF could not be linked to his activities. To compensate for the risks involved, Basson was provided with a generous level of funding. The only restrictions placed on his activities, aside from the injunction for secrecy and deniability, were that he operate within the approved annual budget, did not transport hazardous materials on commercial aircraft, and did not enrich himself at the project's expense.[593] The responsibility, freedom and financial rewards granted to Basson due to the perceived need for secrecy led him to realize that no one

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[590] Gould and Folb, *Project Coast*, p. 118; and Burger, and Gould, *Secrets and Lies*, pp. 9, 26.

[591] Joby Warrick and John Mintz, "Lethal Legacy: Bioweapons for Sale," *Washington Post*, April 20, 2003, p. A1; and Joby Warrick, "Biotoxins Fall Into Private Hands," *Washington Post*, April 21, 2003, p. A1.

[592] General D. P. Knobel, Fondsbehoefte en fondshantering: Projek Jota [Funding needs and the handling of funds: Project Jota], GG/UG/302/6/J1282/5/1, July 6, 1992, p. 2 (as translated by the Centre for Conflict Resolution, South Africa), http://www.isn.ethz.ch/researchpub/publihouse/za_cbw/docs/EXHK2.htm.

[593] Burger and Gould, *Secrets and Lies*, pp. 17, 20.

else in SADF knew anything about chemical and biological weapons and that "in the land of the blind, the one-eyed man is king."[594]

The adverse consequences of the secrecy and compartmentalization of Project Coast, which left Basson as the sole military authority on chemical and biological weapons, were evident from the very beginning of the program. After visiting the United States, Taiwan and various European nations, including unidentified Eastern bloc countries, Basson briefed the SADF chief of staff and members of the General Staff in July 1981.[595] Basson's findings from his fact-finding mission formed the sole basis for the nature and direction of Project Coast.[596] Many of his findings, however, are highly questionable. Basson reported that chemical and biological weapons programs were structured in other countries so that private civilian facilities engaged in research and development until the point of weaponization. This final step then took place in top-secret military laboratories.[597] Although this was not an accurate description of the Western approach to chemical and biological weapons, it was similar to the Soviet approach and became the basis for the organization of the South African program. Basson's initial proposal to the Minister of Defense was to create a defensive program using front companies that would attract talented scientists while remaining under the watchful eye of the Surgeon General to ensure compliance with the Geneva Protocol and BWC. Basson, however, also noted that these treaties were "practically useless." Despite the official policy of a defensive program aimed at foreign threats, Project Coast was an offensive program that focused as much, if not more, on internal threats. For example, while facilities for offensive research, development and production were establishing in 1982, defensive chemical training for SADF soldiers did not begin until 1988. Basson also proposed that South Africa focus its research on incapacitating agents that could be used against soldiers on the battlefield and rioters in the streets at home. He reported that both the United States and Soviet Union had abandoned lethal agents in order to focus on incapacitating agents and that both superpowers had developed a highly effective teargas, called CR. Basson was either grossly misinformed or lying when he reported this. In fact, the United States had just launched a program to acquire artillery shells and aerial bombs filled with a binary version of the highly lethal nerve agent VX.[598] Furthermore, there is no evidence that either the United States or Soviet Union produced significant quantities of CR.[599]

Project Coast's Chain of Command

The chain of command running from Wouter Basson, the Project Officer of Project Coast, to the Minister of Defense was convoluted, compromised by excessive compartmentalization, and easily circumvented. Basson served two masters from the outset of his appointment as the Project Officer for Project Coast. While he reported to the Surgeon General as the Program Manager, Basson was based at Special Forces Headquarters and was under the operational command of the Chief of Special Forces.[600] One of his duties at Special Forces was to create the Special Operations Unit to provide medical support to Special Forces units operating outside of South Africa. By 1985, Basson was promoted to Colonel and became

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[594] Ibid., pp. 17, 179.
[595] Ibid., p. 18.
[596] Gould and Folb, *Project Coast*, p. 192.
[597] Gould and Folb, "The South African Chemical and Biological Warfare Program," p. 12.
[598] On the U.S. binary chemical program in the 1980s, see Smart, "History of Chemical and Biological Warfare," pp. 70-71.
[599] Gould and Folb, *Project Coast*, p. 157; and Burger and Gould, *Secrets and Lies*, pp. 18-19.
[600] Gould and Folb, *Project Coast*, p. 50.

head of this unit.[601] In 1988, the unit was renamed the 7th Medical Battalion and was transferred from Special Forces to the Surgeon General.[602] That same year, Basson became a Brigadier and the head of Medical Staff Operations as well as Research and Development for the South African Medical Services (SAMS).[603] SAMS supplied the medical doctors and corpsmen who served in the South African military and also participated in "civic action" programs such as providing medical services to local populations where the SADF was operating.[604] Basson's close association with Special Forces throughout his tenure as head of Project Coast strongly contributed to his ability to circumvent the chain of command, mislead his superiors, and engage in unethical and illegal behavior.

South Africa extensively used special forces fielded by the military, police and intelligence agencies for direct action against insurgents abroad and at home. Given the lack of a political strategy to end the revolution against apartheid, special forces gained disproportionate influence over operations and strategic planning which provided them with incredible latitude.[605] According to Rocklyn Williams, "The influence of the SADF's Special Forces occurred within the context of a deteriorating and increasingly unaccountable political culture, the excessive concentration of power in the executive regions of the state, and the veil of secrecy surrounding all military activities under the State of Emergency. It also reflected the extent to which an influential faction within the SADF had managed to shape the SADF's strategic and political direction."[606] General A.J. (Kat) Liebenberg, Chief of Special Forces during the early 1980s and later Chief of Army and Chief of SADF, and a confidante to Minister of Defense Magnus Malan, exemplified this approach. Chandre Gould and Peter Folb, who worked on the TRC investigation of Project Coast, report that, "It was Liebenberg's practice to restrict the flow of information, bypass normal chains of command and ensure that people in positions of power were those who toed the line."[607] Basson reported to Liebenberg as Chief of Special Forces and continued to do so when Liebenberg was promoted to Chief of Army and later chief of SADF. These connections gave Basson access to the highest levels of SADF. The *modus operandi* of South Africa's Special Forces was decentralization, intense secrecy, and compartmentalization of organizations and operations to provide plausible deniability to senior officials. These characteristics were recognized as increasing the potential for corruption and mismanagement or for illegal operations authorized by one or a few senior officials.[608]

The Coordinating Management Committee and Obstacles to Oversight

The oversight mechanism put in place to monitor Project Coast was undermined by the secrecy, compartmentalization, and divided chain of command that characterized the program. At the apex of the chain of command for Project Coast was the Reduced Defense Council. Since Project Coast was classified as highly as the nuclear weapons program and covert units of

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[601] Gould and Folb, *Project Coast*, p. 43; Mangold and Goldberg, *Plague Wars*, p. 239.
[602] Burger and Gould, *Secrets and Lies*, p. 47.
[603] Gould and Folb, *Project Coast*, p. 43; Mangold and Goldberg, *Plague Wars*, p. 239.
[604] Willem Steenkamp, *South Africa's Border War, 1966-1989* (Gibraltar: Ashanti Publishing, 1989), p. 246.
[605] Kevin A. O'Brien, "Special Forces for Counter-Revolutionary Warfare: The South African Case," *Small Wars & Insurgencies*, Vol. 12, No. 2 (Summer 2001), p. 82.
[606] Rocklyn Williams, *Back to the Barracks: The Changing Parameters of Civil-Military Relations under the Botha and De Klerk Administrations* (Colchester, United Kingdom: University of Essex, 1992), p. 230.
[607] Gould and Folb, *Project Coast*, p. 15.
[608] Stephen Ellis, "The Historical Significance of South Africa's Third Force," *Journal of South African Studies*, Vol. 24, No. 2 (June 1998), pp. 261-299.

Special Forces, strict "need-to-know" regulations applied even at the highest levels of South Africa's political-military leadership.[609] The structure that connected the Minister of Defense and Chief of SADF, the Defense Command Council, did not as a whole meet to discuss these programs. Instead, the Reduced Defense Command Council, composed of only officials with the requisite "need-to-know," met after a meeting of the whole council and usually excluded the chiefs of the navy and air force.[610]

The next layer of oversight was the Coordinating Management Committee (CMC), which was established in 1981 to supervise the budget and direction of Project Coast. The committee, appointed by the Minister of Defense, was chaired by the chief of SADF and included the generals in charge of finance, medical services, operations, logistics, intelligence and the army.[611] Once a year the CMC reported to the Minster of Defense. Day-to-day management of Project Coast lay with Surgeon General D. P. Knobel as the Program Manager.[612] CMC met only annually after 1981 to discuss budgetary issues.[613] According to Knobel, Basson reported to the CMC the progress of the project towards objectives established and approved by CMC only in broad terms. This was reportedly due to the fact that the members of the CMC did not have the scientific knowledge or background to address the technical details of the project.[614]

Basson was able to leverage his supposed expertise in chemical and biological weapons and his superior's desire for secrecy to serve as their sole source of information on the project. According to the TRC, "Overall understanding of the programme, and its co-ordination and direction, were vested in the hands of one person, Dr Basson, whose ability and (it is assumed) integrity were unquestioned both by those who served under him and by those to whom he had to report. It emerged in the hearings that the military command was dependent on Dr. Basson for the conduct and command of the programme, even at a time when there were sufficient indications that Dr. Basson might not be trustworthy and that there were serious aberrations in what was happening."[615]

Basson controlled the three working groups established by the committee to guide its decision-making and exercise oversight over the project: a technical working group, a security group, and an administration and finance group.[616] This allowed Basson to prepare all of the documentation for the committee and therefore monopolize the information flowing to it. In addition, Basson served as the only direct link between CMC and the project's front companies. According to Knobel, CMC would approve an objective or study and then the Technical Working Group would determine the equipment, materials, facilities, and staff required for conducting the work, translate this into budget terms and present the estimate to the CMC. The working group was also supposed to establish the research agenda for each of the front companies. On paper, the Technical Working Group was composed of Basson, the directors of RRL and Delta G, and some of the scientists in these front companies. In fact, Basson was the only constant member of the group. Knobel explained that the fluid nature of the group was due to the fact that scientists participated only with regard to their specific research since the program

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[609] It was SADF policy to shred documents relevant to Project Coast every two years. Burger and Gould, *Secrets and Lies*, p. 13.
[610] Gould and Folb, *Project Coast*, p. 169.
[611] Ibid; Burger and Gould, *Secrets and Lies*, p. 20.
[612] Burger and Gould, *Secrets and Lies*, p. 20.
[613] Gould and Folb, *Project Coast*, p. 173.
[614] Ibid., p. 170.
[615] TRC, *Truth and Reconciliation Commission of South Africa Report*, Vol. 2, p. 522.
[616] Ibid., p. 518.

operated on a "need-to-know" basis. However, many scientists claimed that they rarely met with Basson and had never heard of the Technical Working Group.[617] In effect, Basson was able to use the Technical Working Group as a fig leaf for controlling the research agenda and budgetary submissions of Project Coast.

The CMC also had a Security Committee responsible for maintaining the security and secrecy of Project Coast. This committee, composed of the Chief of Staff Intelligence, the Surgeon General and the Project Officer, also likely existed on paper only. Gen. Badenhorst, head of Military Intelligence in 1989-1991 reports that he never attended a meeting of the committee. Basson's trial revealed that Basson himself was responsible for security of the Project.[618] According to Lt. Gen. Dirk Verbeek, a senior SADF intelligence official, all secret SADF projects would have a security officer, who would report to the Chief of Staff Intelligence, assigned to them to handle physical security of facilities, proper classification and handling of documents, screening of personnel, travel and accommodation arrangements, advice on how to route finances to prevent them from being linked back to SADF, and other counterintelligence activities. To fulfill his duties, the security officer would need to have access to all aspects of the project including the identities of all key decision-makers and members of the project as well as outsiders and companies involved in transactions conducted by the project. He would also need details about foreign bank accounts used by the project, safe houses used by employees, and all contacts between the project officer and outsiders. In short, the security officer would have to know as much as possible about the project to ensure its security and to anticipate or detect breaches in the project's secrecy. However, Johan Theron, the security officer for Project Coast, testified at Basson's trial that he was denied access to any transaction conducted by Basson and that he reported directly to Basson. As a result, the security officer had no ability to act as a check on Basson.[619]

The financial oversight mechanism for Project Coast consisted of internal audits by the head of the program's administrative front company and an annual external audit. However, these audits did not rely on invoices, receipts or inventories, but on Basson's assertions about the program's costs, expenditures, and purchases.[620] As Burger and Gould observe, "even the highest echelon of the SADF was entirely dependent on Basson for every detail of the CBW programme it had created."[621] D. John Tuter, who managed Project Coast's administrative front company between 1989 and 1994, testified at Basson's trial that, "Wouter Basson *was* Project Coast—end of story."[622] According to Petro Theron, auditor of the front companies, only Basson knew what substances the program was procuring, how much they cost, and whether and how they were being used.[623] Surgeon General Knobel justified this practice by claiming that the overriding priority was to prevent foreign suppliers or anyone else from knowing of the military's connection to Basson's activities.[624]

Compounding the problem of exercising effective oversight over Project Coast was Bassn's divided chain of command. Although the Surgeon General and CMC exercised programmatic oversight of South Africa's chemical and biological weapons research and

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[617] Gould and Folb, *Project Coast*, pp. 170-171.
[618] Ibid., p. 174.
[619] Ibid., pp. 185-186.
[620] Burger and Gould, *Secrets and Lies*, pp. 20-21.
[621] Ibid., p. 21.
[622] Ibid (emphasis in original).
[623] Gould and Folb, "The South African Chemical and Biological Warfare Program," p. 14.
[624] Ibid.

development, these entities were not involved in decisions to employ the weapons developed by the project. The Minister of Defense, chief of SADF, head of Special Forces, Chief of Staff Intelligence, the Police Commissioner, head of the Security Police, and Director-General of National Intelligence could each request equipment or support from Project Coast through a direct request to Basson. The links between Project Coast and the non-military security forces was withheld from Knobel, Basson's immediate superior. Basson has stated that he would not even see Knobel for months at a time and instead he took orders from the Chief of Staff Intelligence or Chief of Special Forces. These operational instructions were not reported to the Surgeon General.[625] The assassination weapons developed by Project Coast were never discussed at meetings of the CMC or Reduced Defense Command Council. Although Knobel denied any knowledge of them, General Liebenberg reportedly took responsibility for them.[626] Knobel's protestations of innocence and ignorance during the TRC hearings and Basson's criminal trial have been undermined, however, by his attendance at monthly meetings with RRL management at which all current projects were discussed.[627]

The Front Companies

In 1982, Project Coast established two front companies: Delta G Scientific for research on chemical agents and weapons and Roodeplatt Research Laboratory (RRL) for research on toxins and biological agents. In 1984, another front company, Infladel, was established to funnel funds from SADF to these companies. Other private companies provided ancillary services to the program such as security, testing, physiological research, and research on protective clothing materials. The purpose of the front companies was to conceal the military's involvement in chemical and biological weapons research, development, and production. In addition, the use of front companies granted the scientists free access to the international scientific community, facilitated the recruitment of top-level scientists since they could offer higher pay, and assisted with the procurement of dual-use equipment and materials from abroad.[628] RRL's cover story was that it was a contract research facility in the fields of medicine, pharmacology, agriculture, biology, and veterinarian medicine and the laboratory conducted peaceful research to sustain this cover.[629] The "need-to-know" principle was also strictly applied within Project Coast. Civilian employees were reportedly ignorant of the sponsor and purpose of their research and believed that they worked at a legitimate private research institute. Scientists were not allowed to know how the results of their research were to be used.[630] Basson was the only SADF officer who had direct contact with Delta G and RRL. Due to the high level of secrecy and strict compartmentalization, Knobel was the only member of CMC ever set foot on the premises of Delta G or RRL.[631]

The high degree of compartmentalization of the program allowed Basson to circumvent the usual organizational and procedural checks and balances of secret military programs. As a

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[625] Burger and Gould, *Secrets and Lies*, p. 21; Gould and Folb, *Project Coast*, p. 173.
[626] Gould and Folb, *Project Coast*, pp. 172-173.
[627] Ibid., p. 76.
[628] Ibid., pp. 7, 58; and Gould and Folb, "The South African Chemical and Biological Warfare Program," p. 14.
[629] About 15% of RRL's projects were commercial with results published in professional journals. Burger and Gould, *Secrets and Lies*, p. 29; and Gould and Folb, *Project Coast*, p. 72.
[630] Mangold and Goldberg, *Plague Wars*, p. 239; and Gould and Folb, "The South African Chemical and Biological Warfare Program," p. 17
[631] He visited Delta G once, on a Sunday, and RRL twice, also outside of normal working hours. Burger and Gould, *Secrets and Lies*, p. 20.

result, Basson was able to control the entire program and manipulate his overseers as desired. Basson was in charge of personnel decisions, the program's research agenda, budgetary matters, as well as overt and black market procurement. Basson would eventually exploit the secrecy and autonomy of his program to abuse all of these responsibilities. The investigation of the TRC as well as Basson's two and a half-year trial revealed how excessive secrecy, compartmentalization, and lax oversight resulted in a program that was both mediocre and murderous as well as highly corruption and at great risk of proliferating biological weapons materials and know-how to states and terrorists.

Project Coast's Dirty Tricks

While RRL was ostensibly a civilian research institute, its secret purpose was to find new poisons and toxins that could be used to murder individuals viewed as enemies of the state. Dr. Schalk van Rensburg, director of laboratory services and head of the animal testing unit at RRL from 1984 to 1991, claims that at Basson's insistence "the Holy Grail of all research was the perfect murder weapon: a tasteless, colorless, odorless toxin that could not be traced *post mortem*."[632] In keeping with the program's fetish with compartmentalization, the microbiologist in charge of culturing organisms at RRL would turn over pathogens to the head of his department, Dr. Andre Immelman, and he never knew what happened to them. Dr. Immelman was in charge of RRL's military projects and secretly served as RRL's liaison with South Africa's special forces, supplying them with whatever pathogens or toxins Basson ordered. According to records kept by Immelman, RRL supplied members of the South African security services with numerous samples of pathogens and poisons as well as innocuous items such as alcoholic beverages, cigarettes, chocolates, and deodorants that had been laced with these dangerous substances.[633] In addition, screwdrivers, walking sticks, and umbrellas were transformed into assassination weapons.[634] Members of the security services have reported that they used these crude weapons to assassinate members and supporters of the ANC and to contaminate the water supplies of refugee camps.[635] Some of the members of the Special Operations Unit, later renamed 7th Medical Battalion, under the command of Basson reportedly drew upon Project Coast's resources to conduct interrogations with so-called truth serums, provide drugs and poisons to security forces for use in executing prisoners and enemies of the state, and engage in human experimentation with substances or items developed by the project. Basson reportedly supplied massive quantities of muscle relaxants to Johan Theron, a member of a highly secretive military unit responsible for clandestine cross-border operations, which he used during the 1980s to kill hundreds of prisoners of war before dumping them into the ocean from an airplane. Basson allegedly used these drugs to kill four prisoners in Namibia as part of this operation. In addition, members of the security services who were believed to pose a security risk were also killed with poisons believed to have been supplied by Project Coast.[636]

The Mediocrity of Project Coast

Basson used his position as the sole source of his superiors' information about Project Coast to exaggerate the program's achievements. This was motivated in part by Basson's

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[632] Ibid., p. 29
[633] Ibid., pp. 31-35.
[634] Gould and Folb, *Project Coast*, pp. 103-104.
[635] Burger and Gould, *Secrets and Lies*, pp. 31, 36.
[636] Ibid., pp. 18, 47, 53-77; Gould and Folb, *Project Coast*, pp. 159-167.

narcissism as well as his desire to increase the program's funding and autonomy by inflating its importance and success. After the program was terminated, this myth was sustained due to his need to defend himself during the TRC investigation and criminal trial and provide justification to his former superiors for the trust they had placed in him. Basson claimed that South Africa's chemical and biological weapons program was second only to the Soviet Union's during the Cold War in terms of scientific achievement, a perspective shared by Knobel. According to Knobel, Project Coast's achievements, stored for posterity on 16 CD-ROMs, were a "national asset." Even the judge at Basson's trial believed that the project had been a huge success.[637] The TRC assessment of this aspect of Project Coast is worth quoting at length:

"One of the curious aspects of the CBW programme was the high level of respect it enjoyed with the military and the government of the day. The facts, as they emerged in the Commission's hearings, show that this respect was misplaced. The scientific research undertaken by the project was pedestrian, misdirected, ineffectual and unproductive. It was also exorbitantly expensive, costing the nation tens if not hundreds of millions of rands."[638]

The comparison of the South African program with that of the former Soviet Union is mind-boggling and demonstrates the depth of Basson's narcissim, egomania, and ability to lie as well as the gullibility of senior military leaders. Project Coast's two chemical and biological laboratories employed fewer than 200 technical professionals with another 200 employed by supporting facilities and firms.[639] In contrast, the Soviet biological warfare program alone consisted of over 50 facilities employing 60,000 personnel.[640] Although RRL and Delta G were well equipped and employed some bright scientists, the achievements of the program, especially in the biological field, were minimal and pale in contrast with those of the Soviet program. Project Coast was not a biological weapons program in the mold of the Soviet and American programs that sought to develop weapons for use by regular military force, but a "dirty tricks" program to develop means of assassination and sabotage for special forces and intelligence agencies. According to Dr. Daan Goosen, managing director of RRL from 1983 to 1986, "Certainly there was the potential of reaching high levels of sophistication. We established the ability to do genetic engineering that would have produced effective biological products, but nothing new was ever really made. The facilities lacked nothing...but when the scientists got to the point where we should have been producing bio-weapons, there was no support...and the assassination weapons were crude, off the shelf products."[641]

Project Coast's only weapons were cigarettes, chocolates, and bottles of deodorant, whiskey, and beer contaminated with *B. anthracis*, *Salmonella typhimurium* (a bacteria that causes food poisoning) and botulinum toxin. In contrast, the Soviet Union mass-produced and weaponized the deadliest pathogens known and developed the means to deliver them with a wide range of tactical and strategic weapons. The Soviet Union also conducted extensive research on genetically modifying pathogens to be more virulent or resistant to traditional treatments. In contrast, the only genetic engineering attempted by Project Coast was a scientist's pet project to create a vaccine for sheep against *Clostridium perfringens*.[642] Several other exaggerated claims

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[637] Burger and Gould, *Secrets and Lies*, p. 23.
[638] TRC, *Truth and Reconciliation Commission of South Africa Report*, Vol. 2, p. 511.
[639] Burger and Gould, *Secrets and Lies*, p. 24; and Gould and Folb, "The South African Chemical and Biological Warfare Program," p. 17.
[640] Smithson, *Toxic Archipelago*, pp. 9-10.
[641] Burger and Gould, *Secrets and Lies*, p. 23.
[642] Gould and Folb, *Project Coast*, pp. 95, 98-99.

were made by Basson during his trial and accepted by the judge as factual.[643] In fact, Dr. Wynand Swanepoel, director of RRL from 1986 to 1991, testified to the TRC that no significant breakthroughs were made by Project Coast in the fields of chemical and biological warfare.[644] In 1997, after Basson's arrest for drug dealing and the discovery that he still possessed secret Project Coast documents, the CD-ROMs that were supposed to contain highly classified information on South Africa's chemical and biological warfare achievements were reviewed and found to contain only previously published literature on chemical and biological weapons.[645] Instead of a national asset, Project Coast had been shown to be a national embarrassment.

The Corruption of Project Coast

Project Coast, was, in the words of the TRC, "fraught with financial irregularities."[646] This is not surprising given that the CMC's philosophy of financial management has been summarized as: "We give the money. You bring the product. It does not matter where you get it. You can buy it on the black market, or through bribery, and if you must, you can steal it."[647] In October 1999, Wouter Basson went on trial in Pretoria for 67 charges of possession of illegal narcotics, murder, attempted murder, conspiracy to murder, and fraud, which stemmed from his actions as the head of Project Coast from 1981 to 1993. This section focuses on the charges of fraud since they most clearly demonstrate how Basson was able to use the desire for secrecy and the technique of compartmentalization to evade oversight and engage in illicit activities.

Basson engaged in two main types of corruption. First, he misappropriated funds designated for the procurement of chemical and biological weapons-related materials from abroad to support a luxurious lifestyle outside of South Africa for himself and select colleagues. Basson claims he used the funds to purchase a range of drugs and materials, but these purchases were never physically verified. In addition, scientists at RRL stated that they never received any items from Basson and the officer in charge of procurement at Delta G stated that the company had never had any problems procuring required equipment or materials through normal commercial channels. Thus, Basson's supposed foreign procurement activities were not necessary for the two front companies.[648]

In October 1986, Basson established the WPW Group and three companies in the Cayman Islands. Basson was listed as the vice president for each company. A small group of close associates of Basson, most of whom also worked for Project Coast, ran these companies. WPW Group was believed to be named after the three main players: Wouter (Basson), Philip (Mijburgh), and Wynand (Swanepoel).[649] These arrangements created severe conflict-of-interest problems and allowed Basson to co-opt or enrich key people whose cooperation was needed to make this scheme work. The indictment against Basson stated that he had financial interests, through WPW, in 45 companies but investigators later uncovered at least as many more of these

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[643] Interviews with the project's scientists would later show these claims to be false. Burger and Gould, *Secrets and Lies*, pp. 204-205.
[644] Gould and Folb, *Project Coast*, p. 144.
[645] Burger and Gould, *Secrets and Lies*, p. 26.
[646] TRC, *Truth and Reconciliation Commission of South Africa Report*, Vol. 2, p. 518.
[647] Judgment in The State vs. Wouter Basson, South Africa High Court, Transvaal Division, April 11, 2002, paragraphs 113 and 114, cited in Gould and Folb, *Project Coast*, p. 170.
[648] Gould and Folb, *Project Coast*, p. 200.
[649] Mijburgh and Swanepoel served with Basson in the Special Forces and 7th Medical Battalion and were later named managing directors of Delta G and RRL, respectively. Mijburgh was also the nephew of Minister of Defense Magnus Malan.

investments. Basson was accused of using these companies as a means of laundering R46 million ($17 million in 1991 dollars) diverted from Project Coast and SADF through fraud and theft. A forensic auditor found that over a seven-year period, R86 million ($31 million) of Project Coast funds flowed through a labyrinth of offshore accounts that Basson had access to but which were never reported to Knobel or CMC. Knobel did not object to this practice, he told the TRC, since the need to shield SADF from connection to Project Coast and the international sanctions against South Africa necessitated complex overseas financial arrangements that were too complicated for him to understand.[650]

Due to the covert nature of the program, the stated need to acquire equipment and material on the black market or to smuggle it into the country due to the embargo, and the limited oversight exercised by CMC, Basson was able to divert virtually all of the money allocated for overseas procurement from Project Coast and launder it through the WPW Group.[651] Government investigators found that Basson, through the WPW Group, had used his embezzlement to support a luxurious life style in South Africa and abroad for himself and his close colleagues. The WPW Group purchased a cottage in England, a lodge at the Fancourt golf club, a zoo in South Africa, a suite at Pretoria's main rugby stadium, a Jetstar and a King Air aircraft, and renovated a luxurious compound in Pretoria. Project Coast funds were also used for frequent and extravagant vacations within South Africa and to the United States and Europe.[652]

The second type of corruption was the structuring of Project Coast's financial arrangements so that select insiders benefited from the program's implementation and privatization. Basson, Dr. Wynand Swaenpol, managing director of RRL, and Dr. Philip Mijburgh, managing director of Delta G Scientific, became millionaires after the privatization of these front companies in 1991. In 1986, after RRL was up and running, the veterinarian Dr. Daan Goosen was removed from his position as the managing director of the facility on the basis of charges of poor management and receiving kickbacks from contractors. He was replaced by Dr. Wynand Swanepoel, a Special Forces dentist and close friend of Wouter Basson, who admitted to the TRC that he had no knowledge of the scientific work conducted at RRL. Shortly thereafter, Basson arranged a management change at Delta G Scientific with chemist and chief executive Willie Basson (no relation) being replaced by another of Basson's Special Forces colleagues, medical doctor Philip Mijburgh. Basson thus was able to replace the civilian scientists in charge of these front companies with two personal friends who were also members of the Special Operations Unit commanded by Basson.[653] This management shake-up was timed to just before the commercialization phase of Project Coast and resulted in Swanepoel and Mijburgh becoming millionaires after the "sale" of these companies to their management.[654]

Although annual audits of Project Coast accounts were conducted, in the absence of supporting documents, Basson's voucher for the expenditure was sufficient. No inventories of the equipment or materials he claimed to have purchased were conducted and the ultimate

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[650] Burger and Gould, *Secrets and Lies*, pp. 91-93; and Gould and Folb, *Project Coast*, p. 183.

[651] Burger and Gould, *Secrets and Lies*, pp. 91, 199.

[652] For the trips abroad, transportation was either by private jet, first class on commercial airlines, or on the Concorde. Vacation activities included golfing, hunting trips, stays at private game lodges, attending the Monaco Formula 1 Grand Prix race, going to Disney World, attending rugby matches, shopping, and dinner at five-star restaurants. Ibid., pp. 95-96, 121-140; and Gould and Folb, *Project Coast*, pp. 204-205.

[653] Burger and Gould, *Secrets and Lies*, pp. 39-41; and Gould and Folb, *Project Coast*, pp. 148-152.

