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OFFICE OF THE DIRECTOR OF NATIONAL INTELLIGENCE
WASHINGTON, DC

3 December 2024

Reference: ODNI Case No. DF-2022-00321

This letter provides an interim response to your Freedom of Information Act (FOIA) request to the Defense Intelligence Agency (DIA), dated 18 September 2017, requesting 18 specific theses written by students at the National Intelligence University. As previously noted by DIA, DIA transferred these cases to the Office of the Director of National Intelligence (ODNI) in 2022.

ODNI processed this request under the FOIA, 5 U.S.C. § 552, as amended and located 17 of the theses requested. Note, despite a thorough search, "Rationing the IC: The Impact of Private American Citizens on the Intelligence Community" was not located.

This interim response provides a response on ten of the theses. During the review process, we considered the foreseeable harm standard and determined that certain information must be withheld pursuant to the following FOIA exemptions:

- (b)(3), which applies to information exempt from disclosure by statute. Specifically, the National Security Act of 1947, as amended:
  - Section 102A(i)(l), 50 U.S.C. § 3024(i)(1), which protects information pertaining to intelligence sources and methods; and
  - Section 102A(m), as amended, 50 U.S.C. § 3024(m), which protects the names and identifying information of ODNI personnel.
- (b)(6), which applies to information that, if released, would constitute a clearly unwarranted invasion of personal privacy.

Be advised, we continue to process your request. If you are not satisfied with this response, a number of options are available. You may contact me, the FOIA Public Liaison, at ODNI_FOIA_Liaison@odni.gov, or the ODNI Requester Service Center, at ODNI_FOIA@odni.gov or (703)-275-1313. You may also submit an administrative appeal to the Chief FOIA Officer, c/o Chief, Information Management Office, Office of the Director of National Intelligence, Washington, DC 20511 or emailed to ODNI_FOIA@odni.gov. The appeal correspondence should be clearly marked "Freedom of Information Act Appeal of Adverse Determination" and must be postmarked or electronically transmitted within 90 days of the date of this letter.

Lastly, the Office of Government Information Services (OGIS) of the National Archives and Records Administration is available with mediation services and can be reached by mail at 8601

Adelphi Road, Room 2510, College Park, MD 20740-6001; telephone (202) 741-5770; toll-free (877) 684-6448; or email at ogis@nara.gov.

Sincerely,

Erin Morrison
Chief, Information Review and Release Group
Information Management Office

ABSTRACT

TITLE OF THESIS: Anhrax: Indicators of Terrorist Use

STUDENT: (b) (6)

CLASS NUMBER: PGIP 0501 **DATE: August 2005**

THESIS COMMITTEE CHAIR: (b) (6)

SECOND COMMITTEE MEMBER: (b) (6)

In October 2001, a highly lethal form of anthrax powder was sent in an envelope to the U.S. Capitol. This letter, one of seven sent, contained less than one gram of anthrax agent, yet it heavily contaminated U.S. postal centers it was processed through and offices in the U.S. Senate. Two of the postal centers were closed for more than two years and the Hart Senate building was shut down for three months. Non-state actors showed they now had the capability to employ biological weapons and threaten large numbers of people.

The purpose of this thesis is to provide intelligence analysts the background information on the methods and procedures that would be required for a non-state actor to develop and disseminate an anthrax agent with the intent to inflict mass casualties or create terror in a population. The ability of intelligence analysts to identify a non-state actor's activities as being associated with developing this type of agent would require a basic understanding of how anthrax behaves as a natural disease and as a biological

weapon. Additionally, the thesis identifies the ease or difficulties that might be involved with employing it as a weapon.

Chapter One discusses the different types of Chemical, Biological, Radiological, and Nuclear (CBRN) weapons, and the different advantages and disadvantages each may offer to a non-state actor when used as a Weapon of Mass Destruction (WMD). After illustrating the advantages that a biological anthrax agent would present in terms of cost, ease of production, and mass casualty estimates over other methods of CBRN, subsequent chapters provide basic knowledge on anthrax symptoms and effects, terrorist motivations and mindsets, and development and dissemination methods.

The final chapter concludes with a discussion of the benefit of medical and first responder's immediate recognition of an anthrax attack or recognition within the first few hours after an attack. The ability to use information from these individuals, who are likely the first to notice signs of a biological attack, would be significant in managing and minimizing the effects of an attack. Additionally, other activity, while not suspicious in and of itself, linked with other indicators may point toward a non-state actor's attempts at developing an anthrax agent prior to an actual attack. The thesis concludes with a list of these indicators that could be used by analysts to discern suspicious activity and relate to the possible attempts by a non-state actor to develop an anthrax agent.

ANTHRAX: INDICATORS OF TERRORIST USE

by

(b) (6)
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MSSI Class 2005

Unclassified thesis submitted to the faculty
of the Joint Military Intelligence College
in partial fulfillment of the requirements for the degree of
Master of Science of Strategic Intelligence

August 2005

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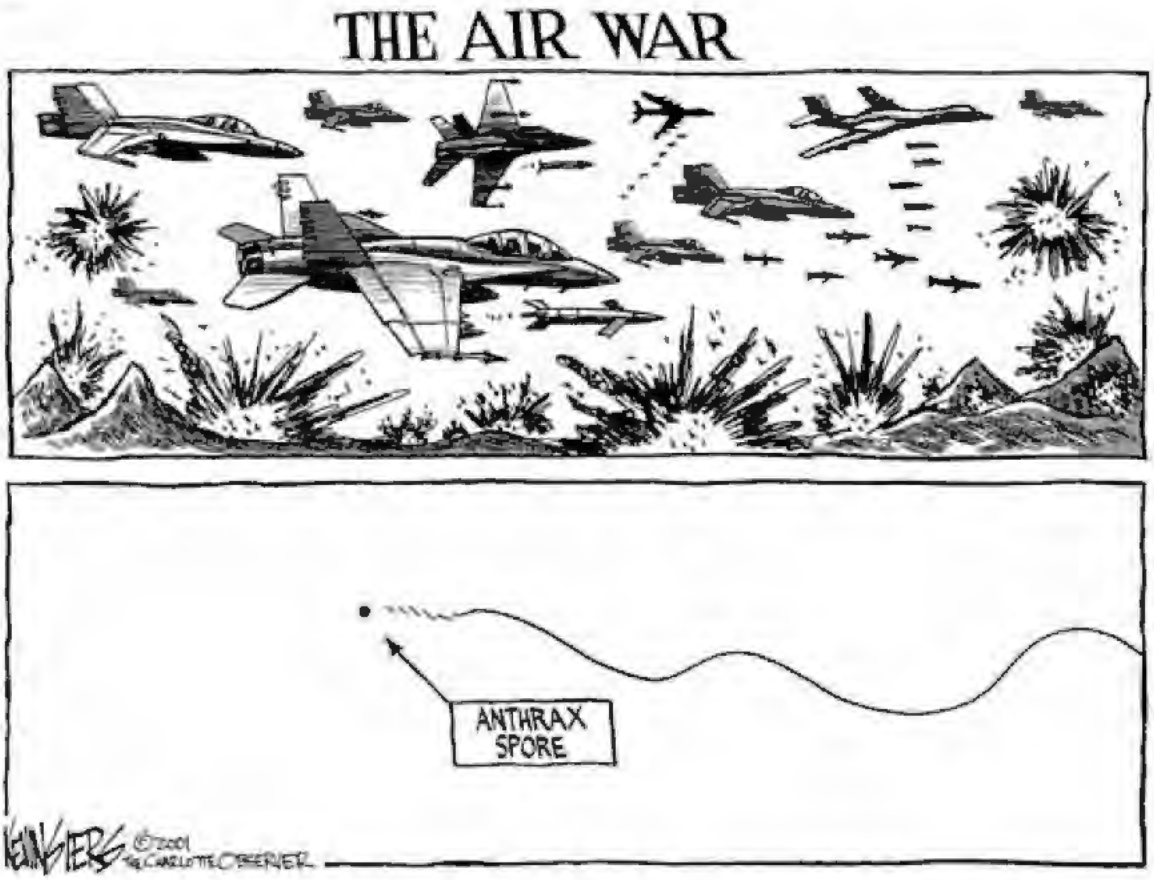

Figure 1. Air War and Anthrax Spore.