[654] Swanepoel received a payment of R4 million ($1.5 million) when RRL was privatized in 1991 and Mijburgh earned a profit of R15 million ($5.4 million) from the privatization of Delta G. Burger and Gould, *Secrets and Lies*, p. 41; and Gould and Folb, *Project Coast*, pp. 67, 100, 143-144.

destination of the money transferred by Project Coast to foreign bank accounts was never questioned. As his boss, Niel Knobel, testified, "His word was enough. After all, the man was a brigadier, a senior military officer. If you can't trust him, who can you trust?"[655] By 1992, however, the financial irregularities of Project Coast had come to the attention of the Chief of Staff Finance, Military Intelligence, and the SADF's Auditor-General. Military Intelligence was responsible for the annual budgets of secret programs and would transfer the money from a secret military account to the project officer who would spend it at their discretion. With regards to Project Coast, these transfers were made to foreign bank accounts based on the signature of Basson or Knobel. Due to the need-to-know principle, no justification was required to authorize the transfer. Furthermore, Military Intelligence conducted no auditing of how the money was spent except for verifying that the proper signatures were on the paperwork and that the annual budget was not exceeded. This methodology was applied to all top-secret programs, not just Project Coast. At one point the SADF Inspector-General requested that an independent audit be conducted. Knobel rejected the request based on Basson's advice that such an audit could represent a security risk. Once again, Basson used secrecy as a means to shield his project's autonomy and hide his wrongdoing.[656]

Despite the array of evidence presented against him and the testimony of 153 witnesses for the prosecution, on April 11, 2002, after a 30-month trial, Wouter Basson was found not guilty or acquitted on all charges.[657] The government is appealing the verdict.[658]

The Misleading of Senior Civilian Officials

F. W. de Klerk's replacement of P. W. Botha as the President of South Africa in 1989 represented the beginning of the end of Project Coast. De Klerk ushered in a new era in South Africa's domestic politics and international relations by beginning a dialogue with opposition groups, including the African National Congress (ANC). These negotiations eventually led to the end of apartheid and genuine democratic elections in South Africa. Project Coast, however, refused to fade away. In 1989-1990, in the face of a declining foreign threat and military-wide spending cuts, all existing military projects were re-evaluated. The decline in the perceived threat of chemical and biological weapons led the Army in March 1990 to terminate a separate initiative, called Project Academic, to upgrade defenses against nuclear, biological and chemical weapons. There is no documentary evidence or testimony that a similar re-evaluation process was followed for Project Coast.[659] At this time, the senior civilian leadership believed that Project Coast was a strictly defensive program. De Klerk told interviewers that upon taking office in 1989, he had been briefed by Knobel that Project Coast was a defensive program.[660]

Basson continued to misrepresent the nature of Project Coast when he briefed de Klerk in March 1990.[661] De Klerk was told that the chemical program focused on the development and

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[655] Burger and Gould, *Secrets and Lies*, p. 108.

[656] Gould and Folb, *Project Coast*, pp. 175, 178-181.

[657] For a thorough description of the shortcomings of the judge's rulings in this case, see Center for Conflict Resolution, "Report on the Judgment in The State vs. Wouter Basson Delivered on 11 April 2002," *Trial Report No. 63*, undated, http://ccrweb.ccr.uct.ac.za/cbw/63.html.

[658] Mariette le Roux, "State May Have Another Chance to Get Basson," *Independent Online*, March 10, 2004, http://www.iol.co.za/index.php?click_id=15&art_id=qw1078928461744B252&set_id=1

[659] Gould and Folb, *Project Coast*, p. 110.

[660] Mangold and Goldberg, *Plague Wars*, p. 267.

[661] Wouter B. Basson, "Projek Coast: Voorligtig aan Statspresident," [Project Coast: Briefing of the State President], GG/UG/302/6/C123/BK, March 26, 1990, (as translated by the Centre for Conflict Resolution, South Africa), http://www.isn.ethz.ch/researchpub/publihouse/za_cbw/docs/CBW003.htm.

production of incapacitating and irritant chemical agents that were not prohibited by the Geneva Protocol. According to Julian Perry Robinson, a British expert on chemical weapons, the international consensus is that these chemicals were indeed covered under the protocol and cannot be used in military conflicts.[662] On the biological side, Basson reported that, "Our biological capacity is focused on staying up to date with the changing threat. To do this we are constantly producing new organisms in order to develop a preventative strategy as well as a strategy for treatment."[663] As a result of this briefing, De Klerk approved the continuation of the defensive chemical and biological programs while confining the offensive chemical program to the development of incapacitating and irritating chemical agents.[664]

Unbeknownst to de Klerk, the ostensibly defensive biological research program at RRL actually conducted almost exclusively offensive research.[665] A 1989 document authored by Basson demonstrates that the purpose of Project Coast was to develop both offensive and defensive capabilities and to support the employment of these capabilities by special forces, intelligence and internal security agencies, and the 7th Medical Battalion. According to this report, "Current biological warfare research focuses on offensive, epidemic agents. The researchers are also working on the development of new agents." In addition, the biological program included research on weaponization "to create a bridge between the agent on the one side and the ammunition on the other. Researchers are trying to develop the best possible distribution techniques for the agent."[666]

President de Klerk first learned of Project Coast's nefarious activities in 1992. In December 1992, General Pierre Steyn provided de Klerk with a secret report on criminal activities conducted by the SADF. Among other things, Steyn reported that the Seventh Medical Battalion was involved in a chemical biological warfare called Project Coast that engaged in assassination and drug trafficking. Although the report did not include concrete evidence to back up its accusations, the report led to the expulsion of 23 officers from SADF, including Wouter Basson. On March 31, 1993, de Klerk ordered the biological weapons portion of Project Coast closed down. On the same day, Basson was dismissed from SADF, but immediately rehired for one year to tie up loose ends.[667] The Steyn report also triggered an investigation by the Office of Serious Economic Offenses (OSEO) into Project Coast's financial arrangements that resulted in many of the charges levied against Basson in 1999.

Despite these investigations and mounting evidence of the project's improprieties, no further action was taken by the South African government to examine the history and conduct of Project Coast. Project Coast's past offensive activities, both research and employment, were effectively sanitized from South African government documents and briefings for South African and foreign officials. In December 1993, South Africa submitted a declaration to the United Nations on its past and current offensive and defensive biological activities as required by a

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[662] Gould and Folb, *Project Coast*, p. 118.

[663] Basson, "Projek Coast: Voorligtig aan Statspresident," [Project Coast: Briefing of the State President].

[664] Wouter Basson and Gen. D. P. Knobel, "Voorligting aan die Minister van Verdediging oor die verloop en huidige status van Projeke Coast en Jota te George op 7 Jan 1993," [Presentation to the Minister of Defense about the course and current status of Projects Coast and Jota at George on 7 January 1993], GG/UG/302/6/J1282/5, January 8, 1993, (as translated by the Centre for Conflict Resolution, South Africa), http://www.isn.ethz.ch/researchpub/publihouse/za_cbw/docs/CBW006.htm.

[665] Burger and Gould, *Secrets and Lies*, p. 26.

[666] Wouter B. Basson, "Projek Coast: Moontlikhede vir privatisering," [Project Coast: Possibilities for Privatization], SADF Document GG/UG/302/6/COAST/BFW, November 28, 1989, pp. 2-4, (as translated by the Centre for Conflict Resolution, South Africa), http://www.isn.ethz.ch/researchpub/publihouse/za_cbw/docs/EXHIB23B.htm.

[667] Gould and Folb, *Project Coast*, pp. 116-117, 209; and Mangold and Goldberg, *Plague Wars*, p. 267.

BWC confidence-building measure. The declaration stated that South Africa had not conducted offensive biological research and that defensive biological research programs had been conducted only in 1990 and 1992.[668] The declaration neglected to mention the offensive and defensive activities of RRL from the mid-1980s through 1991. A March 1994 document prepared for de Klerk repeated the claim that South Africa's biological research was defensive only and that "officially no biological agents were used offensively."[669]

South Africa's refusal to be fully open about its past chemical and biological warfare activities, to brief Mandela on these activities, or to exercise tighter control over Wouter Basson led to an April 11, 1994 meeting between the American and British ambassadors and President de Klerk.[670] While the South African officials resisted the demand to fully declare its past offensive activities, which they contended were unauthorized and against official policy, they did agree to brief Mandela on the SADF's defensive chemical and biological warfare program.[671] However, the value of this future briefing was thrown into question by an overview of Project Coast provided by Basson to the ambassadors. A document that may have been the basis for this briefing claimed that the goal of Project Coast was to develop self-sufficiency in chemical and biological defense through the establishment of defensive research and production facilities. In addition, South Africa sought to develop a retaliatory chemical capability, but not necessarily a lethal one, that would force an enemy to don protective gear. The document also claims that no biological weapons or delivery systems were developed by Project Coast.[672] This briefing is misleading in many ways. First, the emphasis on defense is misplaced since defensive work did not begin until 1988, seven years after the program began. Second, all other previous justifications for developing non-lethal agents focused on their role in crowd control or counterinsurgency, not as retaliatory weapon to deter an enemy from using chemical weapons. Third, RRL did in fact produce biological weapons and delivery systems, just not the traditional ones developed by other states.[673]

On April 22, 1994, one week before South Africa's first democratic multiracial elections, the American and British ambassadors held another meeting with de Klerk. De Klerk reaffirmed his commitment to brief Mandela, but after the election Mandela had still not briefed. Five days before the inauguration, U.S. Ambassador Princeton Lyman informed Mandela's aide Thado Mbeki about the issue and urged Mandela to seek a briefing.[674] Mandela finally received his briefing in August 1994 from Surgeon General Niel Knobel, but he was not fully informed on the program's previous activities. Knobel briefed Mandela that, "As an offensive option for SADF, BW were considered too dangerous because of the difficulty in controlling the spread of the organisms, and in any case would be ethically and morally unacceptable. For these reasons it

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[668] South Africa, Confidence Building Measure F: Declaration of Past Activities, December 15, 1993, cited in Gould and Folb, *Project Coast*, p. 100.

[669] "Further Background Information With Regards to the Biological Warfare Project for the State President," March 1994, (as translated by the Centre for Conflict Resolution, South Africa), http://www.isn.ethz.ch/researchpub/publihouse/za_cbw/docs/CBW050.htm. The author of the document is unknown. The document was found in 1997 in a trunk belonging to Basson that contained other Project Coast documents.

[670] Since 1993, the United States and United Kingdom had received reports that Basson had been traveling to Libya, a state suspected of developing both chemical and biological weapons. The first Anglo-American demarche to South Africa on this matter was sent in 1993. Mangold and Goldberg, *Plague Wars*, p. 269.

[671] Gould and Folb, *Project Coast*, pp. 210-211.

[672] "The South African CBW Programme," undated, cited in Gould and Folb, *Project Coast*, p. 212.

[673] Gould and Folb, *Project Coast*, p. 212.

[674] Ibid., pp. 212-213.

was decided that the SADF would only undertake extensive research into the BW threat possibilities and concentrate on countermeasures in case of the possible manipulation of local organisms by hostile parties."[675] Knobel also repeated to Mandela the false claim first put forward in the 1993 BWC declaration that South Africa had engaged only in defensive biological research.[676] The failure to disclose South Africa's past offensive activities extended to its 1995 BWC declaration. In this document, South Africa reported that it had run a defensive biological research and development program from 1987 to 1992, contrary to internal South African documents that showed that the program had run from 1983 to 1994. The declaration also reported that this defensive program had been motivated by a perceived biological weapons threat against South African forces in Angola. Gould and Folb report that no document regarding such a threat assessment has come to light. Finally, the declaration made no mention of RRL or of any of its research, development, production, and deployment of biological agents and devices for offensive purposes.[677] South Africa's declarations from 1996 to 2000 repeated the same information despite the startling revelations about the program exposed by the TRC hearings and the Basson trial.

Proliferation

The secrecy and autonomy with which Project Coast had been run for over ten years not only made it very difficult for the senior political leadership to gain a complete understanding of the program and to make it transparent to outsiders, but also compromised their efforts to properly dismantle the program. In January 1993, the Minister of Defense ordered Basson to destroy the chemical and biological materials produced and purchased by Project Coast and to destroy the project's documents after key data was transferred to CD-ROMs.[678] Basson later reported to the CMC that he had accomplished both tasks. However, there were no documents or witnesses to certify the destruction of either the materials or the documents.[679] Nevertheless, South African officials accepted Basson's claims and reassured the United States and United Kingdom that the offensive program had been terminated and all materials of proliferation importance had been destroyed or were "under strict centralized control."[680] Basson's 1997 arrest clearly demonstrated that he had not followed these orders and had lied to his superiors.

On January 29, 1997 Basson was arrested for the possession of a large quantity of illegal narcotics, including over 3,000 capsules of MDMA (also known as Ecstasy) and 1000,000 tabs of methaqualone (also known as Mandrax). Both of these drugs had been produced by Delta G before the termination of Project Coast as part of a research program on using street drugs as incapacitating chemical weapons for crowd control.[681] Furthermore, after his arrest, numerous classified technical documents from Project Coast were found in two trunks belonging to Basson.

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[675] D. P. Knobel, "Briefing to President Mandela on the Defensive Chemical and Biological Warfare Programme of the SADF and the RSA's Position with Regard to the CWC and BWC," CG/UG/302/J1282/5, August 18, 1994, p. 3, http://cryptome.org/mandela-cbw.htm.

[676] Ibid., p. 8.

[677] Gould and Folb, *Project Coast*, pp. 213-214.

[678] Burger and Gould, *Secrets and Lies*, pp. 26-27; and Gould and Folb, *Project Coast*, p. 214.

[679] Gould and Folb, *Project Coast*, pp. 214-216, 222.

[680] Knobel, "Briefing to President Mandela on the Defensive Chemical and Biological Warfare Programme of the SADF and the RSA's Position with Regard to the CWC and BWC," p. 13.

[681] The actual fate of the 1,000 kilograms of methaqualone (Mandrax), 912 kilograms of MDMA (Ecstasy), 37 kilograms of cocaine, and 980 kilograms of the chemical incapacitating agent BZ that Basson claimed to have disposed of in January 1993 is unknown. Gould and Folb, *Project Coast*, pp. 217-218.

Scientists from RRL reported that they had also retained copies of their research reports.[682] It later emerged that Basson and his staff had also not destroyed the stocks of biological cultures as they were supposed to when the program was closed down. Goosen, the former director of RRL, maintained a personal collection of 150 strains collected by or developed by the project, including *B. anthracis,* and six genetically modified strains such as an *E. coli* strain that produces the toxin of *C. perfringens.*[683] Other scientists also retained copies of strains to continue working on vaccines and therapeutic treatments with commercial prospects.[684] Goosen and other scientists previously involved with Project Coast have reportedly been approached by foreign countries and extremist groups seeking chemical and biological weapons.[685] Basson's involvement in drug trafficking clearly illustrates the risk that former weapons scientists could sell their know-how or access to highly valuable materials on the black market.

Conclusion

Project Coast is a stark example of how secrecy, compartmentalization, and organizational autonomy can impede effective oversight, undermine civilian control, and distort decision-making. After holding seven days of hearing on Project Coast, receiving testimony from eleven former participants, and reviewing previously classified documents, the TRC found that, "Inevitably, the CBW programme achieved little of value or of common good. Enveloped as it was by secrecy, threats and fear, opportunism, financial mismanagement, incompetence, self-aggrandisement, together with a breakdown in the normal methods of scientific discourse, the results were paltry. Tens, even hundreds, of millions of rands were squandered on ideas that had no scientific validity. At best, the programme succeeded in producing for manufacture analogues of CR and BZ incapacitants, and in making local arrangements for protective clothing for troops against mass chemical and biological attack. At worst, the programme had criminal intent."[686]

Basson exploited his position to engage in illegal and unethical activities that not only enriched himself and his closest associates, but also likely led to mass murder with poison and disease.[687] Gould and Folb believe that the ability of Project Coast to evade SADF's normal financial and security controls was not due solely to Basson's efforts. They believe that there was a decision made by the senior SADF leadership that the project should operate with the minimal amount of control in order to ensure plausible deniability.[688] According to Knobel, Basson was given *carte blanche* to obtain the desired results. As Burger and Gould paraphrased Knobel: "The end totally justified the means, and if that meant that Basson had to lie, steal or bribe people, no one in SADF would blink an eye. Who he dealt with and how he achieved he desired results were 'details' that members of the CMC specifically did *not* want to know."[689] The lack

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[682] Ibid.,, p. 222.

[683] Goosen attempted unsuccessfully to sell this collection to the United States government in 2002. Warrick and Mintz, "Lethal Legacy," p. A1.

[684] Warrick, "Biotoxins Fall Into Private Hands," p. A1.

[685] Robert Block, "Bitter Researchers Are Big Question in Germ Warfare," *Wall Street Journal*, May 20, 2002, p. A1; Warrick, "Lethal Legacy," p. A1; and Gould and Folb, *Project Coast*, pp. 207-208

[686] TRC, *Truth and Reconciliation Commission of South Africa Report*, Vol. 2, p. 521.

[687] In 1999, Basson was charged with multiple counts of murder, attempted murder, and conspiracy to murder. Although Project Coast scientists testified to the production of assassination weapons under orders from Basson and members of Special Forces units testified to using such devices to carry out murders and executions, Basson denied that he was involved in any way with these operations. The judge found him not guilty or acquitted him of these charges. Gould and Folb, *Project Coast*, p. 240.

[688] Gould and Folb, *Project Coast*, p. 186.

[689] Burger and Gould, *Secrets and Lies*, p. 20 (emphasis in original).

of controls allowed Project Coast to develop sufficient autonomy to resist later efforts to exercise more stringent oversight over the program's finances and activities. In addition, the highest levels of the South African government, the United Nations, and the American and British governments were consistently misled about the nature of Project Coast. The lack of adequate oversight also made it difficult for Pretoria to shut down the program in a complete and verifiable manner. This allowed Basson and other Project Coast scientists to divert project materials for their own purposes, which increased the risk of chemical and biological weapons proliferation.

CONCLUSION

Biological weapons programs operate under extreme secrecy and compartmentalization for legal, normative, and strategic reasons. As a result, these programs are able to attain a high degree of autonomy that obstructs civilian oversight and distorts decision-making. The security implications are subtle but disturbing. Biological weapons program are able to escape review by senior officials, leading to a dissonance between military means and political ends in a state's grand strategy.[690] Moscow's strategy of reconciliation and cooperation with Western powers under Gorbachev and Yeltsin was undermined by the continuation of the biological weapons program in violation of the BWC. As a result, such reviews are typically conducted as a result of external pressure that raises the cost of the dissonance. The efforts by Gorbachev and Yeltsin to rein in the offensive program were triggered by, and sustained by, diplomatic pressure from the United States and United Kingdom. South Africa's biological weapons program was shut down due to a series of criminal investigations into illegal activities committed by Basson, the program's manager. Another example of the role of external pressure in triggering a long overdue review of chemical and biological weapons policies can be found in the United States' unilateral abandonment of biological weapons in 1969. Mounting scientific and congressional opposition to the use of riot control agents and herbicides in Vietnam and the testing of chemical weapons in the United States led to the first National Security Council review of the United States' chemical and biological weapons program in over 15 years. The review resulted in the termination of the offensive biological weapons program and the United States' renunciation of the use of biological weapons.[691]

Even if senior officials attempt to monitor the biological weapons program, such oversight may be compromised by uncooperative program managers who can exploit their monopoly on information to mislead senior officials. The motive for such manipulation may be merely bureaucratic maneuvering to maintain or increase budget, prestige or autonomy, or be an attempt to avoid accountability for unethical or illegal activities. The leaders of Biopreparat and the military's biological weapons program repeatedly misled and lied to the civilian leadership in order to justify the continuation of their programs. Basson also misled his superiors in order to conceal his involvement in assassination operations and to cover-up his fraud, embezzlement, and drug trafficking. As a result, government leaders may not know the full extent and nature of past and current activities. However, since these leaders have an incentive to distance themselves from such activities, it may be difficult to determine to what extent they are truly ignorant or are turning a blind eye. This false information may also be propagated internationally through incomplete and inaccurate declarations to the United Nations and negotiating partners.

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[690] On the dangers of a lack of political-military integration, see Posen, *The Source of Military Doctrine*, pp. 24-29.
[691] See Tucker, "A Farewell to Germs," pp. 107-148.

Organizations that enjoy a high degree of autonomy also allow managers to hinder the implementation of unwelcome policies and resist efforts to comply with international obligations. Kalinin's manipulation of Gorbachev's May 1990 decree and the military's domination of chemical and biological weapons policy making under Yeltsin allowed the continuation of illegal activities, the maintenance of offensive capabilities, and a failure to fully divulge the program's past activities. This resistance, coupled with the withholding of information from senior political leaders, can make it more difficult to negotiate arms control and nonproliferation measures in good faith, especially if the other party has access to information that the leadership does not. The United States and United Kingdom faced these problems when working with the Soviet, Russian, and South African governments to bring them into compliance with the BWC.

Finally, the lack of adequate oversight increases the risk that such programs, or the remnants of these programs, could become the source of expertise, materials, or weapons for terrorists or other states. In both Russia and South Africa, former participants in the biological weapons program have offered such resources on the international market and been approached to supply these resources to states and terrorists. The case of Dr. Abdul Qadeer Khan's extensive covert assistance to nuclear programs in Iran, Libya, North Korea, and possibly elsewhere, demonstrates the proliferation risks inherent in an opaque weapons program that lacks appropriate oversight and accountability mechanisms.[692]

[692] See Guarav Kampani, "Proliferation Unbound: Nuclear Tales from Pakistan," *CNS Research Story*, February 23, 2004, http://www.cns.miis.edu/pubs/week/040223.htm.

Chapter 6. Flawed Threat Assessment

States tend to have flawed assessments of the biological warfare intentions and capabilities of their adversaries. The multi-use nature of biotechnology, the overlap between offensive, defensive, and civilian activities, and the lack of easily detectable signatures for offensive programs, as described in chapter 3, and the strict secrecy that shrouds biological programs, as described in chapter 5, combine to make these weapons a notoriously difficult target for intelligence agencies. According to the CIA's top nonproliferation analyst in 1999, "Biological weapons (BW) pose, arguably, the most daunting challenge for intelligence collectors and analysts."[693] Assessing the biological threat posed by terrorists is even more difficult given the intensively secretive nature of such organizations. Biological threat assessments must take into account not only multi-use capabilities that are challenging to monitor, but also intentions that are even more difficult to discern.[694] Due to multi-use nature of biotechnology, properly gauging intent is crucial to determining the purpose and significance of an observed capability or activity. Assessing intentions, however, has traditionally been the most difficult challenge for intelligence agencies. Intentions are not physical objects that can be easily observed, but beliefs and plans that may be subject to rapid change and be known to only a handful of people. In addition, indicators of intent are frequently ambiguous, fragmentary, and contradictory. As a result, the most valuable intelligence on biological threats has most often been that provided by human sources, either defectors or informants, with inside knowledge of the program.

The historical record is replete with flawed biological threat assessments that have resulted in significant overestimates and underestimates of an adversary's biological warfare capabilities and intentions. During World War II, both the Allied and Axis powers had poor intelligence on the facilities, scientists, and agents involved in the biological warfare programs of the other side.[695] The United States grossly underestimated the Japanese biological warfare program until it was able to interview personnel captured during and after the war.[696] In contrast, because of their misreading of German intentions, the Allies' fear of a German biological warfare program was greatly exaggerated.[697] As John Moon has observed, "Since biological warfare intelligence was a 'black hole,' policy experts had to assume the worst: their enemies had the capacity and the ruthlessness to use any means at hand if the need arose."[698] This fear spurred crash programs by the Allies to develop a range of offensive and defensive biological warfare capabilities.[699] The implications of these flawed threat assessments is discussed in the

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[693] Statement by John A. Lauder, Special Assistant to the Director of Central Intelligence for Nonproliferation, to the House Permanent Select Committee on Intelligence, *Worldwide Biological Warfare Threat*, March 3, 1999, http://www.cia.gov/cia/public_affairs/speeches/archives/1999/lauder_speech_030399.html.

[694] For a primer on the analytical process for biological threat assessment, see Pearson, "The Essentials of Biological Threat Assessment," pp. 55-83.

[695] Erhard Geissler, John Ellis van Courtland Moon, and Graham S. Pearson, "Lessons from the History of Biological and Toxin Warfare," in Geissler and Moon, *Biological and Toxin Weapons,* pp. 260-263.

[696] Harris, *Factories of Death*, pp. 160-204.

[697] Adolf Hitler had forbidden the development of biological weapons and, as a result, Germany conducted very little offensive biological research during the war. Erhard Geissler, "Biological Warfare Activities in Germany, 1923-1945," in Geissler and Moon, *Biological and Toxin Weapons*, pp. 99-102.

[698] John Ellis van Courtland Moon, "U.S. Biological Warfare Planning and Preparedness," in Geissler and Moon, *Biological and Toxin Weapons*, p. 216.

[699] Geissler, Moon, and Pearson, "Lessons From the History of Biological and Toxin Warfare," in Geissler and Moon, *Biological and Toxin Weapons*, pp. 259-260.

next section, followed by a description of the process for evaluating intelligence assessments, and summaries of the findings of the four case studies.

Implications of Flawed Threat Assessments

Accurate and timely intelligence has long been regarded as a crucial element in defending against biological weapons. In 1969, President Nixon stated that the unilateral renunciation of biological weapons would not "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."[700] The historical record suggests, however, that intelligence on foreign biological warfare programs and biological terrorist groups will not be sufficient to prevent surprises. The difficulty in conducting accurate biological threat assessments has several implications.

First, without adequate intelligence, it is more difficult to develop and deploy effective defenses. The agent-specific nature of most medical countermeasures and diagnostic and detection systems requires advance knowledge of which agents an adversary is developing. As a result, it is "an established principle that offensive developments will always lead and drive defensive developments."[701] In addition, without credible intelligence indicating that an adversary's biological warfare program poses a significant threat, it may not be possible to mobilize the resources for researching and fielding defenses against the threat.

Second, without credible intelligence, it is much more difficult to rally domestic and international support for diplomatic efforts to bring states into compliance with their biological disarmament obligations. Paradoxically, the reluctance to share sensitive information may limit the utility of the most useful types of intelligence on foreign biological warfare programs, such as that provided by spies and defectors.[702] Allegations of biological weapon development or use that prove to be false are likely to cause long-term credibility problems for the accuser. This loss of credibility may complicate future efforts to obtain public and international support for measures to combat the threat of biological weapons.

Third, poor intelligence hampers efforts to use inspectors to verify a state's compliance with biological arms control agreements. As demonstrated by the experiences of the United States and United Kingdom in the Soviet Union and Russia and UNSCOM in Iraq, accurate intelligence is crucial for planning, conducting, and analyzing inspections.[703] However, the poor record of U.S. intelligence on assessing foreign biological weapons programs should give pause to biological arms control advocates who take comfort in the fact that the intelligence community successfully predicted every Soviet intercontinental ballistic missile (ICBM) *before* it was tested.[704] The performance of the U.S. intelligence community in monitoring Soviet strategic nuclear forces is not an appropriate indicator of their ability to obtain accurate intelligence on

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[700] "Statement by the President," Office of the White House Press Secretary, November 25, 1969, p. 2, Nixon papers.

[701] Thomas Dashiell, "The Need for a Defensive Biological Research Program," *Politics and the Life Sciences*, Vol. 9, No. 1 (August 1990), p. 89.

[702] According to a participant in the debate on how to confront the Soviet Union with the information provided by Pasechnik in 1989, "We were worried about not being able to convince people because our evidence was secret." Mangold and Goldberg, *Plague Wars*, p. 103.

[703] David C. Kelly, "The Trilateral Agreement: Lessons for Biological Weapons Verification," in Trevor Findlay and Oliver Meier, eds., *Verification Yearbook, 2002* (London: VERTIC, 2002), p. 104; and Tim Trevan, "Exploiting Intelligence in International Organizations," in Zilinskas, *Biological Warfare*, pp. 207-224.

[704] Barbara Hatch Rosenberg and Gordon Burck, "Verification of Compliance with the Biological Weapons Convention," in Wright, *Preventing a Biological Arms Race*, p. 305 (italics in original).

biological weapons programs. Indeed, the low quality of U.S. intelligence provided to UNMOVIC on Iraq's weapons of mass destruction programs in 2002-2003 was more of a hindrance than a help.

The fourth implication is that poor intelligence may lead to false optimism and the outbreak of crises and war. Intelligence that indicates that an adversary does not possess biological weapons, or only meager offensive capabilities, may contribute to a state's assessment that its adversary is weak and susceptible to diplomatic or military pressure. False optimism has historically played an important role in the outbreak of wars.[705] This outcome, however, is unlikely. Since intentions are key to determining the purpose and significance of multi-use biotechnology capabilities, even peaceful and defensive activities of a state viewed as hostile are likely to be considered suspicious. This suspicion is likely to lead to the opposite danger of false optimism: worst-case planning.

Fifth, in the absence of firm and reliable intelligence, governments may engage in worst-case planning and undertake an exaggerated reaction to perceived threats.[706] In light of the similarities between offensive and defensive biological warfare activities, interpreting uncertain intelligence in this way could lead to a security dilemma where states take actions to improve their own defense that inadvertently threatens other states.[707] As the number and size of national biological defense programs increases in response to the threat of biological warfare, other states may perceive these activities as threatening, thereby providing a justification for initiating or continuing a biological weapons program. Worst-case assessments of an adversary's biological warfare capabilities and intentions are especially likely if the adversary is viewed as particularly difficult to deter. The logic of preventive action reduces the threshold of evidence required to justify action because an attack is viewed as inevitable and the consequences of such an attack are perceived as being large. This phenomenon was observed in both the Clinton Administration's decision to strike the Al Shifa pharmaceutical plant in Sudan in 1998 and the Bush Administration's decision to invade Iraq in 2003.

Timely and reliable intelligence will not negate the threat posed by biological weapons, but it would help states calibrate defensive and diplomatic responses to these threats and reduce the likelihood of counterproductive actions.