Source: Daryl Cagle's Professional Cartoonist's Index, under the term "anthrax," URL: <http://cagle.slate.msn.com/news/anthrax/2.asp>, accessed 15 June 2005.

CHAPTER ONE

TERRORISTS WEIGHING CBRN OPTIONS

> The gravest danger to out Nation lies at the crossroads of radicalism and technology. Our enemies have openly declared that they are seeking weapons of mass destruction and evidence indicates that they are doing so with determination….History will judge harshly those who saw this coming danger but failed to act.
>
> President George W. Bush, 2002

There is considerable debate among counterterror analysts over the possibility of terrorist use of Weapons of Mass Destruction (WMD). In the past, there have not been a significant number of terrorist groups that have conducted chemical, biological, radiological, or nuclear (CBRN) attacks beyond simple poisoning and assassinations, and certainly none that used CBRN successfully in mass casualty WMD attacks. With some exceptions, terrorists have not attempted to induce mass casualties on their targets for fear of the target's retaliatory response or the fear of losing an otherwise sympathetic audience.

In the last decade, however, non-state actors are demonstrating increased interest in CBRN weapons.[1] The events of 11 September 2001 and the anthrax attacks the

[1]Central Intelligence Agency, Chemical, Biological, Radiological, and Nuclear (CBRN) Terrorism Reporting Guide (Washington, DC: 2004), 5. Cited hereafter as CBRN Reporting Guide.

following month demonstrate that some non-state actors are no longer restricting themselves from mass-casualty attacks or from using WMD.

In the quest to inflict greater numbers of casualties on their targets, it would appear that some non-state actors would be motivated to develop a WMD capability.[2] To do so, however, a group would have to overcome logistical and technical hurdles to employ such weapons. Most non-state actors who have attempted to use WMD have either been incapable of surmounting these hurdles or have abandoned their efforts for other reasons, such as the fear of handling chemical or biological weapons.

TYPES OF WMD

Nuclear Bombs

Even with the dissolution of the Soviet Union, acquisition of a nuclear weapon by non-state actors is not a likely event. If they could overcome the financial burden of purchasing an adequate supply of weapons grade fissile material, finding a seller and successfully conducting a transaction would still be a hurdle. Despite the relaxation of security immediately after the Soviet break-up, there is little evidence of terrorists having acquired nuclear weapons.

Once terrorists obtained the material, building a workable bomb is not as easy as might be portrayed on the internet or in a novel. Building a nuclear bomb requires

[2]Neil C. Livingstone and Joseph D. Douglass Jr., *CBW: The Poor Man's Atomic Bomb* (Washington, DC: Corporate Press, 1984), 6.

extensive financial resources, significant scientific knowledge, and extensive equipment and laboratories, none of which is likely to be available to non-state actors.[3] Nuclear weapons expert Bruce Blair, states that the level of control the Russians exercise over their nuclear arsenal is no more relaxed than that of their Soviet predecessors. As noted by Richard Pearlstein, it is extremely unlikely that an intact nuclear weapon could be smuggled out of the former Soviet republics and the prospect of nuclear terrorism is no more likely than it was prior to 1991. Blair does concede that looser security of nuclear material outside of the nuclear weapons infrastructure is a more feasible possibility.[4]

Radiological "Dirty" Bombs

If terrorists could obtain radioactive material, building a "dirty bomb" would be a low-tech option for them. The radioactive material could be dispersed among a civilian population by spreading it with a conventional explosion. The material would not have to be weapons grade material, only radioactive; for example, radioactive medical waste, which would not be very difficult to obtain.

An example of the panic that a terrorist group could instill with radiological terrorism was illustrated in 1995 when a prominent Chechen commander displayed containers of radiological materials in Moscow and claimed his forces could dispense them. Although the materials were not dispersed and found not to be harmful, there was significant fear and publicity over the potential weapon.[5]

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[3]Livingstone and Douglass, 4, 7.

[4]Richard M. Pearlstein, *Fatal Future? Transnational Terrorism and the New Global Disorder* (Austin, TX: University of Texas Press, 2004), 90-91.

[5]*CBRN Reporting Guide*, 8.

The disadvantage to a "dirty bomb" would be the low number of casualties. Certainly the event might cause an initial panic because of the fear of a radioactive material, however, dirty bombs would not cause significant casualties beyond the initial blast effects of the conventional explosion**.** A large conventional bomb would be much more effective in terms of the resultant mayhem and casualties. Jessica Stern states that, "radiological materials [are] unlikely to kill or injure many people," and Sarah Mullen asserts that a radiological dispersal device is, simply, not a weapon of mass destruction. Chemical and biological weapons are far less expensive, more easily obtained or manufactured, and easier to use as a weapon.[6]

Chemical Weapons

Formulas for producing nerve agents, mustard gas, and other chemical agents are available in scientific texts. The equipment required to manufacture such weapons can be purchased at low cost and requires minimal space. In addition, only an extremely small amount of a chemical agent is needed to produce casualties. One drop of VX nerve agent, the size of the head of a pin, is a lethal dose in a human being. Four tons of VX released in a crowded urban area in an aerosol would cause several hundred thousand deaths.[7] It should be noted, however, that manufacturing chemical weapons in such large quantities as illustrated in this example is usually limited to nation states and not likely to be produced on a large scale by non-state actors.

[6]Pearlstein, 92.

[7]Livingstone and Douglass, 7.

Chemical agents are relatively easy to produce, especially simple agents like cyanide gas; however, there is still a problem with handling and employing them. Employing chemical agents without an efficient system, such as airborne sprayers or air-dropped bombs, would significantly reduce the effects of the chemicals. Although the Aum Shinrikyo religious sect in Japan employed chemical agents on the Tokyo Subway, the death toll was relatively low due to an ineffective method of distribution.

Biological agents offer certain distinct advantages over chemical weapons. Under the right conditions biowarfare agents can cover a wider area than an equal amount of chemical agent. Studies using computer models have shown that anthrax spores can be infectious more than 125 miles from the original aerosol source. Pound-for-pound biological agents are considerably more potent and the costs for developing biological weapons are also lower.[8]

Biological Weapons

Acquiring and employing a mass casualty biological weapon is not nearly as difficult as nuclear weapons.[9] With the potential for mass casualties, and the feasibility of producing sufficient quantities in a small-scale lab, biological weapons are probably the most feasible option for a mass casualty weapon for potential terrorist use. In the previous scenario using four tons of VX nerve gas, the same number of casualties is possible with only 50 kilograms of anthrax.[10] Still, developing weapons grade biological

[8]Eric Croddy and others, Chemical and Biological Warfare (New York: Copernicus Books, 2002), 197-198.

[9]John Mintz, "Technical Hurdles Separate Terrorists From Biowarfare," *Washington Post*, 30 December 2004, A1+.

[10]Livingstone and Douglass, 7.

material is something that requires some scientific know-how and research. Moreover, effectively employing such a weapon might prove difficult.

The development of biological weapons is not a simple task. However, some believe that a determined individual with a master's degree in microbiology and a small laboratory could manufacture a biological agent capable of killing thousands.[11] Additionally, while manufacturing a nuclear bomb would cost hundreds of millions of dollars, a biological weapon capable of killing the same number of people could be produced in a kitchen lab at minimal cost.