Evaluating Biological Threat Assessments

Evaluating the accuracy of biological threat assessments is a difficult undertaking.[708] Two requirements must be met for this exercise to be meaningful. The first requirement is having a complete record of a state's intelligence on an adversary's biological warfare capabilities and intentions with enough detail to identify sources of information, analytical assumptions, and standards of evidence for conclusions. Having access to documents that provide such detail over time is more useful than infrequent snapshots. Studying the evolution of threat assessments over time allows the evaluator to determine to whether changes in intelligence assessments were due

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[705] Geoffrey Blainey, *The Causes of War* (New York: Free Press, 1988), pp. 35-56; and Van Evera, *Causes of War*, pp. 14-34.

[706] Robert Jervis, *Perception and Misperception in International Politics* (Princeton, N.J.: Princeton University Press, 1976), pp. 64-66.

[707] Jervis, "Cooperation under the Security Dilemma," pp. 169-170.

[708] For excellent studies on U.S. estimates of the Soviet strategic nuclear threat during the Cold War, see John Prados, *The Soviet Estimate: U.S. Intelligence Analysis and Soviet Strategic Forces* (Princeton, N.J.: Princeton University Pres, 1986); and Lawrence Freedman, *US Intelligence and the Soviet Strategic Threat* (Princeton, N.J.: Princeton University Press, 1986).

to new evidence, reinterpretation of existing information, competing interpretations of the same evidence, or responses to political or bureaucratic pressures. The second requirement is a comprehensive record of what the adversary's biological warfare capabilities and intentions actually were. This "ground truth" provides a benchmark against which the accuracy of the intelligence can be assessed. Such details are typically unavailable to academics, but a combination of independent inspections, investigative journalism, and knowledgeable defectors have provided insights into the biological weapons programs of the former Soviet Union and Iraq.

The most comprehensive such study in the open literature was conducted by Graham Pearson, the former director general of the Chemical and Biological Defense Establishment at Porton Down in the United Kingdom. He found that the U.S. biological threat assessments of Iraq and the Soviet Union were "broadly correct."[709] This study was handicapped, however, by its failure to exploit declassified intelligence documents to develop a deeper understanding of U.S. biological threat assessments and to utilize the testimony of defectors and former participants in these programs to develop a more detailed account of actual Soviet and Iraqi biological weapons activities. The evaluations conducted in this chapter are as comprehensive as possible given the restrictions on the release of intelligence documents and the lack of access to definitive accounts of Moscow's and Baghdad's biological warfare capabilities and intentions.

This chapter evaluates the U.S. intelligence community's assessments of the Soviet biological weapons program during the Cold War, Iraq's biological weapons program prior to the 1991 Gulf War, and Iraq's biological warfare capabilities and intentions prior to Operation Iraqi Freedom in March 2003. These are the only three modern cases where sufficient material is available to compare intelligence assessments with the ground truth.[710] In addition, the grave difficulty of law enforcement and intelligence agencies to detect and identify bioterrorist groups is briefly examined. A review of modern bioterrorism incidents reveals that almost every case of prevention, preemption, and attribution has been possible when law enforcement agencies have received information from a defector or informant. As a result, it is possible that a terrorist group with the motivation and capability to use biological weapons could emerge with little or no warning.

In contrast to Pearson, I found that during the Cold War, the United States and its allies lacked a clear understanding of the Soviet biological weapons program. According to a 1970 U.S. interagency report, "Useful intelligence on actual production, weaponization and stockpiling remains nonexistent, and information on the Soviet biological warfare program remains incomplete in almost all important details."[711] This lack of intelligence led to an underestimation of the size and sophistication of the Soviet biological warfare program that was only revealed in 1989 by the defection of Vladimir Pasechnik, a high-ranking member of Biopreparat and the director of a key biological weapon research institute. Based on his information, British and American intelligence doubled their estimates of the number of Soviet biological warfare facilities.[712] When the full extent of the Soviet biological weapons program

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[709] Pearson, "The Essentials of Biological Threat Assessment," pp. 71-79.

[710] Another potential case study is Libya, but insufficient information has been released to date on Libya's biological activities to evaluate the accuracy and completeness of the U.S. assessment of Libya's biological weapon program.

[711] Interdepartmental Political Military Working Group, *Annual Review of United States Chemical Warfare and Biological Research Programs as of 1 November 1970*, p. 19.

[712] Bill Gertz, "Defecting Russian Scientist Revealed Biological Arms Efforts," *Washington Times*, July 4, 1992, p. A4; and R. Jeffrey Smith, "Russia Fails to Detail Germ Arms," *Washington Post*, August 31, 1992, p. A1.

was finally revealed by defectors, even the skeptics in the intelligence community had to acknowledge that the most alarmist analysts had in fact been underestimating the threat.

In addition, U.S. intelligence on Iraq's biological weapons program prior to the 1991 and 2003 wars was seriously flawed. While the United States correctly assessed that Iraq had begun production of two biological warfare agents and had probably filled these agents into munitions, the intelligence community failed to identify virtually all of Iraq's key biological weapons facilities, including the main production plant at Al Hakam. As a result, Iraq's biological weapons production infrastructure emerged virtually unscathed from the Gulf War. Prior to Operation Iraqi Freedom in March 2003, the U.S. intelligence community grossly exaggerated Iraq's biological warfare capabilities. The intelligence community believed that Iraq had an active weapons program that was even larger and more advanced than it was in 1991 as well as stocks of biological weapons and mobile production facilities.[713] The reported results of the Iraq Survey Group (ISG), which has been probing the history of Iraq's weapons of mass destruction programs since June 2003, has shown that virtually every aspect of the United States' biological threat assessment was deeply flawed. The overestimation of Iraq's biological weapons capabilities contributed to the Bush Administration's justification for preventive war against Iraq in 2003.

U.S. ASSESSMENT OF THE SOVIET BIOLOGICAL WEAPONS PROGRAM

American intelligence regarding Soviet biological warfare intentions and capabilities was woefully inadequate throughout the Cold War. Pearson's finding that the U.S. assessment of Soviet biological warfare agents and facilities were "broadly correct" is too kind.[714] My findings are in accordance with those of Jonathan Tucker and Raymond Zilinskas who concluded that, "It appears that the U.S. intelligence community had no firm evidence during this time that the Soviet Union possessed an offensive BW program."[715]

The Soviet Union was particularly adept at exploiting secrecy, the multi-use nature of biotechnology, and the overlap between offensive, defensive, and civilian biological activities to conceal its biological weapons program. The Soviet Union's totalitarian government, intrusive security services, and the vastness of its territory facilitated its obsessive pursuit of secrecy. The Soviet biological weapons program had, in fact, been closely associated with the internal security services since its inception.[716] The variety and extent of disease in the Soviet Union caused by pathogens that were also viewed as candidate biological warfare agents also made it difficult to interpret the purpose of Soviet activities in this field. Since these diseases were legitimate public health, veterinary, or agricultural problems, extensive research on these diseases for peaceful purposes was justifiable. The Soviets were also known to have a robust biological defense program, which was seen as an extension of the overall Soviet investment in strategic defenses. In addition, the Soviet emphasis on live vaccines and aerogenic immunization (delivering vaccines through an aerosol instead of direct injection) provided additional cover for research, production and testing activities with direct applicability to developing biological weapons.[717] The Soviet Union also possessed one of the largest biotechnology industries in the world with

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[713] CIA, *Iraq's Weapons of Mass Destruction Programs* (Langley, Va.: CIA, October 2002), pp. 2, 13-17.

[714] Pearson bases his assessment of U.S. intelligence on a single unclassified Defense Intelligence Agency report from 1986. Pearson, "The Essentials of Biological Threat Assessment," p. 79.

[715] Tucker and Zilinskas, "Introduction," p. 11.

[716] See chapter 5.

[717] DIA, *Chemical and Biological Warfare Capabilities—USSR*. DST-1600S-034-76-SUP-1, March 1976, p. 247-248, Box 13, NSA.

over 100,000 workers, 200 factories, and 150 research centers.[718] This industry was actively used to conceal offensive facilities and activities.[719] In effect, the United States intelligence community had to contend with lots of "noise" as well as an adversary who was skilled in masking "signals" that could reveal information about its development of biological weapons.

This case study describes and then evaluates U.S. intelligence on the Soviet biological weapons program during two periods, from 1945 to 1970 and from1970 to 1990. During the first period, the United States struggled to piece together a coherent picture of the Soviet program from human sources, scientific publications, and overhead reconnaissance systems. The lack of hard evidence, however, frustrated analysts and contributed to misinterpretation and underestimation of Soviet activities in this field. During the second period, more compelling information from satellites and human sources became available regarding suspect biological weapon sites, but the purpose and activities of most of these sites remained ambiguous. The scope, scale, and sophistication of the Soviet biological warfare program was not revealed until the defection of key scientists beginning in 1989.

U.S Intelligence on the Soviet Biological Weapons Program, 1945-1970

The U.S. assessment of Soviet biological warfare activities during this period oscillated considerably due to the paucity of hard evidence and multiplicity of plausible interpretations of the available information. From the end of World War II through the late 1950s, the United States remained suspicious that the Soviet Union had a biological weapons program, but lacked the evidence to demonstrate this. These suspicions were based on the reports of Soviet human sources obtained by German intelligence during World War II and additional low-grade intelligence acquired by the United States after the war. More valuable, yet still ambiguous, information was available from Soviet scientific publications and U-2 reconnaissance aircraft by the late 1950s for the intelligence community to reach firmer conclusions about Soviet biological warfare activities. Reinterpretation of this evidence in the mid-1960s led the CIA to judge that the Soviet program was small and relatively primitive. By the late 1960s, conflicting interpretations of Soviet biological warfare activities had re-emerged. Following a description of U.S intelligence on the Soviet biological program between 1945 and 1970, the accuracy of these shifting biological threat assessments are evaluated.

Suspicion and Speculation

The United States knew virtually nothing about Soviet biological warfare intentions or capabilities until the end of World War II.[720] The capture of Japanese and, particularly, German personnel knowledgeable about Soviet biological warfare activities at the end of World War II provided America with its first, albeit uncertain and unconfirmed, insights. The most valuable information was obtained from Dr. Heinrich Kliewe, a leading bacteriologist who became part of

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[718] The Soviet Union was the world's largest producer of single cell protein and microbial pesticides. Anthony Rimmington, *Ex-USSR Biotechnology Industry* (York, United Kingdom: Technology Detail, 1994), p. 5.

[719] Soviet denial and deception techniques included putting the same organization in charge of both civilian and weapons facilities, conducting civilian research at weapons facilities, conducting weapons-related research at unsuspecting civilian institutes, co-locating civilian and weapons facilities, and converting civilian pharmaceutical and biopesticide plants to biological warfare agent production in time of war. In addition, the Soviets developed elaborate legends for weapons-related facilities and research activities and devoted significant resources to counterintelligence operations and technologies.

[720] CIA, *The Soviet BW Program: Scientific Intelligence Research Aid,* OSI-RA/61-3, Office of Scientific Intelligence, April 24, 1961, p. 1, http://www.foia.cia.gov.

the German biological research program during World War II, and Walter Hirsch, former chief of chemical weapons research, development, and testing and head of the German biological warfare planning committee.[721] The information provided independently by Hirsch and Kliewe to the United States is fairly consistent and appears to be based on the same two Soviet sources debriefed by German intelligence in 1942. These sources, a former biological warfare scientist and air force officer, provided details about the activities of Soviet biological warfare research and testing sites in Leningrad, Moscow, Gorodmylia Island, and Vozrozhdeniya Island in the Aral Sea. A wide range of agents were reportedly researched and tested in a variety of munitions and dissemination devices with the primary focus on *B. anthracis*, *F. tularensis* (the bacteria that causes tularemia), *Y. pestis,* and *Vibrio cholerae* (the bacteria that causes cholera).[722] At that time, the United States had no way of confirming the validity of the information provided by these sources. Nevertheless, twenty years later, the information provided by Hirsch was still considered "one of the pillars upon which the still incompletely known historical developments of Soviet BW activities has been partially reconstructed."[723]

The quality of the information the United States obtained on biological warfare-related activities in the Soviet Union for the first decade after World War II remained low. The CIA was only able to report vague generalities about Soviet activities in this field. According to a 1949 report, "The USSR is certainly alert to the possibilities of BW. It is believed that certain people and places in the USSR have something to do with BW...In short, it is not yet possible to produce intelligence for specific guidance of U.S. defense against BW."[724] The supposition that the Soviets had a biological warfare program was based on the following logic: "Because the Soviets have long been aware of BW, because they felt they needed BW defenses during World War II and a potent weapon to offset their lack of the atomic bomb after World War II, because they have scientists capable of developing BW based on the open literature from the United States, and because they have areas where such work can proceed in secrecy, it is believed that research and development on BW is being carried out in unidentified places in the USSR."[725] This assessment was not based on any hard evidence. According to a 1950 Army intelligence report, 44 biological warfare research centers in the Soviet Union had been reported with four partially confirmed and one confirmed beyond reasonable doubt by separate intelligence reports.[726] Five years later, however, the same agency stated that since the 1930s more than 50 Soviet installations had been reported as being linked to biological weapons research, but that no

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[721] Geissler, "Biological Warfare Activities in Germany, 1923-1945," p. 97.

[722] Walter Hirsch, *Soviet BW and CW Preparations and Capabilities* (Washington, D.C.: U.S. Army Chemical Intelligence Branch, May 15, 1951), pp. 101-113. The information provided by Kliewe is summarized in Office of Naval Intelligence, *Naval Aspects of Biological Warfare*, August 5, 1947, pp. 46-51, General Records of the Department of the Navy, RG 80, National Archives II, College Park, Maryland [hereafter NA].

[723] CIA, *The Soviet BW Program*, p. 1.

[724] This assessment was based on the reports of four unrelated informants who had been interrogated in great detail by the Soviets after World War II regarding biological warfare. The CIA interpreted this as indicating Soviet knowledge of and interest in biological warfare. CIA, *Quarterly Review of Biological Warfare Intelligence*, First Quarter, 1949, OSI/SR-1/49, May 13, 1949, p. ii, Declassified Document Reference System [hereafter DDRS].

[725] CIA, *Estimate of the Situation in BW Intelligence in the USSR*, OSI/SB-8/49-1, October 7, 1949, p. 1, DDRS.

[726] Department of the Army, *Preliminary Report on Soviet Activities and Capabilities in Biological Warfare Research and Development* (Washington, D.C.: Intelligence Division, General Staff of the United States Army, October 12, 1950), U.S. Army Military History Institute, Carlisle, Pennsylvania [hereafter MHI].

conclusive connections had been made to any of them.[727] Soviet defectors during the 1950s did not reveal any significant information about the Soviet biological weapons program.[728]

As a result of the paucity of any current information, intelligence assessments of Soviet biological warfare activities through the 1950s were based primarily on extrapolations from the Hirsch report, assumptions derived from the United States' experience with biological warfare, and speculation.[729] The intelligence community assessed that the Soviet Union had an interest in biological warfare and that a research and development program existed. The lists of agents that the Soviets were believed to be interested in were the same as those developed by the United States and its allies during World War II. Some reports also indicated a specific Soviet interest in *B. anthracis*, *F. tularensis*, *Y. pestis* and *Brucella* spp. (there are several species of bacteria in the *Brucella* genus that cause brucellosis) for anti-personnel purposes. In addition, rinderpest and foot and mouth disease, both highly contagious viruses lethal to cattle, were believed to be under investigation for use in anti-livestock biological warfare.[730] The assessments also acknowledged that they did not have any direct evidence of research, production, or testing of biological agents or weapons and had not definitively identified any installations conducting these activities. The Soviet threat during this time was perceived to be primarily from sabotage operations. This was probably due to the perceived American vulnerability to this form of attack, the ease of developing this capability without detection, and the failure to identify large-scale production facilities or uncover evidence of testing or deployment of biological weapons.[731] Despite this lack of evidence, Soviet capabilities for biological warfare were also commonly assumed to be generally equivalent to those of the United States.[732]

Senior policy-makers and intelligence officials were aware of the poor state of intelligence on the Soviet biological weapons program throughout the 1950s. In 1952, the Secretary of Defense complained that, "Current intelligence on this subject is so sparse that it does not provide a satisfactory basis for overall evaluation or formulation of Department of

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[727] Department of the Army, *Soviet Biological Warfare Capabilities*, Intelligence Staff Study (Washington, D.C.: Office of the Assistant Chief of Staff, G-2, September 9, 1955), MHI.

[728] Key defectors during this period included GRU Lt. Gen Petr Popov, and GRU Maj. Gen. Dimitry Polyakov. Mangold and Goldberg, *Plague Wars*, p. 48.

[729] See Joint Intelligence Group (JIG) 297/3, *Note by the Secretaries to the Joint Intelligence Committee on Soviet Capabilities for Employing Biological and Chemical Weapons*, 27 January 1949, Box 2, NSA; CIA, *Estimate of the Situation in BW Intelligence in the USSR*, October 7, 1949; CIA, *Probability of Soviet Employment of BW and CW in the Event of Attacks Upon the US*, National Intelligence Estimate 18, January 10, 1951, File 6, NIE Box 1, Records of the Central Intelligence Agency, RG 263, NA; CIA, *Soviet Capabilities for Clandestine Attack Against the US With Weapons of Mass Destruction and the Vulnerability of the US to Such Attack (Mid-1951 to Mid-1952)*, National Intelligence Estimate 31, September 4, 1951, File 16, NIE Box 1, RG 263, NA; CIA, *Soviet Gross Capabilities for Attack on the US and Key Overseas Installations and Forces Through Mid-1959*, National Intelligence Estimate 11-56, March 6, 1956, FOIA; and CIA, *Soviet Capabilities and Intentions With Respect to the Clandestine Introduction of Weapons of Mass Destruction Into the US*, National Intelligence Estimate 11-7-60, May 17, 1960, FOIA.

[730] CIA, *Soviet Gross Capabilities for Attack on the US and Key Overseas Installations and Forces Through Mid-1959*, p. 5; and CIA, *Soviet Science and Technology*, National Intelligence Estimate 11-6-59, July 21, 1959, p. 31. Document kindly provided by John Moon.

[731] The vulnerability of the United States to clandestine sabotage attack with biological weapons had been demonstrated by a mock attack conducted by Fort Detrick personnel against the Pentagon in 1950.

[732] Earl P. Stevenson, *Report of the Secretary of Defense's Ad Hoc Committee on Chemical, Biological and Radiological Warfare*, June 30, 1950, p. 15, OSD Decimal File, July-December 1950, CB 385 (General), Records of the Office of the Secretary of Defense, RG 330, NA.

Defense planning in this field."[733] In 1954, a special conference was held by the Chemical Corps, which was responsible for developing biological weapons, to determine the requirements for biological warfare intelligence. The conference "revealed that present BW information was so meager that only the broadest estimates could be made. The conference therefore agreed that there existed a great need of detailed information concerning Soviet Union and satellite BW activities."[734] In 1956, a CIA report noted, "Several critical gaps in Soviet BW intelligence were identified in the course of the recent studies, and the lack of progress in determining the scope and magnitude of the Soviet program, especially its offensive features, was pointed out."[735]

The Evidence Accumulates

By the late 1950s and early 1960s, thanks to photographs from U-2 reconnaissance aircraft and Soviet scientific publications, the CIA had access to more information that enabled it to make firmer statements about Soviet biological warfare activities. By 1958, the CIA was reporting "The existence of an active Soviet BW research and development program has been *confirmed*, through identification of a research center and field test site as well as through extensive Soviet literature applicable to this subject."[736] In contrast, between 1948 and 1952, U.S. intelligence had only "strongly suggested" a research and development program and by 1956 the CIA was estimating that the Soviets "almost certainly" had an active program.[737]

A comprehensive review of intelligence on Soviet biological warfare activities and capabilities in 1961 noted that modern intelligence efforts had been unable to confirm the existence of the great majority of the 20-odd previously reported research and testing sites. Analysts believed that much of the earlier reported biological warfare activity may have been related to the public health sphere such as anti-plague research and epidemiological studies.[738] However, the review concluded that based on indirect evidence, such as the publication of research applicable to biological weapons and knowledge of a suspected biological weapon test site, that the Soviets were conducting an active research and development program that encompassed both offensive and defensive aspects.[739]

This assessment was based in large part on an outpouring of scientific publications since 1956 that had provided a wealth of data on Soviet applied research for public health and defensive purposes, some of which could have offensive implications. Such multi-use research included studies of aerobiology, development of chambers for the study of aerosolized agents, immunity against respiratory infection, immunogenic properties of airborne organisms, aerosol sampling devices, detection and identification of biological agents in the laboratory and field, development of multiple, combined and improved vaccines and treatments, and improved disinfection techniques.[740] There was not enough evidence to determine which biological agents

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[733] Memorandum for Secretaries of Army, Navy, and Air Force, and Chairman of the Joint Chiefs of Staff, from Secretary of Defense, subj: Biological Warfare Intelligence, August 16, 1952, (Entry 199-Box 367) CD 385 (BW) 1952, RG 330, NA. Kindly provided by John Moon.

[734] Chemical Corps, *Summary of Major Events and Problems Fiscal Year 1954* (Edgewood, M.D.: Office of the Historian, Chief of the Chemical Corps, September 1954), p. 91, FOIA.

[735] CIA, *The Soviet BW Program*, p. 7.

[736] However, there was still no evidence of the existence of a large production facility. CIA, *Main Trends in Soviet Capabilities and Policies, 1958-1963*, National Intelligence Estimate 11-4-58, December 23, 1958, p. 35 (emphasis added), http://www.foia.cia.gov/.

[737] CIA, *The Soviet BW Program*, p. 7.

[738] Ibid., p. 3.

[739] Ibid., pp. iii.

[740] Ibid., p. 8.

were under investigation for offensive purposes or had already been standardized by the Soviets, but there were indications of at least 16 being studied.[741] The most commonly discussed agents in Soviet writings were *B. anthracis*, *F. tularensis*, *Y, pestis*, and *Brucella* ssp. Older references cited the development of *Salmonella* Typhi (the bacteria that causes typhoid fever), dysenteric diseases, and *V. cholerae*. Bacterial toxins, viruses, and rickettsia were mentioned far less often.[742] The Soviets were also judged to have only a marginal interest in anti-crop biological warfare and there was no evidence of Soviet interest in developing plant pathogens.[743]

The Ministry of Defense was suspected of exercising general supervision over the Soviet biological weapons program with supporting research diffused throughout secret sections of the Ministries of Agriculture, Defense, and Health and the Academy of Sciences. The observed research appeared related to public health and biological defense, but it was presumed to be applicable to, if not motivated by, an offensive program.[744] The belief that offensive biological research would also be widely dispersed by the Soviets rather than confined to a single installation or agency was consistent with the distribution pattern of defensive biological research in the Soviet Union.[745] The Ministry of Internal Affairs (MVD) and State Security Committee (KGB) were also believed to be conducting microbiological research and perhaps also playing a role in managing the overall program.[746]

The review highlighted two facilities as central to the Soviet biological warfare program: the Scientific Research Institute of Epidemiology and Hygiene of the Armed Forces (NIIEG) in Kirov and the suspected biological weapon test site on Vozrozhdeniya Island in the Aral Sea. NIIEG appeared to be the successor to the biological weapons research institute formed on Gorodmyla Island in the mid-1930s and was deemed to be the current center of anti-personnel biological warfare research in the Soviet Union.[747] The institute was best known for its development of live dry vaccines against *B. anthracis*, *Y. pestis*, *F. tularensis*, and *Brucella* spp. The efficacy of the plague and tularemia vaccines was tested against aerosol challenge and *Y. pestis* and *F. tularensis* were reportedly the first agents tested on Vozrozhdeniya Island.[748] The CIA believed that these diseases were the most likely Soviet anti-personnel agents since there were close parallels between research and production of live vaccines and biological warfare agents.[749] NIIEG also studied *Pseudomonas mallei* (the bacteria that causes glanders), *Burkholderia pseudomallei* (the bacteria that causes melioidosis), and *Clostridiun botulinum* (the bacteria that produces botulinum toxin).[750] NIIEG was not known to have published anything on viruses or rickettsia.[751] Tracking the activities of NIIEG became extremely difficult after 1948 when the institute stopped publishing in scientific journals. As a result, by 1961, it was unknown if NIIEG still existed and, if active, if it was still located in Kirov.[752]

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[741] Ibid., pp. iii.
[742] Overall, the agents most commonly cited tended to be those that caused lethal rather than debilitating diseases. Ibid., p. 3.
[743] Ibid., pp. 3, 54.
[744] Ibid., pp. 10-11.
[745] Ibid., pp. 16-17.
[746] Ibid., pp. 10-11, 15.
[747] Ibid., pp. 60-61.
[748] Ibid., p. 88.
[749] Ibid., p. 87.
[750] Ibid., pp. 89-90, 92-93.
[751] Ibid., pp. 96-98.
[752] Ibid., p. 64.

Vozrozhdeniya Island in the Aral Sea had been identified by Hirsch and Kliewe in the 1940s as a biological weapon test site. However, no description of the installation or confirmation of its existence was possible until photographs of the island was provided by a U-2 reconnaissance aircraft in August 1957.[753] These pictures led the CIA to conclude that the island was probably a biological weapon test site.[754] The CIA also found that there was evidence of field tests having been carried out for many years, probably with variety of dissemination devices and delivery systems including aircraft and possibly artillery.[755] The island's military installation was believed to have the potential for self-sufficient research, development, and testing as well as the production of enough biological agents for experiments or clandestine weapons. The CIA also noted that it was possible that Soviet biological warfare agent development took place solely on the island with the exception of any large-scale agent and munition production.[756] This finding was consistent with the lack of knowledge of the current status of NIIEG and the failure to identify any other biological weapons facilities.[757]

In the early 1960s, the CIA received confirmation of some of the information provided by Hirsch and Kliewe as well as their suspicions of ongoing Soviet development of biological weapons. Colonel Oleg Penkovsky of the Soviet military intelligence agency GRU reported that the chemical and biological weapons program was the responsibility of the 7th Main Directorate of the General Staff. He also reported the existence of a "special bacteriological storage place" on a small island in the Volga near the city of Kalinin.[758]

Reappraisal

By the mid-1960s, this assessment of the Soviet biological weapons program was replaced by a more cautious appraisal. The basis for this reappraisal, as described by two CIA analysts, was a reinterpretation of evidence that indicated that the Soviet Union's biological warfare capability was less advanced than previously believed and reduced confidence in judgments regarding previously identified biological weapons facilities.[759] As a result of this reassessment, the 1964 National Intelligence Estimate (NIE) on the Soviet biological warfare program concluded that, "We believe that a BW research program exists in the USSR, but we know of no facility devoted exclusively to offensive BW research and we have no evidence of field testing."[760] The intelligence community had accumulated indications of possible biological weapons activity at a few locations, with Vozrozhdeniya Island as the most suspicious, but there

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[753] Photographs of Vozrozhdeniya Island were taken during U-2 Mission 4035 on August 5, 1957. Some of these photographs can be found at http://www.globalsecurity.org/wmd/world/russia/vozrozhdenly.htm

[754] CIA, *The Soviet BW Program*, p. 77.

[755] Ibid., pp. iii.

[756] Ibid., pp. 68, 83.

[757] Ibid., p. 84. This finding would appear to undermine assertions made by Tom Mangold and Jeff Goldberg that the United States had firm evidence at this time of biological weapons activities at Zagorsk and Sverdlovsk. Mangold and Goldberg, *Plague Wars*, pp. 50-51.

[758] This island may be the same one mentioned in the Kliewe and Hirsch reports as the site of a Soviet biological research institute established in the mid-1930s. Oleg Penkovskiy, translated by Peter Deriabin, *The Penkovskiy Papers* (New York: Doubleday, 1965), p. 249; and Lawrence Freedman, *US Intelligence and the Soviet Strategic Threat* (Princeton, N.J.: Princeton University Press, 1986), p. 72.

[759] Wilton E. Lexow and Julian Hoptman, "The Enigma of Soviet BW," *Studies in Intelligence*, Vol. 9 (Spring 1965), pp. 15-20, http://www.foia.cia.gov.

[760] CIA, *Soviet Capabilities and Intentions with Respect to Biological Warfare*, National Intelligence Estimate 11-6-64, August 26, 1964, p. 1, DDRS.

was "no strong evidence, however, that this activity is connected with BW research."[761] The estimate does not mention NIIEG or any other suspect facilities.

The intelligence community also lacked much evidence that Soviet research on dangerous pathogens was part of an offensive program. The intelligence community still lacked sufficient evidence on which to base an estimate of the types and quantities of biological warfare agents in the Soviet's offensive program. The potential biological warfare agents that the Soviets were known to have conducted research on, such as botulinum toxin, Yellow fever, *Y. pestis*, *B. anthracis*, tick-borne encephalitis, *F. tularensis*, *Brucella* spp., and *Coxiella burnetti* (the rickettsia that causes Q-fever), were either endemic to the Soviet Union or known to be subjects of American biological weapons research.[762] In addition, the Soviets were known to have a biological defense program administered by the Ministry of Defense to protect military forces and civilian populations against biological weapons. As a result, the NIE judged that, "Virtually all available evidence could be related to Soviet work in epidemiology, public health, and sanitation, but we believe that a BW research program exists in the USSR."[763] The Soviet study of the aerosol dissemination of botulinum toxin, however, appeared to be offensive in nature since this was not the natural means of infection. In addition, Soviet work on *Y. pestis* and *B. anthracis* was also believed to have offensive applications.[764] The estimate found no Soviet interest in plant pathogens or anti-crop biological warfare.[765]

The intelligence community did not have any evidence of Soviet development of biological munitions and delivery systems, or the production and stockpiling of biological weapons. Soviet offensive research was judged as being able to provide the capability to conduct clandestine attacks with biological weapons. Although large quantities of biological agents could be produced in a few months in existing facilities for use in military operations, several years were required for the Soviets to develop a range of effective munitions for use on a large scale. The intelligence report recognized, however, that the development of spray systems for ships, aircraft, submarines, ground vehicles, and cruise missiles could be conducted without detection by the United States. The development of more complex systems, such as a biological warhead for strategic missiles, was judged to be more difficult to conceal.[766]

The intelligence community did not uncover any evidence of Soviet offensive intentions or military doctrine regarding biological weapons. Soviet military training and doctrinal writings regarding biological warfare were all found to be defensive in nature. Soviet military writings and exercises featuring biological weapons were rare. In those cases, available documents indicate that it was "the enemy," not the Soviets, who resorted to biological weapons. Due to the delayed effects of biological weapons and the greater predictability and destructiveness of nuclear weapons, it was judged highly unlikely that the Soviets would consider biological weapons as a useful means of tactical or strategic attack in the event of general war. These factors were also believed to weigh heavily on Soviet employment of biological weapons in limited wars.[767] Accordingly, the intelligence community concluded that, "We believe that the

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[761] Ibid., p. 2.
[762] All but the first two agents were endemic to the Soviet Union. Ibid., pp. 2-4.
[763] Ibid., p. 2.
[764] The basis for this determination is not known.
[765] Ibid., pp. 2-3.
[766] Ibid., pp. 1, 3, 5.
[767] Ibid., p. 5.

Soviets have no present intention to employ BW in military operations. They probably consider BW to be less efficient than other available weapons and uncertain in its effects."[768]

An article published in the CIA's in-house classified journal in 1965 provides important insights into the evidence and analytical assumptions used to formulate this NIE and the reasons for the intelligence community's reassessment of the Soviet biological weapons program. According to this article, the conventional wisdom within the intelligence community "had been that the heavy U.S. BW commitment which has been public knowledge, along with the Japanese World War II effort as known to the Soviets, would probably have engendered a comparable program in the USSR."[769] Statements by some top Soviets boasting about their ability to retaliate against an American attack with nuclear, biological and chemical weapons reinforced this presumption as did postwar defector reports and German intelligence from World War II. However, the authors concluded that, "There is no firm evidence of the existence of an offensive Soviet BW program."[770]

According to the CIA analysts, "The paucity of real evidence has forced us to resort to indirect signs."[771] To discover these indirect signs, analysts examined military-related activity in biology and medicine, technical publications that were censored for security reasons, and biomedical studies that did not correspond with Soviet public health requirements. The intelligence community was able to identify some biomedical research that transcended normal public health requirements, was aware of Soviet concern about the United States' biological weapons research, and had some insights into Soviet preparations for medical defense against biological weapons. However, censorship and good operational security by the Soviets had eliminated anything but defensive preparations and attitudes from the scientific literature and military writings. As a result, analysts were forced to rely on "speculation, analogy, and parallels with other nations' BW research, development, and practice in recent times and in the historical past" and the study of Communist propaganda regarding alleged American use of biological weapons during the Korean War for clues to their sophistication and knowledge about biological warfare agents and delivery systems.[772] The past twenty years of pursuing intelligence on the Soviet biological warfare activities was described by these analysts as "unrewarding."[773]

In the late 1950s, however, "new photographic and other intelligence seemed for a time to confirm our worst suspicions with hard evidence of elaborate BW test range activities."[774] The primary suspect as a biological warfare center had long been Vozrozhdeniya Island in the Aral Sea. The high-level photography of the island taken in 1957 and 1959 revealed 150 buildings in two settlements. The northern and larger settlement appeared to be for administration, logistics, and housing including enough barracks for 1400 people. The southern group of buildings was contained within a high walled area that appeared to be the laboratory site. Roads to the south led to five centers believed to be test sites. At each center was a tower and one or two small buildings. Further south was the small island of Konstantin with thirty-five buildings on its northern tip.[775] The centerpiece of these analysts' skepticism about a robust Soviet offensive

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[768] Ibid., p. 1.
[769] Lexow and Hoptman, "The Enigma of Soviet BW," p. 15.
[770] Ibid.
[771] Ibid.
[772] Ibid., p. 16.
[773] Ibid., p. 15.
[774] Ibid., p. 16.
[775] Ibid., pp. 18-19.

program was their reappraisal of the evidence linking Vozrozhdeniya Island to biological weapons activities.

Despite the fact that the site had been listed as a biological weapon test facility since the 1940s and had been assessed as such so recently by the CIA's photographic interpreters, Lexow and Hoptman felt there were several features of the island's installations that did not fit a biological weapons research and testing profile. The only certain finding was that the layout of the buildings, the parade ground, and other features distinguished it as a military establishment. However, they noted that there were three problems with classifying this site as a biological weapons installation. First, the test sites for measuring the dispersion of agents were small, had a poorly defined configuration, and were unlike those used for Soviet chemical weapon or U.S. chemical and biological weapon testing. Second, there was no indication of the necessary air support for biological weapon testing activities such as a sophisticated landing strip, decontamination capabilities, or night landing facilities. Third, the buildings and inhabitants of Konstantin Island were in the path of prevailing winds and this would preclude conducting tests with live biological warfare agents.

As a result of this reexamination of long-standing assumptions and recent information, Lexow and Hoptman concluded that there was no hard evidence of a Soviet offensive biological warfare program.[776] They asserted that, "Despite tight security, a highly developed Soviet BW weapons system and technology should have surfaced sometime during the years since the war, just as the nuclear and chemical warfare efforts have. Current analyses, therefore, while clearly stating our lack of positive knowledge, depart radically from the old assumption and look at Soviet military doctrine realistically in terms of limited BW activity and the unsure potential of BW weapons."[777] The authors recommended that given limited Soviet capabilities in this field and U.S. vulnerability to clandestine attacks, more emphasis should be placed on possible Soviet covert attacks with biological weapons.[778]

British intelligence reports in the mid-1960s were in broad agreement with the U.S. assessment of the Soviet biological weapons program. They concluded that the Soviets had an extensive defensive biological program that gave them offensive capabilities, but there was no actual evidence of a biological weapons program.[779] Five years later, the Soviet biological weapons program was subject to another NIE that included compelling new information from a defector. However, a review of this intelligence in late 1969 by the National Security Council raised fresh doubts about the status of the Soviet biological weapons program.

The 1969 Review

In February 1969, the intelligence community issued a new NIE on the Soviet biological warfare program. This NIE reported that the Soviet Union was conducting research and

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[776] Ibid., pp. 19-20.
[777] Ibid., p. 20.
[778] Ibid.
[779] U.K. Foreign Office, "The Arms Control Implications of Chemical and Biological Weapons: Analysis and Proposals," p. 28; U.K. Ministry of Defence, Chiefs of Staff Committee, "United Kingdom Military Requirements for Chemical and Biological Warfare Capabilities," Top Secret; Appendix 1 to Annex A to Report No. COS 124/67 (15 December 1967), DEFE 19/97, PRO; and U.K. Ministry of Defence, Defense Intelligence Staff (Directorate of Scientific and Technical Intelligence), "Soviet Measures for Biological Warfare Defence," DSTI Report No. 289 (November 1967), Secret, FCO10/182, PRO cited in Wright, "Geopolitical Origins," p. 318.

development on the possible military application of biological agents.[780] In keeping with the 1964 NIE, however, Vozrozhdeniye Island was not discussed in this context. The report stated that although virtually all of the previously available evidence regarding Soviet biological weapon-related activities could be attributed to legitimate work in epidemiology, public health, sanitation, and defensive aspects of biological warfare, new information regarding Soviet biological warfare doctrine indicated a more mature program than previously suspected. The United States had obtained information from a high-level Czechoslovakian defector on the existence of Warsaw pact contingency plans to deliver biological weapons from the Soviet Union to front commanders in Eastern Europe in the event of a decision to use these weapons to stop or slow an invasion.[781] Front commanders would be authorized to employ biological weapons if Warsaw Pact forces were being forced to withdraw. Additionally, Warsaw Pact military organizational plans depicted components responsible for employing biological weapons.[782] This type of contingency would presumably require the Soviets to have standardized biological warfare agents and munitions and either stockpiles of such weapons or the ability to produce them rapidly. Intelligence on such capabilities, however, was lacking. The Soviets were assessed as having the technical ability to develop, produce, and stockpile militarily significant quantities of biological agents, but the intelligence community was unable estimate the types and quantities of agents that might be available to the Soviets for offensive use. Although the Soviets were still considered unlikely to employ biological weapons in an initial strategic attack, their subsequent use during a general war was now deemed to be possible. Analysts also assessed that the Soviets believed that biological weapons could be effective in some tactical situation and were especially well suited to clandestine attacks.[783]

During the National Security Council review of U.S. chemical and biological weapons policy in late 1969, as directed by National Security Study Memorandum (NSSM) 59, intelligence on Soviet chemical and biological weapons capabilities was also reviewed. An interagency task force on foreign chemical and biological capabilities was formed for this purpose. According to one account based on interviews with participants in the NSSM 59 review, the State Department's Bureau of Intelligence and Research objected to analyses by the Central Intelligence Agency and Defense Intelligence Agency that included quantitative estimates of Soviet biological agent stockpiles. National Security Council staffers demanded to see the data to support these "elaborate, precise estimates" and when this evidence could not be produced, the U.S. intelligence estimates of Soviet biological weapons activity had to be severely

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[780] Evidence of suspected Soviet offensive research and development included studies on increasing agent virulence, maintaining virulence for long periods of time, retarding aerobiological decay, adapting agents to unusual vectors, and testing the infectivity of agents not endemic to the Soviet Union. The report singled out Soviet work on the aerosolization of botulinum toxin as indicative of offensive research. CIA, *Soviet Chemical and Biological Warfare Capabilities*, National Intelligence Estimate No. 11-11-69, February 13, 1969, p. 10, FOIA.

[781] The defector was Jan Sejna, who fled his country in February 1968 prior to the Soviet invasion. Sejna had been Chief of Staff of the Czechoslovakian Ministry of Defense as well as Secretary of the Military Committee of the Central Committee, the state's highest military policy-making body. Jan Sejna, *We Will Bury You* (London: Sidgwick & Jackson, 1982), pp. 32-34, 109. On his revelations about Soviet chemical and biological warfare policy, see Joseph D. Douglass, Jr., "The Expanding Threat of Chemical-Biological Warfare: A Case of U.S. Tunnel Vision," *Strategic Review*, Fall 1986, pp. 42-43.

[782] CIA, *Soviet Chemical and Biological Warfare Capabilities*, p. 9; Foreign Capabilities Task Force, "The Nature of the Threat to the US and its Allies," September 29, 1969, p. 3, FOIA.

[783] CIA, *Soviet Chemical and Biological Warfare Capabilities*, p. 10.

downgraded.[784] While it can be confirmed that there was a dispute between the Department of State and the intelligence agencies regarding Soviet chemical and biological capabilities, this particular account cannot be verified with the declassified documents available.[785] It is apparent, however, that the draft working papers of the task force were based heavily on the February 1969 national intelligence estimate. While the report of the Czechoslovakian defector was repeated throughout these drafts, each working paper also included the disclaimer that the United States had no direct evidence of Soviet production, weaponization, stockpiling, or testing of biological weapons.[786] This mixed assessment of the Soviet biological weapons program was subsequently included in the policy papers submitted for the consideration of the National Security Council.[787] As a result of this intelligence review, SIPRI later reported that "there are now growing indications that more and more US officials do not believe the Soviet Union to possess, or have possessed, an offensive BW capability of much, or even any, military significance."[788]

The next section evaluates the intelligence community's assessment of the Soviet biological warfare program during the period from 1945 to 1970. The second half of this case describes and evaluates U.S. intelligence on Soviet biological warfare activities during the 1970s and 1980s.

Evaluation of U.S. Intelligence on the Soviet Biological Weapons Program, 1945-1970

The intelligence community's assessment that Soviet Union had an active biological weapon research and development program, encompassing both offensive and defensive aspects, was correct. Although the history of the Soviet biological warfare program before and during World War II remains murky, the information provided by Hirsch and Kliewe has generally been accepted as being accurate.[789] While the United States was able to determine the existence and orientation of the Soviet anti-personnel program, it was much less successful at gauging the size, scope, and sophistication of the program. In addition, the intelligence community failed to detect the existence of the Soviet Union's extensive anti-agriculture program. The accuracy of the

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[784] Forrest Russell Frank, *U.S. Arms Control Policymaking: The 1972 Bacteriological Treaty Case*, PhD Dissertation, Stanford University, 1974, p. 180.

[785] After the completion of NSSM 59, the head of the interagency review committee wrote to his colleague in the Department of State's intelligence bureau to report that during the course of the review it had become clear that some of the intelligence on Soviet chemical and biological warfare capabilities was out of date. As a result, the NSSM reflected new views on Soviet capabilities that had not been incorporated officially into the national intelligence estimates. Department of State Memorandum, from Ronald I. Spiers, PM, to Mr. Cline, INR, subject: Chemical and Biological Warfare, December 5, 1969, FOIA.

[786] See Foreign Capabilities Task Force, "The Nature of the Threat to the US and its Allies," August 29, 1969, p. 6, FOIA; Foreign Capabilities Task Force, "The Nature of the Threat to the US and its Allies," September 12, 1969, p. 6, FOIA; and Foreign Capabilities Task Force, "The Nature of the Threat to the US and its Allies," September 29, 1969, p. 3, FOIA.

[787] Interdepartmental Political-Military Group, *US Policy on Chemical and Biological Warfare and Agents*, Report to the National Security Council submitted in response to NSSM 59, October 15, 1969, p. 8, http://foia.state.gov/documents/FOIADocs/000050D9.pdf; Interdepartmental Political-Military Group, *US Policy on Chemical and Biological Warfare and Agents*, Report to the National Security Council submitted in response to NSSM 59, November 10, 1969, p. 8, http://foia.state.gov/documents/FOIADocs/000050DA.pdf; and Interdepartmental Political Military Working Group, *Annual Review of United States Chemical Warfare and Biological Research Programs as of 1 November 1970*, p. 19.

[788] SIPRI, *The Problem of Chemical and Biological Warfare,* Vol. 2, p. 174

[789] Bojtzov and Geissler, "Military Biology in the USSR, 1920-1945," in Geissler and Moon,, *Biological and Toxin Weapons*, pp. 153-167; and Rimmington, "The Soviet Union's Offensive Program," pp. 121-127.

intelligence community's assessment of Soviet doctrine regarding biological weapons is unknown since Soviet planning for the use of biological weapons remains a mystery.

In 1958, the Soviet Union launched an ambitious program to develop and produce plant and animal pathogens for military purposes. Six institutes, split between the anti-crop and anti-livestock missions, were established at the time to conduct research and a special division of the Ministry of Agriculture was created to supervise the program.[790] Although Soviet interest in a small number of animal pathogens had been noted over the years, there had been no indication of Soviet interest in anti-crop agents. The causes for the failure to detect such a large undertaking are unclear. It appears that without human intelligence to guide analysts, the available sources of information—Soviet scientific publications and imagery from reconnaissance aircraft and satellites—were not sufficient to detect the existence of this program.

The ability of the intelligence community to detect and monitor Soviet biological weapons facilities was also very limited. During the period under review, the CIA failed to identify, lost track of, or misinterpreted the Soviet military's biological weapons facilities. Although the CIA had correctly identified the role of Scientific Research Institute of Epidemiology and Hygiene (NIIEG) as a biological research center, it lost track of the activities of this facility in 1948 and by the early 1960s could not even confirm that it still existed or remained in Kirov.[791] It is now know that NIIEG became the hub of the Soviet Union's expanded biological warfare program after World War II and the "most important BW institute in the Soviet military."[792] In addition, the CIA failed to identify the military's other biological research facilities at Sverdlovsk and Zagorsk.[793] Although Mangold and Goldberg report that these sites were identified as biological weapons facilities by the late 1950s, this is not reflected in the intelligence documents declassified to date.[794] The "mobilization" production plants at Omutninsk and Berdsk, which had been built or expanded in the 1960s, also went undetected.[795]

The initial CIA assessment that Vozrozhdeniye Island was a biological weapon test facility, based on German intelligence and U-2 photographs, was accurate. The reassessment in 1964 that the island was probably not a biological test facility was wrong. Vozrozhdeniye Island was used to test biological weapons in 1936 and 1937, but then abandoned until the early 1950s. At that time, a new laboratory was built on the island to conduct experiments and a military unit comprising several hundred soldiers was garrisoned there to support the test program. Until 1991, the island was the site of tests conducted to study the aerobiology of a variety of dangerous

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[790] Rimmington, "Soviet Union's Offensive Program," pp. 113-115; and Alibek, *Biohazard*, pp. 37-38.

[791] CIA, *The Soviet BW Program*, p. 64.

[792] Tucker and Zilinskas, "Introduction," p. 7.

[793] The Sverdlovsk facility was established in the late 1940s and specialized in bacterial agents while the Zagorsk facility was established in 1954 and specialized in viral and rickettsial agents. Anthony Rimmington, "From Military to Industrial Complex? The Conversion of Military Microbiological Facilities in the Russian Federation," *Contemporary Security Policy*, Vol. 17, No. 1 (April 1996), pp. 83-87; and Rimmington, "Soviet Union's Offensive Program," p. 123.

[794] According to Dino Brugioni, former head of the CIA's photoanalysis department, by 1957 the CIA had pinpointed two Soviet biological warfare facilities: a research center at Zagorsk and a testing site in the Aral Sea. In addition, Mangold and Goldberg report that a confidential source told them that in 1958 the Mossad told the CIA that a Jewish refugee had confirmed that the Soviets had built a major biological weapons production facility near Sverdlovsk. Mangold and Goldberg, *Plague Wars*, pp. 50-51.

[795] Alibek, *Biohazard*, pp. 51-52, 59-61.

pathogens, the dissemination pattern of munitions, and the effectiveness of defensive equipment and materials.[796]

The dismissal of Vozrozhdeniye Island as biological testing site in the mid-1960s probably reflected an analytical bias known as mirror-imaging and a misinterpretation of Soviet simplicity, stupidity, and lack of regard for human life. The reasons provided by the analysts for their conclusion—the small and oddly configured test grids, lack of sophisticated air support capabilities, and proximity of an inhabited compound to the test girds—reflect an expectation that the Soviet Union would construct and operate a biological weapon test site the same way the United States would.[797] In fact, the island was equipped with an airport in the northern part of the island that provided regular plane and helicopter transportation to the mainland.[798] It may not have been as well-equipped as its American counterpart, but this may have simply reflected the more primitive nature of Soviet air support operations. In addition, the presence of the compound on nearby Konstantin Island, in the path of the prevailing winds from the test site, did not deter the Soviets from conducting tests with live agents. However, after the wind shifted during one such test in 1960 and contaminated the island, it was evacuated and abandoned.[799]

Evaluating the intelligence community's assessment of biological warfare agents being developed by the Soviet Union is complicated. The intelligence community consistently reported that they had no evidence of the type and quantities of biological warfare agents being developed by the Soviet Union. Nonetheless, the 1964 NIE, which included the most recent and detailed description of potential Soviet biological warfare agents, listed botulinum toxin, Yellow fever, *Y. pestis*, *B. anthracis*, tick-borne encephalitis, *F. tularensis*, *Brucella* spp., and *Coxiella burnetti* (the rickettsia that causes Q-fever) as the primary candidates. It was noted that all of these organisms were either endemic to the Soviet Union or known to be subjects of American biological weapons research.[800] This pool of agents was identified on the basis of the United States' own experience with biological warfare, Soviet research for public health, veterinary, and defensive purposes, and American vulnerability to certain non-native diseases. The only case where research on a particular agent strongly suggested offensive intent was botulinum toxin.[801] In addition, the intelligence community believed that Soviet research on *B. anthracis* and *Y. pestis* was conducted for application to the development of biological weapons. In 1992, Russia revealed that beginning in the 1950s the Soviet military developed *B. anthracis*, *F. tularensis*, *Brucella* spp., *Y. pestis*, botulinum toxin, Venezuelan equine encephalitis (VEE), a rickettsia that

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[796] Gulbarshyn Bozheyeva, Yerlan Kunakbayev, and Dastan Yeleukenov, *Former Soviet Biological Weapons Facilities in Kazakhstan: Past Present and Future,* Occasional Paper No. 1 (Monterey, Calif.: Center for Nonproliferation Studies, June 1999), pp. 5-7.

[797] Indeed, during the 1950s, the CIA photointerpreters who had to analyze novel facilities such as nuclear, biological, and chemical weapon research and production facilities were given tours of such facilities in the United States to familiarize them with their salient characteristics. These tours also allowed them to establish signatures to look for in reconnaissance photographs. Dino A. Brugioni, "Photo Interpretation in the 1950s," in R. Cargill Hall and Clayton D. Laurie, eds., *Early Cold War Overflights, 1950-1956 Symposium Proceedings,* Vol. 1: *Memoirs* (Washington, D.C.: Office of the Historian, National Reconnaissance Office, 2003), p. 315.

[798] Bozheyeva, Kunakbayev, and Yeleukenov, *Former Soviet Biological Weapons Facilities in Kazakhstan,* p. 6.

[799] Ibid., p. 6 fn 40.

[800] All but the first two agents were endemic to the Soviet Union. CIA, *Soviet Capabilities and Intentions with Respect to Biological Warfare*, pp. 2-4.

[801] Offensive intent was inferred from Soviet research on the aerosol dissemination of botulinum toxin, which is not a natural means of transmitting the agent.

causes typhus, and *C. burnetti* as biological warfare agents.[802] Based on this account, the intelligence community accurately identified five agents and missed two with two false positives. According to Ken Alibek, by 1972 the Soviets had weaponized *Y. pestis*, *B. anthracis*, *F. tularensis*, *Brucella* spp., *C. burnetti*, *Rickettsia prowazekii* (the rickettsia that causes epidemic typhus), variola (the virus that causes smallpox), VEE, and *P. mallei* (the bacteria that causes glanders).[803] Based on this account, the intelligence community accurately identified five biological warfare agents and missed four with three false positives. The overall accuracy of the intelligence community's biological threat agent assessment is summarized in Table 6-1.

Table 6-1. Evaluation of U.S. Biological Threat Agent Assessment

Pathogen	1964 NIE	Russian CBM Declaration	Alibek	Evaluation
Botulinum toxin	X	X		Accurate
Y. pestis	X	X	X	Accurate
B. anthracis	X	X	X	Accurate
F. tularensis	X	X	X	Accurate
Brucella spp.	X	X	X	Accurate
C. burnetti	X	X	X	Accurate
Yellow fever	X			False Positive
Tick-borne encephalitis	X			False Positive
Variola			X	False Negative
R. prowazekii		X	X	False Negative
VEE		X	X	False Negative
P. mallei			X	False Negative

Overall, the accuracy of the intelligence community's assessment of the Soviet biological weapons program can be attributed primarily to the information provided in the 1940s by Hirsch and Kliewe. Collection and analysis of Soviet scientific publications supplemented this information, particularly regarding potential biological warfare agents. This source of information, however, failed to reveal Soviet work on anti-crop agents or the existence, identities, or activities of the military's biological research centers. The overhead imagery available at the time did not lead to the discovery of any new biological warfare facilities. In addition, the imagery was ambiguous enough to allow analysts to wrongly dismiss Vozrozhdeniye Island as a biological test site. As a result of this reappraisal of the role of Vozrozhdeniye in the Soviet biological warfare program, the intelligence community adopted a fundamentally different perspective on the Soviet program. Based on this new perspective, the absence of firm evidence for an offensive military program was interpreted as evidence that such a program did not exist. This perception apparently gained ground during the 1969 intelligence review, which again emphasized how little hard evidence the intelligence community had on Soviet biological warfare capabilities and intentions. As described in the next section, the lack of direct and unambiguous intelligence on Soviet biological warfare activities would continue to be

[802] Russian Federation, "Declaration of Past Activity in Regard to Offensive and Defensive Programs of Biological Research and Development," United Nations Form F, DDA/4-92/BWIII, 1992, p. 52. Kindly provided by Jeff Goldberg.

[803] Testimony of Dr. Kenneth Alibek before the Joint Economic Committee, *Hearing on Terrorist and Intelligence Operations: Potential Impact on the US Economy*, May 20, 1998.

a problem that plagued the intelligence community until the defection of a senior Soviet biological warfare scientist in 1989.

U.S. Intelligence on the Soviet Biological Warfare Program, 1970-1990

During the 1970s and 1980s, the United States received new evidence of continued Soviet interest in biological weapons, including the expansion of suspicious sites, construction of new facilities, and reports of research on genetic engineering applicable to biological weapons. This evidence began emerging at a politically inopportune time. During the early 1970s, the United States was in the process of closing down its offensive program and negotiating the Biological Weapons Convention to outlaw these weapons. By the 1980s, the intelligence was being publicized as part of a wider effort to discredit the Soviet Union as a reliable arms control partner and to reinforce its image as "the evil empire."

In 1971, photoreconnaissance satellites began providing the United States with new information on suspected Soviet biological warfare activities. According to CIA director William Colby, this new information "raised the possibility that the Soviets have developed a militarily significant BW weapons production capability. This interpretation centers on whether several large Soviet installations are designed for BW agent R&D and weapons production. Our current assessment is that the evidence is still inconclusive and further study of the problem is required."[804] Satellite imagery of Soviet military installations at Sverdlovsk and Zagorsk revealed very tall incinerator stacks and large cold storage bunkers that could be used for stockpiling biological weapons.[805] As a result, policy makers concluded that, "There is good evidence that facilities necessary for BW research and production are present at both sites (i.e., research type buildings, animal holding facilities, buildings sufficiently large to house production and storage, revetted structure for munition storage)."[806] By 1975, the CIA also had evidence implicating a facility at Omutninsk in the biological weapons program, although the CIA did not feel that the evidence was strong enough to place it in the same category as Sverdlovsk and Zagorsk.[807] In June 1976, an *Associated Press* dispatch reported that U.S. intelligence sources believed that the Soviet Union had six potential biological weapons production plants. In addition to suspected plants at Sverdovsk, Zagorsk, and Omutninsk, the additional plants were reported to be located at Pokrov and Berdsk with another under construction at Aksu [also known as Stepnogorsk]."[808] The most suspicious indicators of biological weapons activity at the suspect sites were storage and bunker areas designed to store explosives. The presence of these bunkers at military biological facilities suggested that they were involved not just in research, but also in production and/or storage of biological weapons. The presence of identical configurations

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[804] Memorandum, From W.E. Colby, Director, Central Intelligence to Dr. Albert C. Hall, Assistant Secretary of Defense (Intelligence), *Subject: Soviet BW Activity*, TCS-2497-75, February 4, 1975, p. 1, Folder 14, Box 75 [3 of 4], RG 273, NA.

[805] William Beecher article in *Boston Globe*, September 28, 1975, cited by Nicholas Wade, "Biological Warfare: Suspicions of Soviet Activities," *Science* 192, April 2, 1976, pp. 38-40.

[806] Interdepartmental Political-Military Group, *Annual Review of United States Chemical and Biological Research Programs as of July 1, 1972*, October 26, 1972, p. 19, NSC, H-Files, Policy Papers, NSDMs, NSDM-35 [4 of 4], Box H-213, Nixon papers. Kindly provided by John Moon.

[807] Memorandum, From Colby to Hall, *Subject: Soviet BW Activity*, p 2.

[808] Nicholas Sims, *The Diplomacy of Biological Disarmament: Vicissitudes of a Treaty in Force, 1975-1985* (New York: St. Martin's Press, 1988), p. 67.

at civilian microbiological sites, such as Omutninsk, Pokrov and Berdsk, also suggested a military purpose to these sites.[809]

The photographic evidence, however, was not judged to provide a high level of confidence in the purpose or activities of these sites. Some government officials regarded the evidence as sufficiently ambiguous to warrant only further surveillance.[810] Although some Pentagon analysts thought that there was enough evidence to seek an explanation from the Soviet Union and the Arms Control and Disarmament Agency (ACDA) urged a comprehensive National Security Council study, neither was done because the evidence was "dismissed as too flimsy."[811] This refusal to act on the available intelligence may have been motivated by a desire not to cause a crisis with Moscow during the early stages of détente. However, differences of opinion among the different intelligence agencies prevented the formation of a unified intelligence community position on the purpose of these facilities.[812] According to the analysts charged with conducting foreign biological threat assessments for the military, "Though there is some indication in newly acquired intelligence of the manufacture and stockpiling of biological weapons by the USSR, it is not "hard" intelligence and not sufficient to warrant full confidence in the existence of such weapons."[813]

More evidence of Soviet biological warfare activities and intentions emerged in the late 1970s from new and unexpected sources. In 1978, Arkady Shevchenko, a senior Soviet diplomat and advisor to Prime Minister Andrei Gromyko, defected to the United States. He provided a unique behind-the-scenes view of Soviet decision-making, including Soviet policy on biological weapons. Shevchenko reported that the Soviet Union had a large chemical and biological weapon program and had signed the BWC in 1972 with no intention of complying with it. The political leadership felt it necessary to agree to the British proposal to ban biological weapons for propaganda purposes. While the military opposed any type of international arms control agreement on these weapons, it agreed to this approach due to the lack of any verification measures in the treaty. Meanwhile, the military planned on maintaining its stockpiles and continuing its development of these weapons.[814] Although Shevchenko is not believed to have offered any hard evidence of these claims, his seniority and access to the inner circle of Soviet decision-making should have lent weight to his information.

U.S. suspicions regarding biological warfare activities at Sverdlovsk appeared to be confirmed by an outbreak of anthrax in the city in 1979. Beginning in the late summer, the intelligence community began receiving reports from eyewitnesses and émigrés of an accident having occurred at a biological weapons facility in Sverdlovsk resulting in dozens of cases of inhalation anthrax.[815] By mid-January 1980, the intelligence community had collected enough circumstantial but compelling information to conclude that the anthrax outbreak was most likely

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[809] DIA, *USSR: Biological Warfare*, Intelligence Appraisal, March 25, 1980, p. 2, http://www.gwu.edu/~nsarchiv/NSAEBB/NSAEBB61/Sverd9.pdf; and House Permanent Select Committee On Intelligence, *Soviet Biological Warfare Activities: A Report of the Subcommittee on Oversight, Permanent Select Committee on Intelligence, US House of Representatives* (Washington, D.C.: U.S. GPO, June 1980), p. 3.