The fears of nuclear weapons proliferation have motivated governments to ensure strict security controls on nuclear materials, yet, protection of dangerous pathogens are weak in comparison. Collections have been stored in unsecured freezers and shipped across international borders with minimal security precautions. Although the U.S. maintains tighter control over biological materials today, many countries worldwide have been slower in establishing stricter controls and few countries regulate who is granted access.[12]

THE ANTHRAX OPTION AS A WEAPON FOR TERRORISTS

Mass Casualties

Estimates of casualties resulting from an anthrax attack are catastrophic and equal in magnitude to a tactical nuclear weapon. In a study by the World Health Organization,

[11]Livingstone and Douglass, 4.

[12]Jonathan B. Tucker, Biosecurity: Limiting Terrorist Access to Deadly Pathogens (Washington, DC: United States Institute of Peace, 2003), 16-17.

the death toll from 50 kilograms of anthrax released over a large city could kill 100,000 people and infect another 150,000.[13] In another computer model study, one kilogram of anthrax spores released in a city the size of New York could kill over 120,000 people.[14] Furthermore, a study by the U.S. Army, which simulated the use of anthrax released in the New York subway system, estimated there would be over 10,000 deaths.[15] In a comparison of the number of potential casualties from a WMD attack, anthrax can create a greater number of casualties than a chemical or nuclear weapon (See Table 1).

[13]Anthony H. Cordesman, *Asymmetric and Terrorist Attacks with Biological Weapons* (Washington, DC: Center for Strategic and International Studies, September 2001), 30.

[14]"Anthrax Attack Could Kill 123,000," *BBC News*, 18 March 2003, URL: <http://news.bbc.co.uk/ 1/hi/ health/2857207.stm>, accessed 1 February 2005.

[15]Cordesman, 27.

Table 1. Comparative Effects of Biological, Chemical, and Nuclear Weapons[16]

	Area Covered in square kilometers	Deaths Assuming 3,000-10,000 people per square kilometer
Nuclear Warhead		
One 12.5 Kiloton nuclear device	7.8	23,000-80,000
Chemical or Biological Agent		
Clear, sunny day, light breeze*		
Sarin Nerve Gas	0.74	300-700
Anthrax Spores	46	130,000-460,000
Overcast day or night, moderate wind		
Sarin Nerve Gas	0.8	400-800
Anthrax Spores	140	420,000-1,400,000
Clear calm night		
Sarin Nerve Gas	7.8	3,000-8,000
Anthrax Spores	300	1,000,000-3,000,000

*Delivery of the chemical or biological agent simulates one aircraft delivering 1,000 kg of Sarin nerve gas or 100 kg of Anthrax spores. Assumes the aircraft flies in straight line over the target at optimal altitude and dispensing the agent as an aerosol.

Fear

The use of biological weapons in any form is a frightening prospect. A biological agent that could infect thousands or hundreds of thousands of people has led nations to establish international weapons ban treaties. Terrorists wishing to profit by those fears may seek to develop and employ biological weapons. Even if there are few deaths as the result of a biological attack, the ensuing psychological effects may meet a terrorist's goals.

[16]Cordesman, 14.

Dr Robert Spencer, an infection control expert at the UK Public Health Laboratory Service, is skeptical of the methods in determining mass casualty estimates and the fears over mass casualties. He does emphasize, however, the level of panic a population may feel in response to a biological attack. He states, "My personal feeling is that anthrax is not a weapon of mass destruction, but a weapon of mass hysteria."[17] The psychological responses from a population that is targeted in a biological attack include: panic, paranoia, loss of faith in and anger with the government, and demoralization.[18] These are many of the key goals of most terrorist groups and add to the appeal of bioweapons.

Economic Impact

The economic impact of biological attack could be devastating. In addition to the effect on the world's financial markets, the estimates of the costs in terms of care for the infected, inoculations, and recovery operations are extreme. A single anthrax attack with 100,000 people exposed is estimated to cost $26.2 billion in recovery efforts.[19] This is provided that health officials could administer a rapid prophylaxis program, which is doubtful. Therefore, the costs could run even higher.

[17]"Anthrax Attack Could Kill 123,000," 18 March 2003.