[810] Wade, "Biological Warfare," pp. 38-40.

[811] William Beecher article in *Boston Globe*, October 15, 1976 cited in Sims, *Diplomacy of Biological Disarmament*, p. 67.

[812] House Permanent Select Committee On Intelligence, *Soviet Biological Warfare Activities*, p. 3.

[813] Don T. Parker, Dale O. Galloway, J. Clifton Spendlove, *Defense Against Biological Attack: A General Assessment* (Dugway, Ut.: US Army Dugway Proving Ground, May 1975), p. 15. NSA.

[814] Arkady N. Shevchenko, *Breaking with Moscow* (New York: Knopf, 1985), pp. 173-174.

[815] DIA, *USSR: Biological Warfare*, p. 2.

caused by an accidental release of anthrax spores from a military facility.[816] The most detailed and convincing evidence that the outbreak involved inhalation anthrax, and not the naturally occurring gastrointestinal form of anthrax, came from a surgeon in Sverdlovsk who was involved in the response to the outbreak.[817] The intelligence community was already suspicious of the Sverdlovsk facility's involvement in biological warfare activities due to satellite photos of the installation's ventilation system, smokestacks, refrigeration facilities, animal pens, revetments, and tight security.[818] In addition, after the outbreak, intelligence officials received evidence of a quarantine and decontamination efforts inconsistent with the later Soviet claim that the outbreak was caused by tainted meat.[819] According to DIA, "The information accumulated on the accident constitutes strong evidence that a biological production or storage site is at the Sverdlovsk facility."[820]

In 1980, based on the Sverdlovsk outbreak and other intelligence, DIA concluded that strong circumstantial evidence indicated that the Soviet Union possessed an illegal stockpile of biological warfare agents and was probably involved in the development or production of biological weapons. This assessment was based primarily on intelligence gleaned from overt literature and human sources along with some clandestine reporting. However, the agency largely lacked detailed information to establish the credibility of its sources. Moreover, none of these sources had been able to describe in sufficient detail Soviet biological munitions, the agent contained in such munitions, or the facilities where these are produced. Extensive analysis of photographs of suspected research and development centers, production, and storage sites, and test sites had yet to yield a definitive biological weapons signature.[821] While the intelligence community continued to grapple with how to determine the size and scope of the Soviet biological warfare program, new and disturbing indications of the nature and sophistication of the Soviet program began to emerge.

The intelligence community's assessment of Soviet interest in biotechnology and genetic engineering for military purposes grew from vague concern to alarm during the 1980s. In 1981, the Department of Defense reported that Soviet biological research and development activities, including genetic engineering, exceeded those needed for defense, but also acknowledged that there was no evidence that this research was related to biological weapons.[822] In December 1983, a CIA report cited examples of Soviet genetic engineering research that could have military implications, but gave no indication that the military had an active and robust program to exploit genetic engineering technologies to develop new and improved weapons.[823]

By early 1984, the United States had collected new intelligence of unknown origin or reassessed existing intelligence that indicated a more concentrated Soviet effort to develop new and improved biological weapons using genetic engineering. The intelligence community now believed that, in the early 1970s, the Soviet Union had launched a multifaceted research and

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[816] CIA, *Soviet Biological Warfare Agent: Probable Cause of the Anthrax Epidemic in Sverdlovsk*, January 16, 1980, http://www.gwu.edu/%7Ensarchiv/NSAEBB/NSAEBB61/Sverd4.pdf.
[817] DIA, *USSR: Biological Warfare*, pp. 3-4.
[818] Leslie H. Gelb, "Keeping an Eye on Russia," *New York Times Magazine*, November 29, 1981, p. 33.
[819] Elisa Harris, "Sverdlovsk and Yellow Rain: Two Cases of Soviet Noncompliance?" *International Security*, Vol. 11, No. 4 (Spring 1987), p. 49.
[820] DIA, *USSR: Biological Warfare*, p. 4.
[821] Ibid., p. 1.
[822] DOD, *Soviet Military Power* (Washington, D.C.: U.S. GPO, 1981), p. 79.
[823] Despite significant redactions in this section of the report, the report's discussion of military involvement in this field is in the future conditional tense, not the present tense. CIA, *Soviet Genetic-Engineering Capabilities*, December 1983, pp. 8-9, 13-14, http://www.foia.cia.gov.

development program with a budget of $2 billion to field a new generation of improved chemical and biological weapons.[824] Using advances in biotechnology such as genetic engineering, the Soviets could develop agents against which current protective measures were inadequate and for which effective medical treatments and detection and identification techniques were not available. In addition, agent properties, such as stability, persistence, dissemination characteristics, and rapidity of effect, could be tailored for specific field requirements. Genetic engineering could also increase the number and kind of possible agents that could be produced in useful quantities. This category included compounds normally found in the body in minute quantities, called bioregulators, that could have a range of negative consequences if introduced at high concentrations or if they had been genetically altered to modify their effects. The effects of these compounds could range from emotional and behavioral changes to physical manifestations such as drowsiness, hemorrhage, and death. In addition, toxins that could traditionally be derived from bacteria, fungi, plants, and animals in only limited quantities could be produced more easily or altered for use as a weapon with genetic engineering.[825] While toxins and bioregulators could be produced through either a chemical process or biological synthesis, using a genetically modified organism to produce these compounds would be more efficient and permit long-term storage of small amounts of various modified organisms. The CIA noted that these cultures could be used to initiate agent production in a variety of large civilian fermentation plants otherwise not used for military purposes.[826] The report also warned that developing countermeasures against such a wide variety of possible agents would be extremely difficult.[827] While it was recognized that there were scientific, nonmilitary rationales for conducting research on genetically modified organisms and studying bioregulators and toxins, the CIA's reasons for why it believed that this research was part of a program to develop novel chemical and biological agents were withheld during the declassification process.[828] The intelligence community estimated that some of these novel agents were within *five years* of transition from pure research to the testing and evaluation stages of development.[829] In addition, these agents were estimated as being available for use against NATO within the next *ten years*.[830]

In 1985, a group of outside experts, the Chemical Warfare Commission, expressed concern that the U.S. intelligence community was not keeping pace with the threat posed by chemical and biological weapons. According to this group, "There is reason to doubt that if the Soviets achieved a sudden breakthrough in chemical or biological weaponry, the United States would learn of it....The Department of Defense does not have an adequate grasp of the biological warfare threat and has not been giving it sufficient attention. Both intelligence and research in this area, although improved after a virtual halt during the 1970s, are strikingly deficient."[831] Although the collection and analysis of intelligence on chemical and biological warfare had been

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[824] CIA, *Soviet Offensive Chemical Warfare Threat to NATO*, Special National Intelligence Estimate 11/17-2-84/L, November 20, 1984, p. 13, FOIA; and CIA, *Soviet Chemical and Biological Warfare Program*, National Intelligence Estimate 11-17-86/5, August 1986, p. 1, http://www.foia.cia.gov.

[825] CIA, *New Directions in Soviet BCW Agent Development and Their Implications: Key Judgments*, Special National Intelligence Estimate 11/17-84/CX, January 24, 1984, pp. 1-2, FOIA.

[826] CIA, *Soviet Offensive Chemical Warfare Threat to NATO*, p. 13.

[827] CIA, *New Directions in Soviet BCW Agent Development and Their Implications*, pp. 1-2.

[828] Ibid.,, p. 2.

[829] CIA, *Soviet Offensive Chemical Warfare Threat to NATO*, p. 13 (italics added).

[830] CIA, *Soviet Chemical and Biological Warfare Program*, p. 4 (italics added).

[831] *Report of the Chemical Warfare Review Commission* (Washington, D.C.: U.S. GPO, 1985), pp. 67, 71.

assigned a relatively low priority through the 1970s, by 1981 it had been raised to the top tier of targets for the intelligence community.[832]

In 1986, DIA released an unclassified report on the Soviet biological warfare program. The report accused the Soviet Union of developing and producing biological warfare agents as well as testing and evaluating delivery and dissemination systems. The Soviets were reported to have developed *B. anthracis*, *F. tularensis*, *Y. pesits*, *V. cholerae*, botulinum toxin, enterotoxin, and mycotoxins as biological warfare agents. In addition, DIA highlighted research sponsored by the Ministry of Defense at microbiological institutes on infectious diseases, aerobiology, cloud physics, airborne infections, and disease agent stabilization as having direct application to offensive and defensive biological warfare. According to this report, the United States had identified a number of installations established by the military and under military control capable of producing biological warfare agents and toxins on a large-scale and placing them in munitions and delivery systems. The only installations singled out by name in the report were the Microbiology and Virology Institute at Sverdlovsk and the test site on Vozrovhdeniye Island.[833] DIA also reported that the Soviet military was using biotechnology to develop new and more effective biological weapons by enhancing the virulence of pathogens, making them antibiotic-resistant, enabling them to overcome vaccine immunity, and modifying them to complicate detection and identification.[834] In addition, normally harmless micro-organisms could be modified to produce deadly toxins or diseases for which there is no known cure or treatment. Other pathogens now considered too unstable for storage and aerosolization could be modified to become more effective warfare agents.[835]

Official and unofficial reports between 1984 and 1988 shed more light on the number and locations of the research and production facilities suspected of being involved in the Soviet biological weapons program. During this time, the U.S. intelligence community identified between seven and nine biological warfare research and production facilities.[836] Since this estimate was not consistent between reports and these reports identify a total of twelve sites by name or location, it appears that the intelligence community did not have a high degree of consensus or confidence in the extent of the Soviet program. The sites that the intelligence agencies had the highest confidence in were the Microbiology and Virology Institute in Sverdlovsk, due to the presence of high security storage bunkers and the 1979 anthrax outbreak, and the Scientific Research Institute of Sanitation in Zagorsk, also due to the presence of high

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[832] The turning point was the 1973 Yom Kippur War which revealed how well-prepared Soviet-equipped Egyptian forces were to operate on a chemical battlefield. Jack Anderson, "Upgrading Germ Warfare Intelligence," *Washington Post*, November 30, 1984.

[833] DIA, *Soviet Biological Warfare Threat*, DST-1610F-057-86 (Washington, D.C.: DIA, 1986), pp. 1-2.

[834] Ibid., p. 8.

[835] Ibid., p. 12.

[836] The number of Soviet biological warfare sites was given as seven in DOD, *Soviet Military Power 1984* (Washington, DC: U.S. GPO, 1984), p. 73; Christopher Joyce, "Will the USSR Take Genes to War?" *New Scientist*, May 31, 1984, p. 9; and Douglas J. Feith, Deputy Assistant Secretary of Defense for Negotiations Policy, Testimony before the House Permanent Select Committee on Intelligence Subcommittee on Oversight and Evaluation, August 8, 1986.

The number of sites was reported as eight in Jack Anderson, "Soviets Push Biological Weapons Work," *Washington Post*, December 4, 1984; and Adams, *The New Spies*, p. 275.

The number of sites was reported as nine in Gary Thatcher, "Disease as an Agent of War," *Christian Science Monitor*, December 15, 1988, p. B1; and Jack Anderson, "Soviets Violate Germ War Pact," *Dallas Morning News*, March 2, 1985.

security and visible bunkers.[837] Other suspected production sites reportedly included Omutninsk, Aksu (Stepnogorsk), Pokrov, Berdsk, Penza and Kurgan, and a storage area at Malta.[838] With the exception of Penza, Kurgan, and Malta, these sites are the same as those reported in 1975-1976. In addition, biological weapons research, including the application of genetic engineering, was believed to be taking place at the Shemyakin Institute of Bioorganic Chemistry in Moscow, the Institute of Biological Preparations in Leningrad, and the Institute of Molecular Biology near Novosibirsk. An unnamed institute in Protvino (Obolensk) was believed to be involved in Soviet genetic engineering for military purposes.[839]

In March 1990, DIA published a comprehensive report on the Soviet biological warfare program.[840] This report is significant because it provides one of the most comprehensive assessments of the major participants in the Soviet biological weapons program and was prepared less than a year before the November 1989 defection of Vladimir Pasechnik, a senior Soviet biological weapons scientist.[841] Pasechnik's revelations about the size and sophistication of the Soviet biological weapons program are dealt with in the next section, which evaluates U.S. intelligence during this period.

According to DIA, three Soviet ministries—Defense, Health, and Medical and Microbiological Industry—and the Soviet Academy of Sciences had institutes associated with the Soviet biological warfare program. The Ministries of Agriculture, Chemical Industry, Machine Building, and Higher and Specialized Secondary Education were also believed to be involved in the program, but no specific facilities were known to be associated with them.[842] Four institutes of the Second Directorate of the Ministry of Health and eight institutes affiliated with Soviet Academy of Sciences were believed to conduct basic and applied research for scientific, civilian, and defensive purposes that was also used to support the offensive program.[843]

The Ministry of Defense and Ministry of Medical and Microbiological Industry formed the heart of the Soviet biological weapons program. The Ministry of Defense's Seventh Main Directorate was responsible for the Institute of Sanitation at Zagorsk and the Microbiology and Virology Institute at Sverdlovsk. The Military Medical Academy in Leningrad was believed to be engaged in medical and biodefense research and to have cooperative arrangements with Sverdlovsk and Zagorsk, but there was no direct evidence that it was controlled by the Seventh Main Directorate or engaged in offensive work.[844] The Ministry of Medical and Microbiological Industry was believed to include five biological weapons-related institutes: the Institute of Molecular Biology at Koltsovo (near Novisibirsk), the Institute of Applied Microbiology at

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[837] Anderson, "Soviets Violate Germ War Pact"; and Thatcher, "Disease as an Agent of War."

[838] Jack Anderson and Dale Van Atta, "Poison and Plague: Russia's Secret Terror Weapons," *Readers Digest*, September 1984, p. 56; Jack Anderson and Dale Van Atta, "Sanitation Institute a Soviet Front," *Washington Post*, August 3, 1989, cited in Milton Leitenberg, "The Biological Weapons Program of the Former Soviet Union," *Biologicals*, Vol. 21 (1993), p. 188; and Thatcher, "Disease as an Agent of War."

[839] William Kucewicz, "The Science of Snake Venom," *Wall Street Journal*, April 25, 1984; William Kucewicz, "A Non-Stop Russian Response to WWI," *Wall Street Journal*, May 10, 1984; and Thatcher, "Disease as an Agent of War."

[840] The document is very heavily redacted. DIA, *Biological Warfare Capabilities—Warsaw Pact*, DST-1610S-123-90, March 1990, http://www.gwu.edu/~nsarchiv/NSAEBB/NSAEBB61/Sverd29.pdf.

[841] Although it was published in March 1990, the report had been prepared using information available as of January 1989.

[842] Ibid., p. 12.

[843] Ibid., p. 21.

[844] Ibid., p. 20.

Obolensk, the Design Bureau for Biologically Active Substances at Berdsk, the Institute of Biological Testing of Chemical Compounds in Kupevna (near Moscow), and the Institute of Extrapure Biological Preparations in Leningrad. The total number of institutes assessed by DIA as being controlled by the Ministry of Defense's Seventh Main Directorate and the Ministry of Medical and Microbiological Industry was seven. This figure matches those put forth by Department of Defense in the mid-1980s.[845]

Evaluation of U.S. Intelligence on the Soviet Biological Warfare Program, 1970-1990

The lack of American knowledge of the Soviet biological weapons program was revealed in 1989 when Vladimir Pasechnik defected to the United Kingdom.[846] Pasechnik offered the first direct evidence of Soviet research, development, and production of biological weapons in violation of the BWC.[847] More details became available when Ken Alibek, deputy director of Biopreparat, defected to the United States in 1992. These defectors revealed that the Soviet biological warfare program was a massive enterprise employing over 60,000 workers at over 50 facilities across four major ministries. The intelligence provided by Pasechnik and Alibek highlight the invaluable contribution that defectors can provide to biological threat assessments. When the full extent of the Soviet biological weapons program was finally revealed by Pasechnik and Alibek, even the skeptics in the intelligence community had to acknowledge that the most alarmist analysts had, in fact, been underestimating the threat.

On the macro level, U.S. intelligence had been able to outline the basic contours of the Soviet offensive program including the major sponsors of research. Although many of the Soviet's biological weapons research and production sites were identified at one time or another by U.S. intelligence agencies, there does not appear to be have been a consistent assessment of the role of these facilities over time or an appreciation for the range of other facilities involved in the biological warfare program. According to Christopher Davis who worked on biological weapon issues for the Defense Intelligence Staff, "we knew quite a lot of the bones, it you like, a little bit of the flesh here and there, but we really didn't have the kind of detail, the kind of bottom line on the weapons."[848] Based on the information provided by Pasechnik, American and British intelligence agencies were forced to double their estimate of between nine and ten Soviet biological weapon sites.[849]

At the micro level, American intelligence was more fragmentary, more ambiguous, and less detailed. The intelligence community did not have very much, if any, information on the type of research being conducted inside these facilities, the agents being produced, or the types of weapons they were destined for.[850] This lack of accuracy at the micro level apparently had an impact on the overall assessment of Soviet biological weapons capabilities and intentions at the macro level. As one former CIA official remarked, "You must understand, there was still a

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[845] DOD, *Soviet Military Power 1984*, p. 73; and Feith, Testimony before the House Permanent Select Committee on Intelligence Subcommittee on Oversight and Evaluation, August 8, 1986.

[846] See chapter 5 for details on Pasechnik's position within the Soviet biological warfare program.

[847] Lester C. Caudle III, "The Biological Warfare Threat," in Sidell, Takafuji, and Franz, *Medical Aspects of Chemical and Biological Warfare*, p. 453.

[848] "Interview with Dr. Christopher Davis," *Plague War*, PBS Frontline, July 1998, http://www.pbs.org/wgbh/pages/frontline/shows/plague/interviews/davis.html.

[849] Bill Gertz, "Defecting Russian Scientist Revealed Biological Arms Efforts," *Washington Times*, July 4, 1992, p. A4; and R. Jeffrey Smith, "Russia Fails to Detail Germ Arms," *Washington Post*, August 31, 1992, p. A1.

[850] Judith Miller and William Broad, "Germ Weapons: In Soviet Past or in the New Russia's Future?" *New York Times*, December 28, 1998, p. A1.

dearth of intelligence on the Soviet BW program [in 1988]. Even some senior CIA analysts still did not believe that the Soviets had a BW program. So some people in authority did not believe they had this capability. The believers didn't know for sure....The CIA had seen Soviet activities at Vozrozhdeniye Island, but we were never certain what it was."[851] This skepticism extended to the highest levels of the CIA's Soviet analysis division.[852]

It took the intelligence community ten years to collect sufficient information to warn senior policymakers about the Soviet program launched in 1974 to apply genetic engineering and other advanced biotechnologies to the creation of new and improved biological weapons. This delay looks less dramatic when one considers that the Biopreparat facilities did not begin working with dangerous pathogens until 1982-1983 due to safety concerns.[853] Nonetheless, it remains disturbing that the true intention behind the Soviet Union's massive investment in advanced biotechnologies went undiscovered for so long.

The intelligence community also did not have a firm grasp on the goals of the Soviet research on novel agents. While the CIA was correct to highlight the importance of toxins and bioregulators in Soviet research, they apparently misunderstood the purpose of this research. The CIA believed that the Soviets sought to produce large quantities of these agents for use as weapons using modified microorganisms to synthesize these compounds. It now appears that the Soviets were primarily interested in using genes that coded for toxins and bioregulators to enhance the virulence of pathogens, not for the production and harvesting of the compounds themselves. Using this technique, the Soviets could transform normally harmless microorganisms into dangerous microbes or make pathogens even more deadly.[854]

The intelligence estimate regarding the transition of genetically modified agents from research to testing by 1989 was fairly accurate. According to Sergeui Popov, a former Biopreparat scientist, modified versions of vaccinia virus (which is used as a vaccine against smallpox), *Y. pestis*, and Legionella (the bacteria that causes Legionairre's disease) with enhanced virulence were successfully tested on guinea pigs, and in some cases primates, by 1990.[855] In addition, genetically modified pathogens, possibly including strains of *B. anthracis* and *Y. pestis*, were reportedly tested on Vozrozhdeniye Island before its closure in 1991.[856] It is not possible to evaluate the accuracy of the intelligence estimate that the Soviets would be able to field new biological weapons by 1996. The activities of the military facilities that were responsible for selecting new biological weapons remain opaque to this date.

During this period, the intelligence community also had a poor grasp of Soviet threat agents. DIA believed that the Soviets had selected *B. anthracis*, *F. tularensis*, *Y. pestis*, *V. cholerae*, botulinum toxin, enterotoxin, and mycotoxins as biological warfare agents. Only the

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[851] Former senior CIA official cited in Mangold and Goldberg, *Plague Wars*, p. 85.

[852] Miller, Engelberg, and Broad, *Germs*, pp. 79-82.

[853] Russian Federation, "Declaration of Past Activity in Regard to Offensive and Defensive Programs of Biological Research and Development," p. 55. This account matches that provided by Pasechnik and former biological weapons scientist Igor Domaradskij. See Urban, *UK Eyes Alpha*, p. 131; and Domaradskij and Orent, "The Memoirs of an Inconvenient Man," p. 256.

[854] Alibek, *Biohazard*, pp. 154-155; Domaradskij and Orent, *Biowarrior*, p. 181; and "Sergeui Popov Interview."

[855] Miller, Stephen, and Broad, *Germs*, pp. 301-303; and "Sergeui Popov Interview."

[856] Bozheyeva, Kunakbayev, and Yeleukenov, *Former Soviet Biological Weapons Facilities in Kazakhstan*, p. 6; and Bakyt B. Atshabar, "Foreword," in Tucker and Zilinskas, *The 1971 Smallpox Epidemic in Aralsk, Kazakhstan and the Soviet Biological Warfare Program*, p. iii.

first three agents were correct.[857] In addition, by the late 1980s the Soviets had standardized variola, *Brucella* spp., *C. burnetti* (the rickettsia that causes Q-fever), Venezuelan Equine Encephalitis, and *P. mallei* (the bacteria that causes glanders) as biological warfare agents. The most startling intelligence shortcoming was the failure to detect the Soviet development of smallpox as a weapon over the course of forty years. The Soviet Union stockpiled twenty tons of the virus and planned on using it against the continental United States as a strategic weapon in the event of war. [858] Meanwhile, the United States had stopped immunizing its civilian population against this disease in 1972. U.S. intelligence also failed to detect Soviet development of anti-crop and anti-livestock agents during this period. The Soviet anti-agriculture program was allegedly highly successful and is reported to have developed foot and mouth disease and rinderpest for use against cattle, African swine fever for use against pigs, and *Chlamydia psittaci* (an intracellular bacterium that causes psittacosis and ornithosis) for use against poultry. Anti-crop agents effective against wheat, rye, corn, and rice were also developed.[859]

The United States was slow to identify the military biological weapons sites at Sverdlovsk and Zagorsk and failed to detect the oldest such facility at Kirov and the newest facility at Strizhi. Sverdlovsk and Zagorsk were only identified following the construction of production and storage units at these sites in the late 1960s, over twenty years after these sites were established.[860] These new units included capabilities to prepare nutrient media, as well as cultivate, concentrate, and purify biological warfare agents on a large-scale, and treat the resulting waste. In addition, bermed storage areas were built to hold munitions.[861] The military microbiological institute at Kirov managed to elude U.S. intelligence throughout the 1970s and 1980s.[862] Since Kirov has been deemed the most important military biological weapons facility in the Soviet program this was a serious failure. This failure is even more striking since the Soviets had even declared the existence of a high containment laboratory at the Ministry of Defense Research Institute of Microbiology in Kirov to the United Nations in 1987.[863] The 1990 DIA report also does not mention the newest plant built by the military near Strizhi in the late 1980s to produce viral and ricketsial agents.[864]

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[857] According to Alibek, the Soviets had abandoned toxins as biological warfare agents in the 1970s due to the difficulty of maintaining high concentrations of the agent over large areas. Tucker, "Biological Weapons in the Former Soviet Union," p. 2.

[858] Ibid; Tucker, *Scourge*, pp. 141-142; and Alibek, *Biohazard*, p. 112.

[859] Rimmington, "The Soviet Union's Offensive Program," pp. 113-115.

[860] It is not known exactly when these units were built, but they were probably the result of a top secret August 1967 decree issued by the Central Committee of the Communist Party and the USSR Council of Ministers that called for a build-up of Soviet chemical and biological weapons capabilities to offset perceived American leads in these weapons. It is possible that the decision to implement this decree was not made until 1969. Raymond L. Garthoff, "Polyakov's Run," *Bulletin of the Atomic Scientists*, Vol. 56, No. 5 (September/October 2000), pp. 37-40. This timing also fits a report that in 1969 the Soviets increased their biological weapons budget to 3% of the total military budget with an eye to exploiting advanced biotechnologies. Confidential interview cited by Mangold and Goldberg, *Plague Wars*, p. 52.

[861] Russian Federation, "Declaration of Past Activity in Regard to Offensive and Defensive Programs of Biological Research and Development," pp. 52-53.

[862] The cause of the failure to identify Kirov is unknown. If the Russian declaration is accurate, the Soviet Union did not build production and storage capabilities at Kirov similar to those that U.S. intelligence detected at Sverdlovsk and Zagorsk. The lack of production and storage facilities at Kirov is not consistent, however, with Alibek's report that Kirov produced and stockpiled twenty tons of *Y. pestis*. Alibek, *Biohazard*, pp. 166, 297. Pasechnik also reported that the Soviets maintained a twenty-ton stockpile of *Y. pestis*. Mangold and Goldberg, *Plague Wars*, p. 94.

[863] Leitenberg, "The Biological Weapons Program of the Former Soviet Union," pp. 187-191.

[864] Alibek, *Biohazard*, p. 298.

The United States correctly identified the network of production plants that comprised the Soviet biological weapons mobilization capacity, but this assessment was lacking from the comprehensive DIA report in 1990. This omission raises the issue of how confident the intelligence community was in its evidence linking these sites to offensive activities. The first such site identified was at Omutninsk. The Omutninsk Chemical Factory began producing biopesticides in the 1960s and was subsequently expanded by the military to serve as a mobilization plant for the production of biological warfare agents in the event of war.[865] The CIA's greater uncertainty regarding the role of this facility, compared to Sverdlovsk and Zagorsk, was probably due to the fact that the expansion of Omutninsk included only production capacity. The facility continued to lack the most visible signature of a weapons facility: munition storage bunkers.

Omutninsk, Berdsk, and Stepnogorsk had been transferred to Biopreparat, the newly created biological weapons research and production organization, in June 1974.[866] Biopreparat eventually became part of the Ministry of Medical and Microbiological Industry. Each of these plants produced legitimate civilian products during peacetime such as antibiotics, vaccines, diagnostic kits, and biopesticides. In the event of an imminent war, production would be switched over to biological warfare agents. Pokrov served a similar role although it was part of the Ministry of Agriculture.[867] Each of these sites also had the capability to fill and store biological munitions in reinforced bunkers.[868] Two other Biopreparat mobilization facilities, at Penza and Kurgan, were mentioned by American media reports as suspect biological weapons plants in the 1980s. The fact that none of these plants were listed in the 1990 DIA report as major facilities in the Soviet biological weapons program raises questions about the intelligence community's confidence in the earlier assessment that these were indeed biological weapons sites. This may have been due to the "signal" of biological weapons activities being masked by the "noise" of these facilities' legitimate civilian activities and the success of Soviet denial and deception operations.

The main research centers established by Biopreparat in the mid-1970s—the Institute of Ultrapure Biological Preparations in Leningrad, the Institute of Molecular Biology at Koltsovo (near Novosibirsk), and the Institute of Applied Microbiology at Obolensk as well as the re-existing Special Design Bureau of Biologically Active Substances at Berdsk—had been identified in American press reports by the mid-1980s. All of these institutes are also listed in the 1990 DIA report. The Institute of Biological Testing of Chemical Compounds also listed in this report appears to be a false positive since there is no mention of its role in the biological warfare program in accounts by scholars or defectors. In contrast, the Institute of Immunology at Lyubychany near Moscow, which conducted research on biological agents to suppress human immune system for Biopreparat, was not identified in the DIA report.[869] Biopreparat's five equipment design and manufacturing institutes also escaped the attention of U.S. intelligence due to the multi-use nature of their products.

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[865] Ibid., pp. 51-52. This expansion probably occurred around the same time that Sverdlovsk and Zagorsk were upgraded.

[866] Rimmington, "The Soviet Union's Offensive Program," p. 110.

[867] Alibek, *Biohazard*, p. 301.

[868] Stepnogork had four bunkers equipped to fill munitions with biological agent and two refrigerated bunkers to store these munitions. Bozheyeva, Kunakbayev, and Yeleukenov, *Former Soviet Biological Weapons Facilities in Kazakhstan*, p. 11. Pokrov had five underground bunkers equipped with production and weaponization equipment. Joby Warrick, "Russia's Poorly Guarded Past," *Washington Post*, June 17, 2002, p. A1.

[869] Alibek, *Biohazard*, p. 299.

Regarding the Ministry of Health's role in the biological weapons program, DIA accurately identified the dual role of some of the institutes in its Second Directorate. However, DIA failed to identify the role that six institutes in the ministry's Third Directorate played in the Soviet program. This directorate was responsible for Project Flute, which developed psychotropic and neurotropic agents to induce altered mood and behavior or to cause sudden death in its victims. The main customer of these agents was not the military, but the KGB.[870] In addition, the network of anti-crop and anti-animal research institutes of the Ministry of Agriculture continued to elude U.S. intelligence through the 1980s.