[18]Harry C. Holloway and others, "The Threat of Biological Weapons: Prophylaxis and Mitigation of Psychological and Social Consequences," in *The War Next Time: Countering Rogue States and Terrorists Armed with Chemical and Biological Weapons,* eds. Barry R. Schneider and Jim A. Davis (Maxwell AFB, AL: U.S. Air Force Counterproliferation Center, April 2004), 184.

[19]Arnold F. Kaufmann and others, "The Economic Impact of a Bioterrorist Attack: Are Prevention and Postattack Intervention Programs Justifiable?", in *The War Next Time: Countering Rogue States and Terrorists Armed with Chemical and Biological Weapons,* eds. Barry R. Schneider and Jim A. Davis (Maxwell AFB, AL: U.S. Air Force Counterproliferation Center, April 2004), 195.

GROWING THREAT OF AN ANTHRAX OPTION

With the increased ease of producing biological weapons, some people wonder why terrorists have not made greater use of them. Although, biological weapons are a growing threat, acquiring and employing them is still beyond the capabilities of most terrorist groups. Aum Shinrikyo was a well financed group with a large body of technical expertise that attempted to use biological weapons, including anthrax, eight times in the 1990s. All the attempts resulted in failures. The failures were mainly the result of using a relatively harmless strain of anthrax and the group's inability to deliver biological agents effectively.[20] The Aum example illustrates the technical obstacles for non-state actors in attempting to develop biological weapons. Nevertheless, government studies have determined that the threat of terrorists using biological weapons is growing exponentially with access to new technologies.

Those skeptical of the danger of biological attacks cite the low number of biological attacks in the past. Though many experts who are more wary of biowarfare's danger concede this point, they also note that access to the technology is easier. Easier access could be the reason biological warfare incidents are increasing. In a study by Seth Carus, there were 150 reported biological terrorism incidents during the 20th century. Although more than 70 percent were threats or hoaxes, 10 involved efforts to acquire biological weapons and 21 more involved acquisition and use. Furthermore, 82 percent

[20]Cordesman, 26-27.

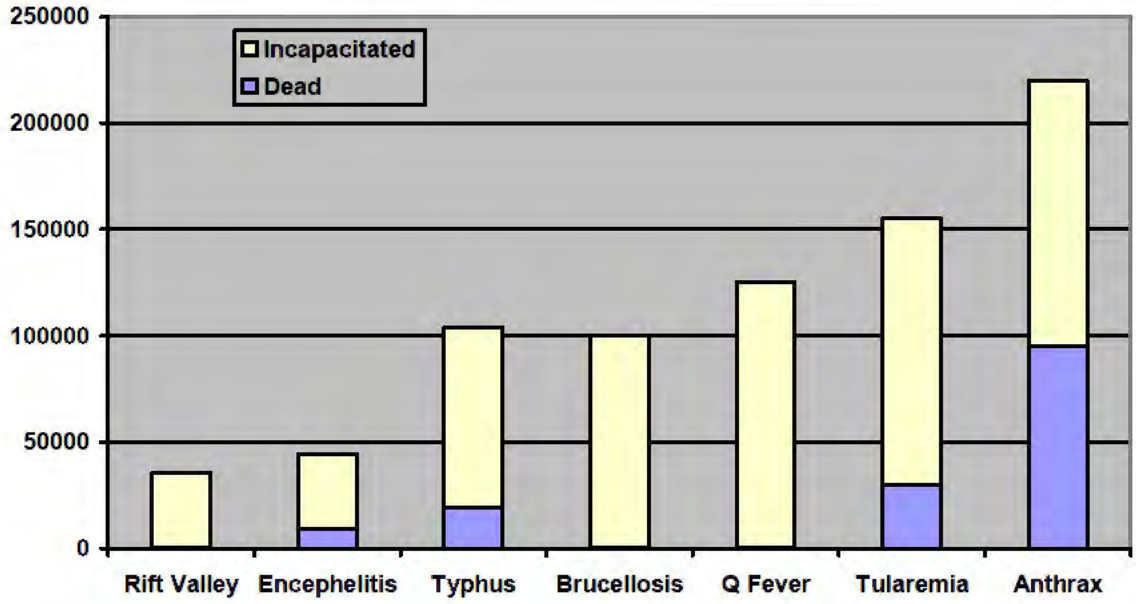
of the reported cases occurred in the 1990s. The remaining 27 cases were divided over the preceding 90 years.[21] The threat of bioterrorism is growing.