The DIA's understanding of the Soviet system of scientific academies' role in the Soviet offensive program was faulty. Six of the eight institutes it believed to be major participants in the weapons program either had no recorded involvement or only provided indirect support. In addition, two institutes that did conduct fundamental research for the weapons program were not listed.[871]

As in the 1960s, American intelligence analysts again fell prey to mirror imaging.[872] According to Mangold and Goldberg, "Western intelligence had wrongly assumed that the whole Soviet BW program was a very small operation, *hidden deep inside the military set up, not the civilian Biopreparat.* Using templates from their own pre-1969 US offensive program for comparison, they mistakenly believed the Soviets would need only a few military facilities (like Fort Detrick, Pine Bluff, and Dugway). When the US confirmed the Sverdlovsk disaster in 1979, they assumed, incorrectly, that they had spotted the main Soviet production facility."[873] As a result, the United States failed to properly assess the size, scope, and sophistication of the Soviet biological warfare program. The defection of well-placed Soviet scientists was required to pierce the veil of secrecy surrounding the Soviet program.

U.S. ASSESSMENT OF IRAQ'S PRE-GULF WAR BIOLOGICAL WEAPONS PROGRAM

The Persian Gulf War provides another opportunity to assess the accuracy of American intelligence regarding the threat posed by biological weapons. This section compares open source and declassified information on Iraq's biological warfare program prior to the Gulf War with the information obtained by the United Nations inspectors after the war. Although the United States detected the emergence of Iraq's offensive biological warfare program in a timely fashion and accurately identified the main research center and the program's two primary biological agents, the scale and maturity of the program surprised intelligence analysts. In addition, the United States failed to identify Iraq's biological warfare agent production plants, which emerged from the Gulf War unscathed. The poor performance of the intelligence community in identifying Iraq's biological warfare agent production plants was due to the multi-use nature of biological production equipment and good operational security by the Iraqis, which included an elaborate denial and deception effort.

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[870] Ibid., pp. 171-172.
[871] Ibid., p. 303; Domaradskij and Orent, *Biowarrior*, p. 303.
[872] "Interview with Gary Crocker," *Plague War*, PBS Frontline, October 1998, http://www.pbs.org/wgbh/pages/frontline/shows/plague/interviews/crocker.html.
[873] Mangold and Goldberg, *Plague Wars*, p. 102 (italics in original).

U.S. Intelligence on Iraq's Pre-Gulf War Biological Weapons Program

The United States first began receiving reports of Iraqi interest in biological weapons in 1987.[874] By 1988, DIA carried sixteen sites in Iraq as potential biological weapons facilities.[875] In early 1989, numerous press accounts based on leaked intelligence reports alleged that Iraq was producing biological warfare agents.[876] In January 1989, American and Israeli sources reported that Iraq had been developing biological weapons, including *B. anthracis, Salmonella typhi* (the bacteria that causes typhoid), and *V. cholerae,* at Salman Pak for more than a year.[877] An Israeli official claimed that, "We know they have developed a military biological capacity. They have completed the research and development for this type of warfare. They may have samples but have not started to manufacture actual biological weapons nor, more importantly, have they yet acquired any airborne weapons, such as sophisticated missiles."[878] On January 19, 1989, Deputy Secretary of State for Near East Asia Peter Burleigh discussed these press reports with Iraqi Ambassador Al-Anbari. Al-Anbari denied that Iraq had a biological weapon program and claimed that Salman Pak was a honeymoon resort.[879] Nonetheless, the intelligence community continued to receive information on Iraq's biological warfare activities. By July 1990, the CIA had concluded that Iraq was already producing large quantities of *B. anthracis* and botulinum toxin and could achieve a limited operational capability by the end of 1990.[880] Assessments of the extent of Iraqi biological warfare capabilities became even more important after Iraq's invasion of Kuwait in August 1990 and the deployment of U.S. forces to Saudi Arabia to defend against further Iraqi attacks.

During Operation Desert Shield, intelligence agencies worked furiously to update their assessment of the Iraqi biological weapons threat. The 1991 Gulf War marked the first time that the United States had confronted a nation armed with biological weapons. As a result, military leaders were desperate to know what agents Iraq was likely to have and how they could deliver them. In addition, it was crucial to pinpoint the location of Iraqi biological weapon research, production, and storage sites to enable their destruction during the air campaign. The United States sought not only to prevent Iraq from using these weapons during the war, but also to eliminate Iraq's capability to produce these weapons after the war.

At the dawn of the Gulf War, the United States intelligence community assessed that Iraq had the most advanced biological warfare program in the Arab world. Iraq's biological warfare agents were believed to be *B. anthracis* and botulinum toxin. The intelligence community estimated that agent production had been underway for at least two years and that Iraq had accumulated as many as 1,000 kilograms of dry anthrax spores and up to 15 kilograms of

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[874] CIA, *Iraqi Development of Biological Agent for Military Purposes*, October 1987, http://www.gulflink.osd.mil/declassdocs/cia/19960417/cia_70501_70500_01.html; and CIA, *BW Capabilities in Iraq*, December 1987, http://www.gulflink.osd.mil/declassdocs/cia/19960702/070296_cia_74620_74620_01.html.

[875] DIA, *Biological Warfare (BW) Association of Abu Ghurayb "Infant Formula" Plant*, March 22, 1991, http://www.gulflink.osd.mil/declassdocs/dia/19961031/961031_950925_0901pgv_91.html.

[876] See Carus, *"The Poor Man's Atomic Bomb?"* pp. 7-8; and Milton Leitenberg, *Biological Weapons Arms Control*, Project on Rethinking Arms Control Paper No. 16 (College Park, M.D.: Center for International and Security Studies at Maryland, May 1996), p. 23.

[877] Stephen Engelberg, "Iraq Said to Study Biological Arms," *New York Times*, January 18, 1989, p. A7.

[878] Bernard Edinger, "Israel Believes Iraq Has Biological Warfare Capacity," *Reuters*, January 18, 1989.

[879] Department of State, Cable from Secretary of State to American Embassy in Baghdad, *Biological Weapons: NEA DAS Burleigh Meeting with Iraqi Ambassador*, State 017946, January 20, 1989, FOIA.

[880] CIA, *Beating Plowshares Into Swords: Iraq's Defense Industrialization Program*, NESA 90-10009, July 1990, p. 3, http://www.foia.cia.gov.

botulinum toxin.[881] It is not clear how the United States determined that these were Iraq's biological warfare agents, but it could have been due to tracking of Iraqi foreign procurement of anaerobic fermenters, growth media, and strains of these agents.[882] The intelligence community also assessed that Iraq had weaponized these agents although no reliable information that this had occurred was available.[883] The intelligence community believed that Iraq had deployed artillery rockets, aerial bombs, and missile warheads filled with biological agent by the end of 1990.[884]

In addition to *B. anthracis* and botulinum toxin, the British also believed that Iraq was developing *Y. pestis* into a biological weapon. According to one source for British intelligence, Iraq had a small-scale production capability for *Y. pestis* using 20-gallon fermenters and a freeze-drier. It was known that Iraq had purchased 1,000 doses of plague vaccine and it was believed that this was being used to protect workers on the project. The British were so confident of this assessment that they immunized their own troops against plague before the 1991 Gulf War.[885] The United States, for unknown reasons, did not view this intelligence with the same amount of credibility and did not immunize its forces against plague.

By the end of the Gulf War, the United States had identified and targeted five production sites and twenty-one bunkers suitable for the storage of biological warfare agents and munitions. Salman Pak was identified as the primary biological weapons research and development center in Iraq as well as a site for production and storage. A veterinary vaccine plant in Abu Ghraib was identified as the location of botulinum toxin production. [886] The plant, which had been completed in 1984, had recently received ten 1,200-liter Italian-made fermenters. Efforts over the past year by Iraq to obtain spare parts for the fermenters indicated that the plant was still operational.[887] A plant located in a military complex at Taji was believed to be the site for pilot-scale production of *B. anthracis*.[888] In 1987, a 450-liter fermenter with a dedicated bacterial spore drier had been installed at the site. Procurement of spare parts for the fermenter and drier in 1989 indicated that it was still at this location.[889] The facility's security fencing, the presence of a laboratory building with multiple vents and probable waste incineration system, and definitive link with a known Iraqi biological weapon front company indicated weapons-related activities.[890] Another site in Abu Ghraib, advertised as an infant formula plant, was suspected of being a back-up BW

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[881] CIA, *Iraq Interagency Biological Warfare Working Group*, undated, http://www.gulflink.osd.mil/declassdocs/cia/19970825/970613_505wp_00d_txt_0001.html.
[882] CIA, *Iraq's Biological Warfare Program*, August 1990, http://www.gulflink.osd.mil/declassdocs/cia/19960517/cia_65171_65171_01.html; and Armed Forces Medical Intelligence Center (AFMIC), *Iraq Biological Warfare Threat*, October 22, 1990, http://www.gulflink.osd.mil/declassdocs/dia/19961031/961031_950901_0408pgf_90.html.
[883] CIA, *Intelligence Related to Possible Sources of Biological Agent Exposure During the Persian Gulf War.*
[884] CIA, *Prewar Status of Iraq's Weapons of Mass Destruction*, March 20, 1991, p. 27, http://www.gwu.edu/~nsarchiv/NSAEBB/NSAEBB80/wmd04.pdf.
[885] Mangold and Goldberg, *Plague Wars*, p. 288. Apparently, the United Kingdom remained confident in this assessment after the war despite the failure of UNSCOM to find any evidence of such a project. The British immunized their troops against *Y. pestis* during the run-up to the December 1998 and March 2003 attacks on Iraq. "British Troops to Get Plague Vaccine," *London Times*, October 20, 2002.
[886] The plant was believed to be capable of producing vaccines against bacteria from the *Clostridium* genus. Botulinum toxin is produced by *Clostridium botulinum.* CIA, *Iraq Interagency Biological Warfare Working Group.*
[887] AFMIC, *Iraq Biological Warfare Threat*; and DIA, *Iraqi BW Capabilities*, 1991, http://www.gulflink.osd.mil/declassdocs/dia/19961031/961031_950901_0628rpt_91.html.
[888] CIA, *Iraq Interagency Biological Warfare Working Group.*
[889] AFMIC, *Iraq Biological Warfare Threat.*
[890] DIA, *Iraqi BW Capabilities.*

production facility.[891] DIA believed that the site was associated with Iraq's biological weapons program because it had never actually produced infant formula, it reportedly had a high level of security, its equipment was capable of producing and processing biological warfare agents, it had high efficiency particulate filters installed, and the facility had been camouflaged before the war.[892] A possible production site at Latifiyah was identified in February 1991 based on the tracking of fermentation equipment imported by Iraq.[893]

By early 1991, the United States had identified 21 bunkers in Iraq believed to be capable of storing bulk quantities of biological agent and biological munitions. In the early 1980s, Iraq built four reinforced and compartmented bunkers, called 12-frame bunkers, just west of the Salman Pak biological research and development facility. By late 1990, two of the bunkers were equipped with refrigeration units. Due to their environmental control systems, high security, and proximity to a confirmed biological weapons facility, these bunkers were assessed as being likely locations for the storage of biological agents or munitions. From 1990 to 1991, an additional 19 refrigerated 12-frame bunkers were identified at eleven ammunition depots around Iraq. Although these bunkers were also suitable for the storage of heat-sensitive materials, such as chemical weapons, electronics, and fuel-air explosives, and the intelligence community did not have any evidence connecting them to biological weapon storage, they were targeted during the air war as a precautionary measure.[894]

During Operation Desert Storm, Iraq's weapons of mass destruction facilities were high priority targets. Almost a thousand strikes were flown against Iraq's nuclear, biological, and chemical weapons infrastructure, half of them with precision-guided munitions.[895] By the end of the war, DIA assessed that bombing had destroyed or severely the thirteen buildings associated with the five biological weapons sites. In addition, nineteen of the twenty-one refrigerated, 12-frame bunkers were also destroyed.[896] As a result of these attacks, Iraq's biological warfare program was believed to have been eliminated. This would turn out to be a wildly optimistic assessment.

Evaluation of U.S. Assessment of Iraq's Pre-Gulf War Biological Weapons Program

After an initial lag in detecting the establishment of Iraq's biological weapons program, the United States developed very good intelligence on the status of the Iraqi program and the primary biological warfare agents it was developing. These successes were due to a combination of human intelligence and tracking Iraqi procurement of critical materials and equipment from foreign suppliers. American intelligence on the locations of Iraq's biological warfare agent production plants, however, was abysmal. After the Gulf War, the Department of Defense

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[891] DIA, *Iraqi Chemical Warheads*, 1991
http://www.gulflink.osd.mil/declassdocs/dia/19961031/961031_950901_035pgv_91d.html
[892] Koblentz, "Countering Dual-Use Facilities," p. 51.
[893] DIA, *Iraqi BW*, February 15, 1991,
http://www.gulflink.osd.mil/declassdocs/dia/19961031/961031_950901_077pgv_91d.html
[894] CIA, *Intelligence Related to Possible Sources of Biological Agent Exposure During the Persian Gulf War.*
[895] Eliot A. Cohen, *Gulf War Air Power Survey*, Vol. 2, Part 2: *Effects and Effectiveness* (Washington, D.C.: Office of the Secretary of the Air Force, 1993), pp. 322, 324.
[896] Two of the bunkers were identified too late in the air war to be bombed. DIA, *Iraq's Chemical and Biological Warfare Capabilities: Surviving Assets and Lack of Use During the War*, Defense Intelligence Memorandum 88-91, March 1991, p. 2, FOIA.

acknowledged that "in contrast to the reasonably comprehensive appreciation of Iraqi CW capabilities and doctrine, intelligence assessment of the BW were much more tenuous."[897]

The United States missed the initiation of Iraq's biological weapons program at Iraq's chemical weapons facility at Muthanna in 1985. At this stage, Iraq was involved only in basic research on the pathogenicity, toxicity, and laboratory-scale production techniques for *B. anthracis* and botulinum toxin.[898] Intelligence agencies did not detect Iraq's offensive program until it was transferred to Salman Pak in 1987. Within a year of this transfer, the United States had identified Salman Pak as Iraq's biological weapons research center. At that time, Salman Pak was engaged in applied research, laboratory-scale production of biological agents, and testing these agents on animals.[899] By 1990, the intelligence community was aware of Iraq's production of *B. anthracis* and botulinum toxin, only two years after pilot-scale production had commenced and one year after large-scale production had begun.[900] While the intelligence community accurately estimated the amount of botulinum toxin produced by Iraq, it significantly overestimated *B. anthracis* production.[901] While the speed with which Iraq's production of these two agents was detected is impressive, the United States badly miscalculated which sites were involved in the production of biological warfare agents.

The only confirmed active biological weapon site struck by the United States during the Persian Gulf War was Salman Pak. The other targeted sites were either never involved in the biological weapons program or had not been for several years.[902] Furthermore, the United States failed to identify and strike the three sites used by Iraq to produce biological warfare agents immediately prior to the war: Al Hakam, the Daura foot and mouth disease vaccine plant, and the agricultural research station at Al Fudhaliyah.[903] The poor performance of the intelligence

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[897] DOD, *Conduct of the Persian Gulf War: Final Report to Congress* (Washington, D.C.: U.S. GPO, 1992), p. 640. The U.S. intelligence community's greater success in monitoring Iraq's chemical weapons program was probably due to the program's larger size, use of dedicated production facilities, heavy reliance on imported precursor chemicals and equipment, and Iraq's extensive employment of these weapons during the Iran-Iraq War.

[898] UNMOVIC, *Unresolved Disarmament Issues*, p. 152.

[899] Ibid., p. 153.

[900] Ibid., p. 155.

[901] Iraq has admitted to producing roughly 19,000 liters of botulinum toxin and 8,500 liters of *B. anthracis*. A conservative estimate by UNSCOM experts is that Iraq could produce one gram of agent for every liter of culture. Thus, Iraq claimed to have produced the equivalent of 19 kilograms of botulinum toxin and 8.5 kilograms of *B. anthracis* spores. This is more than one hundred times less than the amount of *B. anthracis* spores estimated by the intelligence community. If Iraq was able to achieve 10 grams of agent per liter, the amount of botulinum toxin produced would be far higher than estimated, but the quantity of *B. anthracis* produced would still be ten times less than estimated. On Iraq's claimed biological agent production, see United Nations Security Council, *Letter dated 25 January 1999 from the Executive Chairman of the Special Commission established by the Secretary-General pursuant to paragraph 9 (b) (i) of Security Council resolution 687 (1991) addressed to the President of the Security Council*, S/1999/94 (New York: United Nations, January 29, 1999), pp. 132-133. On the liter-to-gram conversion, seee Trevan, *Saddam's Secrets*, pp. 318-319. This analysis is in sharp contrast to the media report that the intelligence community underestimated the amount of botulinum toxin produced by a thousand-fold and the amount of *B. anthracis* by a factor of eight. R. Jeffrey Smith, "Iraq's Drive for a Biological Arsenal," *Washington Post*, November 21, 1997, p. A1.

[902] The role, if any, of the "baby milk factory" at Abu Ghurayb remains unresolved to this day. Although the United States and UNSCOM obtained circumstantial evidence that indicated that the plant might have been engaged in biological weapons-related activities, no direct evidence of this has been uncovered. After his defection, Hussein Kamal, reported that the facility was strictly civilian. See Koblentz, "Countering Dual-Use Facilities," pp. 51-52.

[903] Al Hakam, Iraq's main biological weapons production facility, is believed to have manufactured 18,6000 liters of botulinum toxin and 8,275 liters of anthrax between 1989 and 1991. Daura was a civilian facility taken over by the biological weapon program in August 1990 and used to produce 5,000 liters of botulinum toxin, and possibly *B.*

community in identifying the proper targets was due to the multi-use nature of biological production equipment and good operational security by the Iraqis, which included an elaborate denial and deception effort.

The mistaken attacks on the Al Kindi veterinary vaccine plant in Abu Ghraib and on the facilities at Taji and Latifiyah were directly connected to the intelligence community's failure to detect Iraq's main biological warfare agent production plant at Al Hakam. Al Hakam was constructed in great secrecy in 1988.[904] Iraq's initial plan was to equip the plant with three 5,000-liter fermenters purchased abroad. In 1988, Iraq reached an agreement with a European firm to deliver the first unit by the end of the year. In order to conceal the true destination for the fermenters, Iraq falsified the end-use certificates for the equipment and claimed it would be used for peaceful purposes at a facility in Latifiyah.[905] To prevent foreigners from gaining access to Al Hakam, Iraq modified an existing facility at Latifiyah for a tour by representatives of the European supplier.[906] The firm was unable to meet the end of the year deadline and had to postpone delivery until 1989. Iraq did not want to wait this long and instead turned to domestic sources of fermentation equipment. As a result, the fermenters at the Al Kindi veterinary vaccine plant at Abu Ghraib were transferred to Al Hakam in late 1988.[907] Although the intelligence community believed that this facility had been engaged in the production of botulinum toxin, Iraq denied this.[908] Also, in late 1988, the fermenter at Taji, which had been engaged in the production of botulinum toxin, and not *B. anthracis* as believed by the intelligence community, was transferred to Al Hakam. To conceal the transfer of these fermenters to Al Hakam, Iraq continued to list Taji and Al Kindi as the end-user for the equipment's spare parts.[909] As a result of these transfers, Al Hakam was able to begin large-scale production of botulinum toxin in 1989 and *B. anthracis* in June 1990.[910] Iraq's denial and deception operation successfully concealed the location of its primary biological warfare agent production facility. As a result, the Coalition bombed sites at Latifiyah, Taji, and Al Kindi instead of Al Hakam.

Ironically, despite Iraq's success at concealing Al Hakam's existence through the use of front companies, the layout of the facility itself was highly suggestive of a military, and not civilian, purpose. The facility was in a remote location, covered a large area, its main buildings were widely dispersed, was surrounded by security fences with guard towers, and contained multiple bunkers.[911] These telltale indicators of a military role were clear to the first United

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anthracis, from November 1990 to January 1991. Daura was also the center of Iraqi research on viral biological warfare agents beginning in July 1990. Fudhaliyah was transferred from the Ministry of Agriculture in September 1990 and used to produce 2,200 liters of aflatoxin until January 1991. UNMOVIC, *Unresolved Disarmament Issues,* pp. 155-158.

[904] Iraq learned from its mistakes in the establishment of chemical weapons production at Muthanna and did not allow foreigners to have access to the site. Trevan, *Saddam's Secrets*, p. 317; and UNMOVIC, *Unresolved Disarmament Issues*, p. 154.

[905] Pearson, *The UNSCOM Saga*, p. 141.

[906] Trevan, *Saddam's Secrets*, p. 316.

[907] UNMOVIC, *Unresolved Disarmament Issues*, p. 155.

[908] UNSCOM obtained some documents which indicated that Iraq considered the use of the fermenters to produce biological agent *in situ* and that spare parts for the fermenters were ordered by the biological weapons program in May 1988, well before Iraq claimed the fermenters were transferred to Al Hakam. However, no evidence of *B. anthracis* production at Al Kindi has emerged. United Nations Security Council, *Letter dated 25 January 1999 from the Executive Chairman of the Special Commission established by the Secretary-General pursuant to paragraph 9 (b) (i) of Security Council resolution 687 (1991) addressed to the President of the Security Council*, p. 128.

[909] Trevan, *Saddam's Secrets*, p. 316.

[910] UNMOVIC, *Unresolved Disarmament Issues,* p. 155.

[911] Trevan, *Saddam's Secrets*, pp. 112, 116-117.

Nations inspectors to visit the site and would have also been obvious to photointerpreters who examined overhead pictures of the facility. However, satellite imagery alone would not have revealed Al Hakam's role as a biological weapon production plant. In a country as militarized as Iraq, the facility's security measures may not have seemed suspicious. In addition, overhead imagery could not provide any information about the activities underway inside its nondescript buildings.

The intelligence community's assessment of the role of the refrigerated, 12-frame bunkers in the storage of biological agent or munitions was wrong. Three of the 12-frame bunkers bombed during the Gulf War underwent secondary explosions indicating the storage of conventional explosives. UNSCOM found no evidence that Iraq used these bunkers to store biological agent or munitions. The intelligence community subsequently accepted this finding.[912] Instead of using bunkers, Iraq claims it buried its biological bombs at a military airbase and a military test range and stored the biological warheads for its Al Hussein missiles in pits along the banks of the Tigris Canal and in an abandoned railroad tunnel. The purpose of these unorthodox storage techniques was to avoid the destruction of these weapons by Coalition air strikes.[913] In contrast to the key role that bunkers played in identifying suspected Soviet biological weapons facilities, Iraq's 12-frame bunkers were a red herring. Intelligence analysts encountered a similar problem when they focused on the so-called S-shaped bunkers as the most likely storage sites for forward deployed chemical munitions. After the war it was discovered that this bunker was not a reliable signature for the presence of chemical weapons.[914] This recurring problem indicates that the standard operating procedures or signatures that can be used to identify the biological weapons activities of one state are not necessarily applicable to other states.

The United States' assessment of the biological warfare agents weaponized by Iraq was almost completely accurate. The intelligence community correctly identified *B. anthracis* and botulinum toxin and their potential delivery by aerial bombs and ballistic missiles. The United States, however, had no evidence that biological agents had been filled into munitions or that such munitions had been tested by Iraq.[915] Despite this lack of information, the intelligence community's assessment that Iraq had filled bombs and missile warheads with biological agents was a reasonable inference given the estimate of Iraq's sizable agent stockpile and the impending war. Iraq's production and weaponization of aflatoxin, however, surprised the intelligence community. Since aflatoxin is a carcinogenic fungal toxin with no known acute effects, the oversight of this agent was not militarily significant. A more significant failure was the intelligence community's assessment of biological agents undergoing research and development in the Iraqi program. Before the war, DIA believed that Iraq was investigating *V. cholerae*, *Clostridium perfringens* (the bacteria that causes gas gangrene), *Y. pestis*, and Staphylococcus

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[912] CIA, *Intelligence Related to Possible Sources of Biological Agent Exposure During the Persian Gulf War.*

[913] Ibid.

[914] CIA, *Lessons Learned: Intelligence Support on Chemical and Biological Warfare During the Gulf War and on Veterans' Illnesses Issues*, December 1997, p. 8, http://www.gulflink.osd.mil/an_iii/an_iii_refs/n48en006/1998007_0000028_0000011.htm.

Prior to the air war, Iraq had actually removed most of its chemical munitions from bunkers and left them in the open in the hope that Coalition air strikes would not target them. This tactic was successful. Iraq reported that only 5% of its 700 metric tons of chemical agent stockpile were destroyed by Coalition bombing. CIA, *CIA Report on Intelligence Related to Gulf War Illnesses*, August 2, 1996, http://www.gulflink.osd.mil/cia_report/102496_war.html.

[915] Between 1988 and 1991, Iraq tested a range of biological munitions, including aerial bombs, artillery rockets, a helicopter-mounted aerosol generator, and aircraft-mounted spray tanks. CIA, *Intelligence Related to Possible Sources of Biological Agent Exposure During the Persian Gulf War.*

Enterotoxin.[916] Of these agents, Iraq has admitted to working only on *C. perfringens*. Iraq was also conducting research on ricin, tricotheene mycotoxins, the anti-crop agent wheat smut, and the viral agents camelpox, hemorrhagic conjunctivitis, and rotavirus.[917]

Conclusion

Although the United States detected the emergence of the Iraq's offensive biological warfare program in a timely fashion and accurately identified the main research center and the program's two primary biological agents, the scale and maturity of the program was a major surprise. According to a senior US defense official, "Not even the most alarmed people thought Iraq was as advanced as they in fact were, that they had weaponized systems which were ready for use immediately. What it all adds up to is a program that was...very successfully hidden from the world's intelligence community."[918] While Graham Pearson assesses American and British intelligence on the Iraqi biological weapons prior to the Persian Gulf War as "broadly correct," the failure to detect Iraq's biological warfare agent production plants and the extensive weaponization of these agents was highly significant.[919] However, from a tactical military perspective, the most important intelligence—which biological warfare agents Iraq did have and how could they deliver them—was highly accurate. Although the United States did not have direct evidence of Iraq's weaponization of biological agents, this was a reasonable, and accurate, inference to make.

The success achieved by American intelligence appears to have been due to information provided by human sources and Iraq's reliance on the importation of foreign-made equipment and materials.[920] The contribution of human intellignece to the intelligence community's assessment of Iraq's weapons activities is unknown, but it most likely related to Iraq's production of *B. anthracis* and botulinum toxin. The timeliness with which the United States became aware of Iraq's production of these two agents, and the lack of any technical means for discovering this information, strongly suggest that the information was provided by a knowledgeable Iraqi.

Iraq's large-scale efforts to develop ballistic missiles and nuclear, biological, and chemical weapons were heavily dependent on foreign suppliers for materials and equipment.[921] During the 1980s, the Technical and Scientific Materials Import Division (TSMID) was identified by U.S. intelligence as a front for obtaining biological weapons-related items. TSMID was ostensibly part of the Ministry of Trade, but in fact reported to the Military Industrialization Commission and was the sole ordering agency for the biological weapons program.[922] By tracking TSMID's activities, perhaps through communications intercepts or human sources, the United States and its allies were able to chart Iraq's interest in and procurement of all of the components necessary for a biological weapons program: strains of dangerous pathogens, growth

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[916] AFMIC, *Iraq Biological Warfare Threat*; and DIA, *Iraqi BW Capabilities*.

[917] Iraq also investigated the viruses that cause Yellow fever and Crimean-Congo hemorrhagic fever, but abandoned these agents because they required an insect vector. Zilinskas, "Iraq's Biological Warfare Program," pp. 139-140.

[918] Smith, "Iraq's Drive for a Biological Arsenal," p. A1.

[919] Pearson, "The Essentials of Biological Threat Assessment," p. 75.

[920] Sharon Begley, "The Germ Warfare Alert," *Newsweek*, January 7, 1991, p. 25; Carus, *"The Poor Man's Atomic Bomb?"* pp. 12-13; Kathleen C. Bailey, *Why the United States Rejected the Protocol to the Biological and Toxin Weapons Convention*, (Fairfax, V.A.: National Institute for Public Policy, October 2002), p. 13; and Tucker, "Lessons of Iraq's Biological Warfare Programme," pp. 238-240.

[921] CIA, *Iraq: Foreign Dependency in Developing Weapons of Mass Destruction*, January 1991, http://www.gulflink.osd.mil/declassdocs/cia/19960705/070396_cia_75021_75021_01.html

[922] Barton, "The Application of the UNSCOM Experience to International Biological Arms Control," p. 222.

media, fermenters, spray driers, and filling machines. While this method was effective in determining Iraq's interest in biological weapons, it failed to provide an accurate picture of which facilities were involved in the program.

U.S. ASSESSMENT OF IRAQ'S BIOLOGICAL WEAPONS PROGRAM PRIOR TO 2003

American intelligence on Iraq's biological warfare capabilities and intentions was tested again during the build-up to Operation Iraqi Freedom in March 2003. During the subsequent occupation of Iraq, American investigators and enterprising journalists have collected a great deal of information on Iraq's pre-war biological weapons activities that can be used to evaluate the accuracy of the intelligence community's assessments. Although this evaluation is inevitably incomplete, sufficient information regarding the United States' pre-war intelligence assessments and Iraq's activities during this time have made it possible to conduct a preliminary analysis. In contrast to 1991 when the United States accurately assessed Iraq's intentions and made several correct judgments regarding Iraq's capabilities, virtually all of the estimates of Iraq's biological weapons intentions and capabilities prior to March 2003 were wrong.

U.S. Intelligence on Iraq's Biological Weapons Program, 2003

Prior to March 2003, the United States intelligence community, in the form of an October 2002 NIE, and senior government officials, most notably Secretary of State Colin Powell at the United Nations Security Council on February 5, 2003, made five charges regarding Iraq's biological weapons intentions, activities, and capabilities.

First, Iraq was believed to have an active and ongoing biological weapons program. According to Secretary Powell, "There can be no doubt that Saddam Hussein has biological weapons and the capability to rapidly produce more, many more. And he has the ability to dispense these lethal poisons and diseases in ways that can cause massive death and destruction."[923] According to the NIE, all key aspects of Iraq's biological weapons program—research and development, production, and weaponization—were active and most of these elements were larger and more advanced than before the Gulf War.[924] This finding was based in part on the improvement or expansion of a number of nominally civilian facilities that had been directly associated with biological weapons in the past.[925] The NIE provided three examples of this activity. First, in 2001, Iraq had stated its intent to reactivate the Daura foot and mouth disease vaccine facility, which had been disabled by UNSCOM in 1996 after its role in weapons production had been revealed. The NIE does not state if this reactivation in fact took place. Second, Iraq had recently added new storage capacity to the Amiriyah Serum and Vaccine Institute, which had stored cultures and equipment from the biological weapons program during the Gulf War. Secretary Powell later noted that satellite imagery had shown a truck caravan transferring material out of the Amiriyah institute on November 25, 2002, just two days before UNMOVIC inspections resumed. According to Powell, this is "something we almost never see at

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[923] Secretary of State Colin Powell, "Remarks to the United Nations Security Council," New York City, February 5, 2003, http://www.state.gov/secretary/rm/2003/17300pf.htm.

[924] CIA, *Iraq's Continuing Programs for Weapons of Mass Destruction: Key Judgments,* (Langley, V.A.: CIA, October 2002), p. 7, http://cia.gov/nic/other_keyjudgements.html. This is the declassified excerpt from the NIE's key judgments released on July 18, 2003.

[925] CIA, *Iraq's Weapons of Mass Destruction Programs* (Langley, V.A.: CIA, October 2002), p. 15, http://cia.gov/cia/reports/iraq_wmd/Iraq_Oct_2002.pdf. This is the unclassified version of the NIE released on October 2, 2002.

this facility and we monitor it carefully and regularly."[926] Finally, Iraq had rebuilt the castor oil production plant at the Fallujah III facility in Habbaniyah, which had been destroyed during Operation Desert Storm in 1991 and again during Operation Desert Fox in 1998. The plant had been used to produce the toxin ricin before 1991.[927]

After the war, George Tenet, director of the CIA, revealed that in the fall of 2002 his agency had received several sensitive reports from two sources characterized by friendly foreign intelligence services as "established and reliable."[928] The first source, who was believed to have direct access to Saddam and his inner circle, reported that Iraqi scientists were "dabbling" with biological weapons, with limited success. The quantities in question, however, were not sufficient to constitute a real weapons program. A second sensitive source with alleged access to senior Iraqi officials said he believed that production of chemical and biological weapons was taking place.[929] The first source, who presented the less threatening perspective on Iraq's biological weapons activities, appears to have been given less weight than the second, and more alarming, source despite the fact that CIA officials were present for the interrogation of the first source and not for the second.[930]

Second, Iraq was alleged to have a stockpile of both lethal and incapacitating biological agents, including *B. anthracis*. The intelligence community also judged that there was an even chance that Iraq possessed smallpox and had probably developed genetically engineered biological warfare agents.[931] According to a September 2002 DIA report, "Iraq is assessed to possess biological agent stockpiles that may be weaponized and ready for use. The size of those stockpiles is uncertain and is subject to debate. The nature and condition of those stockpiles are also unknown."[932] In his presentation to the Security Council, Secretary Powell alluded to Iraq's continued refusal to account for the 8,500 liters of *B. anthracis* that it had admitted to having produced before 1991 and the possibility that Iraq had produced as much as 25,000 liters of this agent and converted it into the more stable dry powder form. In addition, Powell stated that since the departure of inspectors in December 1998, "we have amassed much intelligence indicating that Iraq is continuing to make these weapons."[933]

Third, Iraq was reported to have established a large-scale and redundant production capacity. This production capacity was based partly in civilian institutions. In addition, Iraq was reported as possessing mobile production facilities for bacterial and toxin agents with a greater capacity than what Iraq had before the 1991 Gulf War.[934] According to Powell, these mobile biological production plants were "one of the most worrisome things that emerges from the thick

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[926] Powell, "Remarks to the United Nations Security Council."

[927] Iraq claimed that the castor oil was to be used to produce brake fluid. Castor bean pulp, left over from castor oil production, can be used to extract ricin. CIA, *Iraq's Weapons of Mass Destruction Programs*, pp. 16-17.

[928] The foreign intelligence service may have been the United Kingdom's Secret Intelligence Service (MI6). David Hencke, "Inquiry Into Missing Iraqi WMD Calls First Witnesses," *The Guardian*, April 1, 2004, http://politics.guardian.co.uk/iraq/story/0,12956,1183292,00.html

[929] Director of Central Intelligence George J. Tenet, "Iraq and Weapons of Mass Destruction," Georgetown University, Washington, D.C., February 5, 2004, http://cia.gov/cia/public_affairs/speeches/2004/tenet_georgetownspeech_02052004.html

[930] Mark Hosenball, "No U.S. Sources Inside Saddam's Inner Circle," *Newsweek*, February 23, 2004, p. 9.

[931] CIA, *Iraq's Continuing Programs for Weapons of Mass Destruction*, p. 7.

[932] DIA, *Iraq: Key Weapons Facilities—An Operational Support Study*, September 2002 cited in "Pentagon in 2002 Found 'No Reliable' Iraq Arms Data," *Bloomberg*, June 6, 2003.

[933] Powell, "Remarks to the United Nations Security Council."

[934] CIA, *Iraq's Continuing Programs for Weapons of Mass Destruction*, pp. 5, 7.

intelligence file we have on Iraq's biological weapons."[935] The existence of such vehicles had been suspected, but never proven, by UNSCOM.[936] The CIA believed it had received compelling confirmation of the existence of these vehicles in 2000 from an Iraqi chemical engineer who supervised one of these facilities. According to the chemical engineer, Iraq had produced six truck-mounted facilities and one rail-mobile factory. The source reportedly provided highly detailed descriptions of these vehicles and how they operated. The mobile production facilities were said to be capable of producing several hundred tons of unconcentrated agent per year, including *B. anthracis* and botulinum toxin, and processing this product into a dry powder form.[937] This engineer claimed that he had been present during biological agent production runs, including one that led to an accidental release of an unidentified agent that killed twelve technicians.[938]

The intelligence community had three additional sources who corroborated aspects of this account. The second source was an Iraqi civil engineer believed to be in a position to know the details of the program. He reported on the existence of at least one truck-transportable facility in December 2000 at the Karbala ammunition depot. The third source, also assessed as being in a position to know about the program, reported that during the summer of 2002 Iraq had built production systems mounted on trailers and railcars. The stated purpose of these systems was for the manufacturing of single-cell protein, but this source claimed that they could also be used for biological warfare agent production. The fourth source was an Iraqi major in the intelligence service who defected and reported that Iraq had mobile biological research laboratories.[939] According to a senior intelligence official, "We took that [report of mobile biological weapon production plants] seriously as a biological weapon capability that exists...In our view what that means was we though they had probably produced agent and weapons and had them sitting around. Did we know that? No."[940]

Fourth, Iraq was judged to have biological munitions and be developing delivery systems for these weapons. Iraq was assessed as having a range of munitions available, including aerial bombs, missile warheads, and spray tanks, that could be rapidly filled with biological agents.[941] In addition, Iraq was pursuing an unmanned aerial vehicle (UAV) program, including the conversion of some of its L-29 jet trainer aircraft, probably for the delivery of biological weapons.[942] This assertion was based on reports from Iraqi expatriates and defectors.[943]

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[935] Powell, "Remarks to the United Nations Security Council."

[936] Ritter, *Endgame*, pp. 153, 219-220.

[937] Another account stated that the defector also told the United States that the mobile facilities could produce *Staphylococcus*. Judith Miller, "U.S. Aides Say Iraqi Truck Could Be a Germ-War Lab," *New York Times*, May 8, 2003, p. A12.

[938] Powell, "Remarks to the United Nations Security Council"; CIA and DIA, *Iraqi Mobile Biological Warfare Agent Production Plants*, May 28, 2003, pp. 1-2, http://cia.gov/cia/reports/iraqi_mobile_plants/index.html; and CIA, *Statement by Director of Central Intelligence George J. Tenet on the 2002 National Intelligence Estimate (NIE) on Iraq's Continuing Programs for Weapons of Mass Destruction*, August 11, 2003, http://cia.gov/cia/public_affairs/press_release/2003/pr08112003.htm.

[939] Powell, "Remarks to the United Nations Security Council"; and CIA and DIA, *Iraqi Mobile Biological Warfare Agent Production Plants*, pp. 1-2.

[940] Douglas Jehl and David E. Sanger, "Powell's Case, a Year Later: Gaps in Picture of Iraq Arms," *New York Times*, February 1, 2004, p. A1.

[941] CIA, *Iraq's Continuing Programs for Weapons of Mass Destruction*, p. 7.

[942] The Air Force disagreed with this assessment and believed that primary purpose of the UAVs was reconnaissance although a capability to deliver biological agents would still be possible. CIA, *Iraq's Continuing Programs for Weapons of Mass Destruction*, p. 7. This dissent is missing from the unclassified version of the NIE. CIA, *Iraq's Weapons of Mass Destruction Programs*, pp. 22-23.

Fifth, Iraq was accused of having conducted human experimentation with chemical and biological agents. According to Powell, "We also have sources who tell us that since the 1980s, Saddam's regime has been experimenting on human beings to perfect its biological or chemical weapons. A source said that 1600 death-row prisoners were transferred in 1995 to a special unit for such experiments. An eyewitness saw prisoners tied down to beds, experiments conducted on them, blood oozing around the victims' mouths, and autopsies performed to confirm the effects on the prisoners."[944]

The intelligence community expressed a high degree of confidence in the conclusions of the NIE regarding the nature of Iraq's biological weapons program and its possession of biological weapons.[945] Likewise, Powell reassured his colleagues at the Security Council that, "every statement I make today is backed up by sources, solid sources. These are not assertions. What we're giving you are facts and conclusions based on solid intelligence."[946] As the next section will demonstrate, the confidence of the intelligence community and Secretary Powell in their assessments of Iraq's biological weapons program was unwarranted.

Evaluation of U.S Intelligence on Iraq's Biological Weapons Program, 2003

Based on the information uncovered so far by the Iraq Survey Group (ISG) and enterprising reporters who have tracked down Iraqi scientists and documents, the accuracy of the intelligence community's assessment of Iraq's biological warfare capabilities and intentions was extremely poor.

The available evidence indicates that Iraq might have had an active biological research program, but it was certainly not larger and more advanced than the program pursued prior to the 1991 Gulf War. While the evidence cited by the intelligence community in 2002 turned out to be fallacious, the ISG uncovered other activities that could have been part of a biological weapons program.

All three of the sites formerly associated with Iraq's biological weapons program and highlighted as suspicious by the CIA were visited by UNMOVIC and journalists before the war and by journalists afterwards who reported that the sites were either abandoned, not functioning, or harmless. The Daura vaccine plant was found to be in the same state of disrepair that UNSCOM left it in 1998 with cobwebs covering much of the inside.[947] Reporters found the two recently built warehouses at Amiriyah Serum and Vaccine Institute to be filled with glassware, vials, and beakers. One of the warehouses had been bombed and was filled with empty burned and broken vials. The intact building was packed with boxes of glassware and beakers under several inches of pigeon droppings and feathers.[948] Investigators now believe that the trucks outside of Amariyah in the November satellite imagery belonged to black marketers stealing scrap metal and other items of value from the site.[949] UNMOVIC inspections of the Fallujah III castor oil production plant beginning in December 2002 confirmed that the site had been rebuilt

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[943] Bradley Graham, "Air Force Analysts Feel Vindicated on Iraqi Drones," *Washington Post*, September 26, 2003, p. A23.
[944] Powell, "Remarks to the United Nations Security Council."
[945] CIA, *Iraq's Continuing Programs for Weapons of Mass Destruction,* p. 9.
[946] Powell, "Remarks to the United Nations Security Council."
[947] John F. Burns, "Inspectors Find Only Ruins At an Old Iraqi Weapons Site," *New York Times*, November 29, 2002, p. A1; and "Scientists Hunted Futilely in Iraq For Signs of Smallpox," *Associated Press*, September 19, 2003.
[948] Nancy Gibbs and Michael Ware, "Chasing a Mirage," *Time*, October 6, 2003, p. 41.
[949] "Scientists Hunted Futilely in Iraq For Signs of Smallpox," *Associated Press*, September 19, 2003.

since 1998, but also found that the plant had not been operational since mid-2001.[950] Although these sites do not support the intelligence community's original assessment, the ISG did uncover Iraqi activities and equipment that could have been used to support an offensive biological program.

The root cause of this flawed assessment was the intelligence community's reliance on defectors and a failure to verify the credibility of these sources. According to intelligence officials, the evidence that Iraq was producing biological weapons was based almost entirely on human sources of unknown reliability.[951] In addition, the United States did not have direct access to the two sources with access to senior Iraqi officials whose claims of Iraqi possession of chemical and biological weapons were relayed to the United States in September 2002 by two foreign intelligence services.[952] George Tenet has admitted that these claims, despite their second-hand nature and lack of verification, "solidified and reinforced the judgments we had reached" on Iraq's biological weapons program.[953] Despite the lack of support for the evidence presented by the intelligence community before the war, ISG made two discoveries that may point to Iraq's continued development of biological weapons in defiance of the Security Council and UNMOVIC.

After the war, ISG uncovered a secret network of laboratories with dual-use equipment and obtained testimony from Iraqi scientists regarding weapons-related research on dangerous pathogens and simulants. As a result of these findings, David Kay, the head of ISG, reported to Congressional committees that, "All of this suggests Iraq after 1996 further compartmentalized its [biological] program and focused on maintaining smaller, covert capabilities that could be activated quickly to surge the production of BW agents."[954] The level of detail revealed so far by the ISG, however, is not sufficient to determine whether these activities and equipment were in fact used to support an offensive program. Even if this was the case, the level of activities and capabilities represented by these findings are much lower than Iraq's program prior to 1991, let alone what the intelligence community believed to be occurring in Iraq prior to 2003.

The first discovery by ISG was a secret network of two dozen laboratories and safe houses established by the Iraqi intelligence services that contained equipment that was subject to United Nations monitoring and was suitable for conducting research on chemical and biological weapons. The labs were relatively small and located in civilian settings such as houses, residential areas, businesses, and a hospital. According to Kay, the labs were in operation while UN inspectors were on the ground, but they were never detected. This laboratory network was deemed capable of preserving biological weapons expertise, conducting research and development, and maintaining the ability to resume biological weapons production. As of October 2003, ISG was still trying to determine to what the extent the network supported a large-scale military program or a small-scale assassination program.[955] Although the existence of such

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[950] UNMOVIC, *Unresolved Disarmament Issues*, p. 116.
[951] Jehl and Sanger, "Powell's Case, a Year Later: Gaps in Picture of Iraq Arms."
[952] Douglas Jehl, "Agency Alert About Iraqi Not Heeded, Officials Say," *New York Times*, February 7, 2004, p. A6.
[953] Tenet, "Iraq and Weapons of Mass Destruction."
[954] David Kay, *Interim Progress Report on the Activities of the Iraq Survey Group (ISG)*, Prepared Statement Before the House Permanent Select Committee on Intelligence, the House Committee on Appropriations, Subcommittee on Defense, and the Senate Select Committee on Intelligence, October 2, 2003, http://www.cia.gov/cia/public_affairs/speeches/2003/david_kay_10022003.html.
[955] Kay, *Interim Progress Report on the Activities of the Iraq Survey Group (ISG);* "Interview with David Kay," *Chasing Saddam's Weapons*, PBS Frontline, October 2003, http://www.pbs.org/wgbh/pages/frontline/shows/wmd/interviews/kay.html.

a network had been suspected by UNSCOM after 1991, the wording of the ISG report and Kay's own comments leave unclear whether these labs and equipment were actually used for prohibited activities.[956] The description of this network matches that provided by a former brigadier general in the Muhkbarat intelligence agency. According to this source, Muhkbarat had established a network of clandestine cells and small, crude laboratories in late 1996 and 1997 with the goal of reconstituting the chemical and biological weapons program after UNSCOM's departure. The cells were created because UNSCOM had effectively dismantled the pre-1991 programs and continued inspections and sanctions made it too difficult to carry out more advanced or larger activities. Each cell was composed of three to four scientists who had not been part of the previous chemical and biological weapons programs so that they would be unknown to UNSCOM. The scientists conducted crude chemical and biological experiments in bunkers and safe houses around Baghdad. The former general claimed that the teams did not actually produce any weapons, but conducted research and planning for the eventual reconstitution of full-fledged weapons programs. According to this source, "We could start again anytime. It's very easy. Especially biological."[957]

The second ISG discovery was research being conducted by Iraqi scientists that may have been related to the development of biological weapons. ISG uncovered new research on the potential biological warfare agents *Brucella* ssp. and Congo Crimean Hemorrhagic Fever (CCHF) and continuing work on ricin and aflatoxin that had not been declared to the United Nations.[958] In addition, Iraqi scientists had studied the lethality of various unidentified agents. Discussions with Iraqi scientists revealed research with nonpathogenic organisms that served as surrogates for prohibited investigations with pathogenic agents. The biopesticide *B. thuringiensis* was used as a stimulant for *B. anthracis* and medicinal plants were used instead of ricin. Two key former biological weapons scientists claimed that Iraq had refined processes and products relevant to biological warfare agents under the guise of legitimate activity. The scientists discussed the development of improved and simplified fermentation and spray drying capabilities for the simulant *B. thuringiensis* that would have been directly applicable to *B. anthracis*. This research, apparently conducted at the Tuwaitha Biological and Agricultural Research Center, reportedly advanced Iraqi production capability of dry *B. anthracis* by two generations. One scientist confirmed that the production line for *B. thuringiensis* could be switched to produce *B. anthracis* in one week if the seed stock were available.[959] Similar dual-

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In May 2003, British officials revealed that they were interrogating a mid-level Iraqi intelligence agent who appeared to have detailed knowledge of an assassination program sponsored by the Iraqi government using chemical and biological agents such as sarin and ricin. Peter Almond, "Brits Reveal Iraq Assassination Program," *United Press International*, May 8, 2003.

[956] According to a former U.N. weapon inspector, UNSCOM uncovered documents and other evidence about the secret Mukhabarat labs in 1996 and unsuccessfully searched for the labs over the next two years. Bob Drogin, "Friendly Fire," p. 23; and Pincus, "Intelligence Weaknesses Are Cited."

[957] The officer, who had been involved primarily in Iraq's covert procurement operations abroad, refused to show documents he claimed supported his story to the reporter, or take the reporter to any of the laboratories. However, the officer did demonstrate a knowledge of Iraq's former weapons program that matched information available to former UN inspectors and he was able to fill in details on a previously reported Iraqi smuggling ring. Drogin, "Iraq Had Secret Labs, Officer Says."

[958] Both brucellosis and CCHF are naturally occurring diseases in Iraq. Therefore research on these agents was not necessarily part of a weapons program. However, prior to 1991, Iraq had investigated and rejected the use of CCHF as a biological warfare agent and both the United States and Soviet Union had previously developed *Brucella* as a biological weapon. Bob Drogin, "Experts Downplay Bioagent," *Los Angeles Times*, October 17, 2003.

[959] Kay, *Interim Progress Report on the Activities of the Iraq Survey Group (ISG)*; James Risen, "Ex-Inspector Says C.I.A. Missed Iraqi Arms Chaos," *New York Times*, January 26, 2004, p. A1; David Kay, *Iraqi Weapons of Mass*

use research activities with *B. thuringiensis* had also been conducted by Iraq prior to 1996 at the Al Hakam site.[960]

As a result of these discoveries, Kay reported that: "In the chemical and biological weapons area we have confidence that there were at a minimum clandestine on-going research and development activities that were embedded in the Iraqi Intelligence Service. While we have much yet to learn about the exact work programs and capabilities of these activities, it is already apparent that these undeclared activities would have at a minimum facilitated chemical and biological weapons activities and provided a technically trained cadre."[961] While these findings illustrate Baghdad's ongoing interest in developing biological weapons and indicate an intent to restart its biological weapon program at some point in the future, these findings do not support the intelligence community's assessment that Iraq had a large and sophisticated program underway prior to 2003.

The second intelligence assessment, that Iraq possessed a stockpile of biological weapons prior to the war, was also mistaken. In January 2004, Kay reported that, "It is highly unlikely that there were large stockpiles of deployed militarized chemical and biological weapons there."[962] All of the Iraqi officials captured and interrogated or interviewed by the United States after the war said that Iraq had destroyed its chemical and biological weapons in the early 1990s and did not produce any more after 1998.[963] In any case, since Iraq had not been able to perfect a technique to produce dry biological agents before the Gulf War, the stockpile produced by that point would not have remained potent for very long.[964] In addition, ISG collected documentary evidence and oral testimony that supported Iraq's pre-war claims that it had destroyed its chemical and biological weapons during the 1990s.[965] ISG found a six-page handwritten report by Hossam Amin, then head of the National Monitoring Directorate, for Qusay Hussein five days after Hussein Kamal's August 1995 defection to Jordan. According to this report, Kamal knew the full range of activities and capabilities that Iraq had been concealing from the United Nations with the exception of the locations of some of Iraq's weapons-related documentation. In the letter, Amin reminded Qusay that Iraq had destroyed its biological warfare agents during the summer of 1991. A senior Jordanian military officer who had debriefed Kamal after his defection said that, based on this document, Kamal had held back nothing.[966] Kamal told UNSCOM, and reportedly representatives of American and British intelligence agencies, that Iraq had destroyed its stock of biological agents and munitions in 1991.[967]

Destruction Programs, Testimony before the Senate Armed Services Committee, January 28, 2004; and Charles Duelfer, Director of Central Intelligence Special Advisor for Strategy Regarding Iraqi Weapons of Mass Destruction (WMD) Programs, *Testimony to the U.S. Congress*, 30 March 2004, http://cia.gov/cia/public_affairs/speeches/2004/tenet_testimony_03302004.html.

[960] Spertzel, "Sampling and Analysis as a Monitoring Tool," pp. 17-25; and Wallerstein, "Responding to Proliferation Threats."

[961] Kay, *Interim Progress Report on the Activities of the Iraq Survey Group (ISG).*

[962] Kay, *Iraqi Weapons of Mass Destruction Programs.*

[963] Walter Pincus and Kevin Sullivan, "Scientists Still Deny Iraqi Arms Programs," *Washington Post*, July 31, 2003, p. A1.

[964] Judith Miller, "Leading Iraqi Scientist Says He Lied to U.N. Inspectors," *New York Times*, April 27, 2003, p. A11.

[965] James Risen, "Ex-Inspector Says C.I.A. Missed Iraqi Arms Chaos," *New York Times*, January 26, 2004, p. A1; and Walter Pincus and Dana Milbank, "Kay Cites Evidence of Iraq Disarming," *Washington Post*, January 28, 2004, p. A1.

[966] Barton Gellman, "Iraq's Arsenal Was Only on Paper," *Washington Post*, January 7, 2004, p. A1.

[967] John Barry, "The Defector's Secrets," *Newsweek*, March 3, 2003, p. 6; and United Nations Special Commission, "Note for the File," undated, pp. 7-8, 13, http://www.un.org/Depts/unmovic/documents/hk.pdf.

In addition, ISG found no evidence of Iraqi possession of smallpox or development of a genetically engineered pathogen.[968] The only biological warfare agent discovered by ISG was a reference strain of *Clostridium botulinum* type B that had been hidden in a scientist's home since 1993. The scientist who concealed this vial among a collection of 96 harmless strains of other microorganisms also reported that he had refused to conceal another collection of agents, which has not yet been located. [969] The role of this strain of botulinum toxin in Iraq's biological warfare program is unclear. Biological weapons experts have questioned the significance of this finding since this strain of botulinum toxin had not been previously weaponized by Iraq or anyone else. In addition, such reference strains are required for diagnostic and public health reasons.[970] However, UNSCOM sampling of a fermenter at Al Hakam in the mid-1990s tested positive for botulinum type B. At the time, the finding was believed to be the result of local contamination since Iraq claimed that it had worked only on type A toxin and there was no evidence that Iraq had imported *C. botulinum* type B strain.[971] The way in which the strain was hidden for so long may indicate that it played a role in Iraq's biological weapons program.

While there appears to be limited evidence supporting the assessment that Iraq had a biological agent production capacity installed in civilian sites, no evidence has emerged that it had one based on mobile facilities. ISG reportedly found a significant amount of documentary evidence indicating secret plans to purchase and install dual-use equipment in civilian plants that could be converted to military use and provide a "just in time" production capability. Some Iraqi scientists and technicians interviewed by reporters said that chemical and biological agents were produced under this system as recently as 2002. Others said that the system was never used or produced only small test batches in mid and late 1990s.[972] Few details about this system have been released by ISG. The information available, however, casts doubt on the rapidity with which these facilities could be converted to military production. In the chemical field, Iraq's Military Industrial Organization reported to senior leaders in 2001 and 2002 that it would take from two to six months to begin production of mustard gas, the most basic of Iraq's chemical weapons, and up to two years for production of the nerve agent sarin.[973]

The intelligence community's claim that Iraq possessed mobile biological production facilities has been almost completely disproven. In April and May 2003, two trailers were found that resembled the mobile biological warfare production plants described by the United States before the war. At the time, the CIA and DIA called the trailers "the strongest evidence to date that Iraq was hiding a biological warfare program."[974] Subsequent analyses conducted by the State Department's intelligence bureau, engineers from DIA, and British biological weapons experts, however, have disputed this conclusion.[975] According to a former intelligence official,

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[968] "Scientists Hunted Futilely in Iraq For Signs of Smallpox," *Associated Press*, September 19, 2003; and Barton Gellman, "Iraq's Arsenal Was Only on Paper," *Washington Post*, January 7, 2004, p. A1.

[969] Kay, *Interim Progress Report on the Activities of the Iraq Survey Group (ISG).*

[970] Bob Drogin, "Experts Downplay Bioagent," *Los Angeles Times*, October 17, 2003.

[971] Christian Seelos, "Lessons From Iraq on Bioweapons," *Nature*, Vol. 398, March 18, 1999, p. 188; and UNMOVIC, *Unresolved Disarmament Issues*, p. 100.

[972] Bob Drogin, "U.S. Suspects It Received False Iraq Arms Tips," *Los Angeles Times*, August 28, 2003.

[973] Kay, *Interim Progress Report on the Activities of the Iraq Survey Group (ISG).*

[974] CIA and DIA, *Iraqi Mobile Biological Warfare Agent Production Plants*, p. 1.

[975] The leading alternative explanation is that the trailers were used to produce hydrogen for weather balloons used by artillery units. Judith Miller and William J. Broad, "Some Analysts of Iraqi Trailers Reject Germ Use," *New York Times*, June 7, 2003, p. A1; Peter Beaumont, "Iraqi Mobile Labs Nothing to Do with Germ Warfare, Report Finds," *Observer*, June 15, 2003, http://observer.guardian.co.uk/international/story/0,6903,977853,00.html; Douglas Jehl,

only one of fifteen analysts from CIA, DIA, and State who were assembled to discuss the issue in June 2003 endorsed the initial finding.[976] By January 2004, Kay was able to report that the "dominance of analytical opinion" was that the trailers were not designed for the production of biological weapons.[977]

The majority of the United States' information on Iraq's mobile program was obtained from the chemical engineer who claimed to have managed one of the plants.[978] However, the United States never had direct access to this source and instead received its information through the German intelligence service. The intelligence community did not even know the source's name before the war and relied on foreign officials to vouch for his credibility. It turns out that the source, codenamed Curveball, is the brother of a senior official in the Iraqi National Congress (INC), an influential Iraqi exile group that has long favored the overthrow of Saddam Hussein, and was seeking asylum in Germany when he made his claims about the mobile biological facilities.[979] In addition, none of the corroborating sources cited by Powell could provide first-hand confirmation. They never claimed to have seen the mobile facilities and were only reporting what they had heard.[980] DIA analysts had already concluded that the former Iraqi major, who was cited by Powell as the fourth source, was unreliable, had no firsthand knowledge of mobile biological laboratories, and may have been coached by INC, the organization that had supplied him to the agency. The agency's "fabrication notification" regarding this defector, however, was repeatedly overlooked during the process of assembling intelligence for the NIE and Powell's speech to the United Nations Security Council.[981]

The fourth major assessment by the intelligence community, that Iraq was developing UAVs to deliver biological weapons, was also wrong. Members of ISG who inspected UAVs found by U.S. forces and interviewed the Iraqis who designed them determined that the UAVs were meant for reconnaissance and not the delivery of chemical or biological weapons. These relatively small vehicles had glass viewing ports and brackets for mounting cameras and simply did not have enough internal space to accommodate a weapon.[982] Although ISG found that at least one of the families of UAVs under development was descended from an earlier version that was designed with a spray tank, this capability was not a "strong point."[983] These findings support the position of the Air Force before the war, which believed that by 2001 the L-29 UAV program had proven a failure. The smaller drones that Iraq shifted to were designed for reconnaissance and not weapons delivery. In addition, there was little evidence supporting an association between the UAV program and the chemical and biological weapons programs.[984]

"Agency Disputes C.I.A. View on Trailers as Weapons Labs," *New York Times*, June 26, 2003, p. A1; and Douglas Jehl, "Iraqi Trailers Said to Make Hydrogen, Not Biological Arms," *New York Times*, August 9, 2003, p. A1.

[976] Jehl and Sanger, "Powell's Case, a Year Later: Gaps in Picture of Iraq Arms."

[977] "Kay: Bush Administration Hampering Intelligence Reform," *USA Today*, February 12, 2004.

[978] CIA and DIA *Iraqi Mobile Biological Warfare Agent Production Plants*, p. 1.

[979] Walter Pincus, "Experts Say U.S. Never Spoke to Source of Tip on Bioweapons," *Washington Post*, March 5, 2004, p. A20; Mark Hosenball, "The Case For War: Did the Iraqi Defector Lie?" *Newsweek*, March 15, 2004, p. 10; and Bob Drogin and Greg Miller, "Iraqi Defector's Tales Bolstered U.S. Case for War," *Los Angeles Times*, March 28, 2004.

[980] Drogin and Miller, "Iraqi Defector's Tales Bolstered U.S. Case for War."

[981] Jehl, "Agency Alert About Iraqi Not Heeded, Officials Say."

[982] "Air Force Assessment Before War Said Iraqi Drones Were Minor Threat," *Associated Press*, August 25, 2003; David Rogers, "U.S. Case for War Overstated Drones," *Wall Street Journal*, September 10, 2003, p. A1; and Graham, "Air Force Analysts Feel Vindicated on Iraqi Drones."

[983] Kay, *Iraqi Weapons of Mass Destruction Programs*.

[984] "Air Force Assessment Before War Said Iraqi Drones Were Minor Threat," *Associated Press*, August 25, 2003.

The CIA and DIA believed otherwise on the basis of the testimony of defectors.[985] According to Bob Boyd, head of Air Force intelligence, the "defectors didn't always strike us as credible and in many cases their information was dated."[986]

The fifth intelligence assessment, regarding the Iraq's testing of biological weapons on human subjects, has yet to be substantiated. Although Powell cited a figure of 1,600 prisoners being subjected to chemical and biological weapons tests, reports received by UNSCOM in the 1990s put the number at between 50 and 95.[987] In October 2003, Kay reported that ISG had identified a prison laboratory complex "possibly used in human testing of BW agents" that was not declared to UNMOVIC. Kay also noted that ISG was receiving additional information that was beginning to corroborate reports since 1996 about the testing of chemical and biological agents on human subjects, but that progress was slow due to the fear of knowledgeable Iraqis regarding their culpability in crimes against humanity. [988] No more details about this corroborating evidence have emerged.

Conclusion

The intelligence community failed to accurately estimate any aspect of Iraq's biological warfare intentions and capabilities. At most, Iraq may have had a covert offensive research effort with a limited ability to restart production of biological weapons. The evidence for this finding is tentative and it was not the same evidence that served as the basis for the intelligence community's assessments of Iraq's activities in this field. The intelligence community's extremely poor performance in assessing Iraq's biological weapons program was part of a broader failure to understand Baghdad's political intentions and assess the range of Iraqi military capabilities. This catastrophic failure is the subject of numerous internal, Congressional, Presidential and non-governmental probes and is beyond the scope of this dissertation.[989] An examination of the intelligence community's record with regard to biological weapons reveals a few insights into this systemic and deep-seated problem.

The first and most obvious problem with the assessments of Iraq's biological weapons activities was the undue reliance placed on the testimony of defectors of unknown reliability. These defectors provided most, if not the vast majority, of the information on Iraq's activities in this field. In some cases, these defectors were being promoted by an organization with a clear interest in hyping the threat posed by Saddam Hussein as much as possible. All four human

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[985] Graham, "Air Force Analysts Feel Vindicated on Iraqi Drones."
[986] Rogers, "U.S. Case for War Overstated Drones."
[987] Philip Salopek, "Saddam Tested Deadly Weapons on Humans, Accounts Say," *Chicago Tribune*, July 16, 2003; Scott Ritter, "Saddam's Trap," *The New Republic*, December 21, 1998, p. 21; and Ritter, *Endgame*, pp. 180, 219.
[988] Kay, *Interim Progress Report on the Activities of the Iraq Survey Group (ISG)*.
[989] The intelligence community's performance with regards to Iraq's weapons programs is the subject of scrutiny by two internal CIA reviews, the House Permanent Select Committee on Intelligence, the Senate Select Committee on Intelligence, the President's Foreign Intelligence Advisory Board, and the presidential Commission on the Intelligence Capabilities of the United States Regarding Weapons of Mass Destruction. In addition, private groups have conducted their own evaluations. See Joseph T. Cirincione, Jessica T. Matthews, and Geroge Perkovich, *WMD In Iraq: Evidence and Implications* (Washington, D.C.: Carnegie Endowment for International Peace, January 2004) and David Isenberg and Ian Davis, *Unravelling the Known Unknowns: Why No Weapons of Mass Destruction Have Been Found in Iraq*, BASIC Special Report 2004.1 (London: British American Security Information Council, January 2004).

sources on Iraq's mobile biological production facilities were put forward by INC.[990] One of them was later determined to be a liar, the credibility of another is now in serious doubt, and the other two had only second-hand knowledge.[991] INC provided at least two other defectors who claimed to have direct knowledge of Iraq's biological weapons programs, but none of the information provided by these sources has checked out.[992] In other cases, the United States relied on second-hand information provided by foreign intelligence agencies. The German intelligence agency BND was responsible for providing the United States with the information obtained from the Iraqi chemical engineer who claimed to have worked with mobile biological production facilities. The BND refused to allow U.S. intelligence agencies to meet with the source.[993] The United States also did not have direct access to two sources with close ties to Saddam Hussein's inner circle whose influential reports of Iraqi weapons activities were passed on by foreign intelligence services. It is also possible that at least some of the defectors who provided false information did so intentionally or inadvertently as part of a disinformation program run by the Iraqi intelligence services.[994]

The failure to screen these sources more thoroughly and verify their claims had a disastrous impact on the intelligence community's assessment of Iraq's biological weapons program. This may have been due to poor tradecraft, an unwillingness of analysts to challenge information that fit preconceived notions, or pressure to ensure that the intelligence supported the policy that had already been adopted. Indeed, other Iraqi scientists and defectors who reported that Iraq no longer possessed illegal weapons, and that the trailers described by others for biological weapons were actually for a benign purpose, were ignored or dismissed.[995] Ultimately, the blame for these intelligence failures cannot be laid upon Iraqi misinformation, greedy defectors, politically motivated exile groups, or unreliable foreign intelligence agencies, but on

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[990] Johnathan S. Landay and Drew Brown, "INC Supplied Defectors Who Were Sources of Questionable Pre-War Information, Officials Say," *Knight Ridder Newspapers*, April 3, 2004, http://www.realcities.com/mld/krwashington/news/special_packages/8348849.htm.

[991] After the war, an internal assessment by DIA concluded that most of the information provided by the half dozen or so Iraqi defectors put forward by INC was of little or no value. Several of these defectors were found to have invented or exaggerated their credentials and claimed to have direct knowledge of Iraqi government activities in order to boost their credibility. Douglas Jehl, "Agency Belittles Information Given By Iraq Defectors," *New York Times*, September 29, 2003, p. A1.

[992] Adnan Ihsan Saeed al-Haideri, an engineer, provided information to the DIA on underground facilities and biological laboratories, but none of it proved useful in the hunt for Iraq's weapons. In addition, he failed a CIA-administered polygraph test. Saeed fled Iraq due to his fear of his imminent re-arrest on fraud charges. He escaped the country with very little money and with the assistance of the INC. Judith Miller, "Iraqi Tells of Renovations at Sites For Chemical and Nuclear Arms," *New York Times*, December 20, 2001, p. A1; Seymour M. Hersh, "Selective Intelligence," *New Yorker*, May 12, 2002; Bob Drogin, "U.S. Suspects It Received False Iraq Arms Tips," *Los Angeles Times*, August 28, 2003; Warren P. Strobel and Jonathan S. Landay, "Exiles' Prewar Data Assailed," *Philadelphia Inquirer*, February 14, 2004; Jonathan S. Landay and Tish Wells, "Iraqi Exiles Fed Exaggerated Tips to News Media," *Knight Ridder*, March 16, 2004; and Jonathan S. Landay, "White House Released Claims of Defector Deemed Unreliable by CIA," Knight Ridder, May 17, 2004.

INC also provided information to the *Washington Post* about a possible biological lab in Baghdad with an underground test chamber and heavy security that could be conducting research on Ebola. Joby Warrick, "In Assessing Iraq's Arsenal, The 'Reality Is Uncertainty'," *Washington Post*, July 31, 2002, p. A1.

[993] Drogin and Miller, "Iraqi Defector's Tales Bolstered U.S. Case for War."

[994] A former brigadier general in Muhkbarat has claimed that the Iraqi military intelligence agency ran just such a campaign prior to the war. Drogin, "Iraq Had Secret Labs, Officer Says"; and Drogin, "U.S. Suspects It Received False Iraq Arms Tips."

[995] Douglas Jehl, "U.S., Certain That Iraq Had Illicit Arms, Reportedly Ignored Contrary Reports," *New York Times*, March 6, 2004, p. A6; and Drogin and Miller, "Iraqi Defector's Tales Bolstered U.S. Case for War."

the analysts and policy makers who uncritically seized upon confirmatory evidence without adequately gauging and verifying its credibility.

The multi-use nature of biotechnology also played a role in the flawed threat assessment by the United States. Activities at dual-use sites were commonly cited as suspicious and as evidence of Iraq's renewal of its biological weapons program. These allegations were based primarily on satellite imagery that could not reveal the nature of activities taking place. The misinterpretation of the presence of trucks at the Amariyah institute is an illustration of this problem. Indeed, Iraq's extensive deception and denial operations before and after the Gulf War, which successfully shielded much of the biological weapons program for several years, created an expectation that the United States would not detect Iraqi activities in this domain. Perversely, given the strong conviction of the intelligence community that Iraq possessed these weapons, the absence of evidence reinforced the concern that Iraq was successfully concealing its activities.

U.S. THREAT ASSESSMENTS OF BIOTERRORIST GROUPS

Terrorist groups rely on secrecy and surprise to an extraordinary degree due to their great weakness compared to their adversaries. Historical experience with groups that have acquired, employed, or attempted to employ biological weapons illustrates the ease of maintaining the secrecy surrounding their biological weapons activities and the difficulty faced by law enforcement and intelligence agencies in obtaining accurate (or any) information on potential bioterrorists. According to an exhaustive review of bioterrorism cases in the 20th century by W. Seth Caurs, "The available evidence suggests that intelligence and law enforcement agencies are unlikely to learn that a particular terrorist group is interested in acquiring and using biological agents."[996] Virtually all of the biological weapons activities of terrorist groups have been uncovered by law enforcement and intelligence agencies only with the assistance of insiders who provided evidence against other group members. The difficulty of gathering accurate and useful information on bioterrorists is illustrated by the FBI's continued inability to identify the perpetrator of the anthrax letter attacks in October 2001 or the individual who sent letters containing ricin to government offices in 2003 and 2004.

Prior to Aum Shinrikyo's nerve gas attack in the Tokyo subway system, neither the CIA nor the FBI were aware of the cult, its preparations to use chemical and biological weapons, or its virulent anti-Americanism.[997] The Japanese and American governments did not learn of the cult's dozen separate attempts to disseminate *B. anthracis* and botulinum toxin against Japanese and U.S. Navy targets until captured cult members disclosed these activities to the police.[998] The Rajneeshee cult's use of *Salmonella Typhimurium* to contaminate salad bars in a small Oregon town in 1984 went undiscovered for over a year. The state public health department and Centers for Disease Control (CDC) believed that the source of the outbreak that sickened 751 was unsanitary practices by food handlers at the restaurants. It was not until the planners behind the attack fled the cult and the head of the cult publicly accused them of having attempted to poison local officials and the town's water supply that a criminal investigation was launched. With the

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[996] Carus, *Bioterrorism and Biocrimes*, pp. 31-32.

[997] Miller, Engelberg, and Broad, *Germs*, p. 152; Remarks by Richard A. Clarke, National Coordinator for Security, Infrastructure Protection, and Counter-Terrorism, "The Intelligence Threat Assessment Function and the New Threats," to the Armed Forces Communications and Electronics Association (AFCEA) Intelligence Committee. November 12, 1998, http://www.opsec.org/opsnews/March99/opsnewthreatsmarch99.htm

[998] Pearson, "The Essentials of Biological Threat Assessment," p. 81.

assistance of an informant in the cult, investigators raided the cult and found a sample of *S. typhimurium* in a lab in the Rajneeshee compound that matched the strain from outbreak.[999]

Likewise, biological sabotage operations conducted in 1915 and 1916 by German secret agents and their American accomplices went undetected until after the war.[1000] In 1972, four members of the ecoterrorist group R.I.S.E. contacted the FBI when they became concerned that the group's leaders planned on disseminating biological weapons in Chicago. An investigation revealed that the group had obtained seed cultures for a number of bacteria and had been trying to cultivate them in university and hospital labs.[1001] Members of the Minnesota Patriots Council, a small anti-government group, were arrested in 1995 for producing a small quantity of ricin and plotting to use it to kill various government employees after the wife of one of the group's members turned over the toxin to the police following a domestic dispute.[1002] Larry Wayne Harris was the only potential bioterrorist arrested without the use of a defector or informant. Harris was arrested in 1995 for his illegal acquisition of *Y. pestis* from the American Type Culture Collection (ATCC) due to the suspicions of an ATCC technician who talked to Harris on the phone.[1003] These episodes reinforce the finding from the Soviet and Iraq cases that human intelligence is crucial for detecting the proliferation of biological weapons.

CONCLUSION

Biological weapons programs sponsored by states and terrorist groups represent one of the most difficult targets for intelligence and law enforcement agencies. The multi-use nature of biotechnology, the difficulty in distinguishing offensive, defensive, and civilian biological activities, and the extensive secrecy that shrouds biological weapon programs pose unique challenges for intelligence collection and analysis.

Intelligence from human sources (HUMINT), either defectors or informants, has been responsible for the most significant breakthroughs in biological threat assessments. The Hirsch report, the sources that provided information on the outbreak of anthrax at Sverdlovsk in 1979, and the defections of Pasechnik and Alibek were crucial to piercing the veil of secrecy surrounding the Soviet biological weapons program. U.S. knowledge of Iraq's production of biological warfare agents prior to the Gulf War was most likely due to HUMINT. Iraq's August 1995 admission of extensive biological agent production and weaponization, as described in chapter 3, was due to the defection of Hussein Kamal. HUMINT also proved crucial to detecting or confirming the efforts of terrorist groups to develop and use biological weapons. Only such knowledgeable insiders can provide the required information on intent that is required for a comprehensive understanding of an adversary's biological warfare program.

However, as the hunt for Iraq's weapons of mass destruction has shown, HUMINT can be a double-edged sword. The information provided by defectors can be difficult to corroborate

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[999] Miller, Engelberg, and Broad, *Germs*, pp. 23-24. See also W. Seth Carus, "The Rajneeshees (1984)," in Tucker, *Toxic Terror*, pp. 115-137; and Thomas J. Torok, et al., "A Large Community Outbreak of Salmonellosis Caused By Intentional Contamination of Restaurant Salad Bars," in Lederberg, *Biological Weapons*, pp. 167-184.

[1000] A German doctor produced cultures of *B. anthracis* and *Pseudomonas mallei* (the bacteria that causes glanders), both of which are deadly to livestock, in a basement lab in Washington, D.C. American dock workers were used to infect horses and mules at major East Coast ports awaiting shipment to the United Kingdom and France for use as cavalry and draft animals. Mark Wheelis, "Biological Sabotage in World War I," in Geissler and Moon, *Biological and Toxin Weapons*, pp. 35-46.

[1001] W. Seth Carus, "R.I.S.E. (1972)," in Tucker, *Toxic Terror*, pp. 55-70.

[1002] Jonathan B. Tucker and Jason Pate, "The Minnesota Patriots Council (1991)," in Tucker, *Toxic Terror*, pp. 159-183.

[1003] Jessica Eve Stern, "Larry Wayne Harris (1998)," in Tucker, *Toxic Terror*, pp. 227-246.

and such sources may be purposefully or inadvertently transmitting false information, thus contributing to flawed assessments. The success of HUMINT with regards to the Soviet biological weapon program and the early Iraqi program may have contributed to the laxity with which the accounts of more recent Iraqi defectors were analyzed and accepted.

Unlike humans, pictures don't lie. But they also don't tell the whole truth. Overhead reconnaissance, one of the mainstays of U.S. intelligence collection, can identify suspicious features of some biological facilities, but they cannot determine the types or purposes of activities being conducted inside. As Alibek has observed, "Ordinary intelligence and surveillance techniques cannot prove the existence of a biological warfare program. Even the highest resolution satellite imagery can't distinguish between a large pharmaceutical plant and a weapons complex. The only conclusive evidence comes from first hand information."[1004] Imagery of the Soviet test site at Vozrovhdeniye Island was ambiguous enough in the 1960s to allow analysts to misinterpret its role and to prevent them from identifying the nature of the activities being conducted on the island. Satellite imagery alone was also not sufficient to determine the purpose of the bunkers and storage areas located at Soviet civilian and military microbiological facilities. In the case of Iraq, analysis of satellite imagery prior to the Gulf War failed to detect the production plant at Al Hakam or Iraq's testing and deployment of biological weapons. In 2003, the misinterpretation of imagery of dual-use sites led to sinister conclusions about benign civilian facilities.

Other means of intelligence collection no doubt contributed to the U.S. assessments of Soviet and Iraqi biological warfare activities, but details are lacking. The dependence of the Soviet and Iraqi weapons program on imported equipment and materials probably made them vulnerable to communications intercepts and informants in the exporting country. Iraq's foreign procurement efforts were one of the early indicators of their interest in biological weapons and, as described in chapter 3, ultimately provided UNSCOM with the means of uncovering their offensive program. It is unknown to what extent Soviet procurement of biotech-related equipment and materials from the United States and Western Europe was similarly penetrated.

[1004] Alibek, *Biohazard*, p. 277.

Chapter 7. Conclusion

Biological weapons pose one of the most serious challenges to international security in the twenty-first century. As biological warfare capabilities become more capable and more accessible to a wider range of actors, the strategic consequences outlined in this dissertation—proliferation to dissatisfied actors, undermining of deterrence, obstruction of civilian oversight, and flawed threat assessments—should become more evident. This analysis yields five policy prescriptions for countering the growing danger posed by biological weapons: strengthen defenses against biological weapons, increase the transparency of defensive and civilian biological activities, improve intelligence and verification capabilities, enhance cooperative nonproliferation programs, and reinforce the norm against the development and use of these weapons.

STRENGTHEN DEFENSES

Defenses against biological weapons should be strengthened to make these weapons less effective and less likely to be used in future conflicts. This can be accomplished by fundamentally shifting the offense-defense balance towards defense, investing sufficient resources in defense to offset the advantage held by the offense, or a combination of both of these measures. Even if the United States is unable to dramatically reduce the advantage of the offense in biological warfare, the United States and its allies are wealthy enough to invest the resources necessary to neutralize that advantage. Robust defenses against the most threatening agents and further improvements in vaccines, detection, physical defense, diagnosis, surveillance, and therapy could create sufficient uncertainty in the mind of potential attackers about the likelihood of success to deter such attacks.[1005] The ability to rapidly and accurately identify the perpetrator of a biological attack, and thus pave the way for apprehension or retaliation, would also serve as a deterrent.[1006] Besides the substantial investment that must be made in research and development, medical countermeasures need to be stockpiled and the readiness of local public health and medical communities and military units to detect and respond to a biological attack needs to be improved.[1007] Given the diversity of threat agents and the difficulty in accurately gauging biological threats, defensive preparations should emphasize measures that provide broad-spectrum protection against a range of man-made and naturally occurring pathogens and outbreaks.

Since the use of biological weapons anywhere would erode the taboo against these weapons everywhere, these defensive innovations should also be made available internationally to reduce the incentives for any actor to develop or use these weapons.[1008] To the extent that the tools and technologies developed to defend against biological weapons are also useful in combating naturally occurring infectious diseases, this initiative would have humanitarian as well as security benefits.

[1005] For a biodefense research agenda, see National Research Council, *Making the Nation Safer: The Role of Science and Technology in Countering Terrorism* (Washington, D.C.: National Academy Press, 2002), pp. 65-106.

[1006] Randall S. Murch, "Forensic Perspective on Bioterrorism and the Proliferation of Biological Weapons," in Scott P. Layne, Tony J. Beugelsdijk, and C. Kumar N. Patel, eds., *Firepower in the Lab: Automation in the Fight Against Infectious Diseases and Bioterrorism* (Washington, D.C.: Joseph Henry Press, 2001), pp. 203-213; and Bruce Budowle, et al., "Building Microbial Forensics as a Response to Bioterrorism," *Science*, September 26, 2003, pp. 1852-1853.

[1007] For an overview of U.S. bioterrorism preparedness efforts, see Koblentz, "Biological Terrorism," pp. 97-173.

[1008] I thank Paul Schulte for this point.

INCREASE TRANSPARENCY AND OVERSIGHT

The transparency and oversight of defensive and civilian activities in the fields of biology and biotechnology should be increased. The global life sciences research community must "lose its innocence," be more aware of the security implications of their work, and accept greater responsibility in governing their activities.[1009] The United States has taken the lead in imposing stricter regulations on the handling of dangerous pathogens and applying additional scrutiny to biological research that could be misused for hostile purposes.[1010] This latter initiative, overseen by the newly created National Science Advisory Board for Biosecurity (NSABB) at the National Institutes of Health (NIH), should be extended to all federal agencies and private entities receiving federal funds for biological research.[1011] In addition, both of these biosecurity measures should be promulgated on an international level by the World Health Organization or on a more limited scale by the Australia Group, an informal arrangement used by 33 states to exchange information and harmonize national export control policies regarding dual-use materials that could be used to produce chemical and biological weapons.

The growth in biological defense programs around the world, but especially in the United States, need to be subject to greater levels of transparency to ensure that these activities are subject to appropriate domestic oversight and are not being used, or perceived as being used, to mask an offensive program. Although it is unlikely that any state not already developing biological weapons would begin to do so now for fear of a secret offensive program underway in the United States, the lack of transparency regarding defensive activities provides other states, such as Russia, with a convenient excuse for resisting greater transparency in their own ostensibly defensive programs. The development of detection and diagnostic systems and medical countermeasures by the military are unclassified activities subject to extensive reporting requirements from Congress.[1012] Revelations since September 2001, however, have illuminated significant shortfalls in oversight of classified biodefense projects in the United States, especially those conducted by intelligence agencies.[1013] Oversight of these types of projects should be

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[1009] Quote from George Poste in Peter Aldhous, "Biologists Urged to Address Risk of Data Aiding Bioweapons Design," *Nature*, November 15, 2001, p. 237. See also Gerald L. Epstein, "Controlling Biological Warfare Threats: Resolving Potential Tensions among the Research Community, Industry, and the National Security Community," *Critical Reviews in Microbiology*, Vol. 27, No. 4 (January 2002), pp. 321-354; John D. Steinbruner and Elisa D. Harris, "Controlling Dangerous Pathogens," *Issues in Science and Technology*, Spring 2003, pp. 47-54; Gigi Kwik, Joe Fitzgerald, Thomas V. Inglesby, and Tara O'Toole, "Biosecurity: Responsible Stewardship of Bioscience in an Age of Catastrophic Terrorism," *Biosecurity and Bioterrorism*, Vol. 1, No. 1 (2003), pp. 1-9. On the potential drawbacks of these types of proposals, see Stern, "Dreaded Risks and the Control of Biological Weapons," pp. 89-123; and Kendall Hoyt and Stephen G. Brooks, "A Double-edged Sword: Globalization and Biosecurity," *International Security*, Vol. 28, No. 3 (Winter 2003/04), pp. 123-148.

[1010] On limiting access to pathogens, see Jonathan B. Tucker, *Biosecurity: Limiting Terrorist Access to Dangerous Pathogens*, Peaceworks No. 52 (Washington, D.C.: United States Institute of Peace, November 2003). On the review of dual-use biological research, see National Research Council, *Biotechnology Research in an Age of Terrorism: Confronting the Dual Use Dilemma* (Washington, D.C.: National Academies Press, 2003).

[1011] Currently, the guidelines developed by NSABB will apply only to entities that receive NIH funding and to federal agencies that participate on a voluntary basis.

[1012] The Department of Defense 2003 annual report on chemical and biological defense program to Congress is 324 pages long.

[1013] The Department of State and National Security Council were not informed of certain classified biodefense activities that should have been declared to the United Nations as part of a confidence-building measure. On proposed guidelines for regulating sensitive biodefense programs, see Barbara Hatch Rosenberg, "Defending against

vested in an interagency review group capable of balancing the competing needs of secrecy and transparency. Given the inherent secrectiveness of intelligence agencies and the capabilities resident in military research centers and civilian institutes, the role of intelligence agencies in biodefense research should be strictly limited.[1014] Transparency of biodefense programs would not only promote accountability, reduce suspicion, and build confidence in compliance with the BWC, but could also serve a deterrent function by demonstrating the availability of defenses against a range of biological agents.

IMPROVE INTELLIGENCE AND VERIFICATION

The capability to reliably detect clandestine offensive biological activities and to distinguish them from defensive and civilian activities is in need of drastic improvement. This capability is needed for three reasons: (1) to establish a foundation for verification, (2) to provide policymakers with insights into the capabilities and intentions of other nations, and (3) to improve the effectiveness of defenses. Accurate and timely intelligence is crucial to achieving these objectives. Therefore, the United States and its allies should enhance the collection and analysis of intelligence regarding biological warfare programs by aggressively seeking human sources, exploiting open sources, and recruiting more academic and industry biotechnology experts. The difficulty that the United States has had in confirming its pre-war intelligence on Iraq's biological weapons program highlights the urgent need for improvements in this field.

In addition, a major research program is required to develop and refine techniques and technologies that could be employed to investigate allegations of noncompliance with the BWC on an ad hoc basis or as part of a verification regime.[1015] One aspect of such a program would be a rigorous and impartial field-testing and evaluation of verification measures based on the experience gained with inspections of suspected biological weapons sites in the former Soviet Union and Iraq. This program should also involve industry and academia in order to devise methods of protecting proprietary information without compromising the ability of inspectors to collect enough information to determine the compliance status of a facility.

ENHANCE NONPROLIFERATION

Bilateral and international programs to convert former biological weapons-related facilities, increase their security, and employ former weapons scientists should be intensified and expanded. Given the size and sophistication of the former Soviet biological weapons program and the poor economic conditions in the newly independent states, preventing the proliferation of biological weapon-related resources from these countries is essential.[1016] Iran and Iraq have

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Biodefence: The Need for Limits," *Disarmament Diplomacy*, No. 69 (February-March 2003), http://www.acronym.org.uk/dd/dd69/69op03.htm.

[1014] For an argument along similar lines, see Leitenberg, "Distinguishing Offensive from Defensive Biological Weapons Research," pp. 230-232.

[1015] *House of Cards: The Pivotal Importance of a Technical Sound BWC Monitoring Protocol* (Washington, D.C.: Henry L. Stimson Center, May 2001), pp. 99-100; *Compliance Through Science: US Pharmaceutical Industry Experts on a Strengthened Bioweapons Nonproliferation Regime* (Washington, D.C.: Henry L. Stimson Center, September 2002), pp. 66-67.

[1016] Smithson, *Toxic Archipelago*; and Derek Averre, "From Co-option to Cooperation: Reducing the Threat of Biological Agents and Weapons," in Robert J. Einhorn and Michelle A. Flournoy, eds., *Protecting Against the Spread of N Nuclear, Biological, and Chemical Weapons*, Vol. 2: *The Challenges* (Washington, D.C.: Center for Strategic and International Studies, January 2003), pp. 23-52.

already attempted to obtain biological weapons-related resources from Russia.[1017] Similar projects could also be useful in South Africa, Iraq, possibly Libya, and other states unable to fully dismantle their former biological weapons program. Enhanced cooperative nonproliferation efforts would complement efforts to strengthen biological defenses by employing former weapons scientists in civilian or defensive research. These measures would not be able to prevent proliferation, but they could complicate terrorist access to biological weapons based on traditional pathogens and hinder the development of more sophisticated weapons by states. Additional advantages of these programs are their ability to promote transparency regarding current activities and provide insights into past activities of concern.

REINFORCE NORMS

The norm against the development and use of biological weapons should be strengthened to reduce the motivations of states and terrorists to acquire these weapons and gain operational experience with them. One valuable step in this direction would be an international agreement that the development, production, transfer, and use of biological weapons, including unethical human experimentation, represents a crime against humanity and that perpetrators would be subject to international arrest and prosecution.[1018] Criminalizing biological weapons would further delegitimize these weapons and add another element of uncertainty to the calculations of political and military leaders contemplating the use of these weapons.

[1017] Judith Miller and William Broad, "Iranians, Bioweapons in Mind, Lure Needy Ex-Soviet Scientists," *New York Times*, December 8, 1998, p. A1; and R. Jeffrey Smith, "Russians Admit Firms Met Iraqis; Plants That Could Make Germ Weapons at Issue," *Washington Post*, February 18, 1998, p. A16.

[1018] For proposals along these lines, see Matthew Meselson and Julian Robinson, *A Draft Convention to Prohibit Biological and Chemical Weapons under International Criminal Law* (Cambridge, Mass.: Harvard Sussex Program on CBW Armament and Arms Limitation, March 2003), http://www.sussex.ac.uk/spru/hsp/IntroConvRev1.pdf; and Jonathan Moreno, *Undue Risk: Secret State Experiments on Humans* (New York: Routledge, 2000), pp. 294-297.

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DDRS Declassified Document Reference System

MHI Military History Institute, Carlisle Barracks, Pennsylvania

NA National Archives, College Park, Maryland

Nixon Nixon Presidential Materials, National Archives, College Park, Maryland

NSA National Security Archives, Washington, D.C.

PRO Public Records Office, London, United Kingdom

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