The 2001 anthrax attacks against the U.S. Congress have demonstrated the repercussions of a biological attack. The perpetrator introduced a virulent form of anthrax spores into the U.S. Capitol building via a letter mailed to former Senator Tom Daschle. Subsequently, dozens of people became ill and five died. The Daschle letter contained one gram of anthrax, or 1 trillion spores. The attacks on the Capitol demonstrate that the previous limitations on terrorists developing and employing a biological weapon in order to inflict mass casualties may no longer exist. According to Dr, D.A. Henderson, Dean of Public Health at Johns Hopkins University, anthrax requires only a very small volume of material to produce mass casualties. He states that with as little as two pounds of dried anthrax agent, it would be enough to saturate the whole of Manhattan Island. Within two to three days people would develop the disease and die quickly, however, cases of anthrax infection would continue for up to six weeks. He estimates the death toll could reach into the hundreds of thousands.[22] Among the different types of biological agents nonstate actors could develop and employ as a weapon, anthrax offers some of the most significant numbers of estimated casualties. (See Figure 2).

[21]Cordesman, 25.

[22]*Plague War*, Produced by Jim Gilmore and Peter Malloy. Written by Tom Mangold and Jim Gilmore. 1998. Videocassette.

Figure 2. Nominal Lethality of Different Biological Weapons
(Numbers of dead from delivery of 1,000 Kilograms)



Agent	Downwind Reach (Kilometers)	Casualties	
		Dead	Incapacitated
Rift Valley Fever	1	400	35,000
Tick-Borne Encephalitis	1	9,500	35,000
Typhus	5	19,000	85,000
Brucellosis	10	500	100,000
Q Fever	20+	150	125,000
Tularemia	20+	30,000	125,000
Anthrax	20++	95,000	125,000

Source: World Health Organization, *Health Aspects of Chemical and Biological Weapons*, WHO, 1970.

Documents and equipment recovered from Al Qaeda facilities in Afghanistan demonstrate that Al Qaeda was attempting to produce biological weapons and it is believed that the group was focused primarily on employing anthrax for mass casualty attacks.[23] Jeanne McDermott quotes a Defense Department official as stating that

[23] *CBRN Reporting Guide*, 6.

anthrax would make the ideal biological weapon and others believe it is the mass-casualty agent most accessible to terrorists.[24]

Scientists state that it is all but inevitable that terrorists will eventually be able to develop biological weapons and inflict mass casualties. Advances in science and techniques for developing pathogens are now available on the Internet. According to Danzig, there are more than one million scientists who do not have experience working on biological weapons, yet could still construct bioweapons.[25] The anthrax attacks on the U.S. in 2001 demonstrated the relative ease with which a terrorist could employ a biological weapon. A more aggressive individual could have killed thousands with such a lethal form of anthrax. The attacks were a warning for America of a more dangerous future and an inspiration for terrorists searching for a new weapon to achieve their objectives.

While terrorism analysts, such as Brian Jenkins, believe that terrorists are unlikely to resort to the use of CBRN weapons, many others feel that an increasing number of non-state actors are exploring the potential of this mass casualty weapon. This thesis will demonstrate that an anthrax agent has distinct advantages as a weapon for terrorists and that dedicated non-state actors have the ability to develop and disseminate anthrax with the potential to inflict thousands, possibly tens of thousands of casualties. Additionally, with the access to technology and growing expertise in biological science, the likelihood of another attack is becoming greater.

[24]Mintz, "Technical Hurdles," A1+.

[25]Mintz, "Technical Hurdles," A1+.

Figure 3. Then and Now.

Source: Daryl Cagle's Professional Cartoonist's Index, under the term "anthrax," URL: <http://cagle.slate.msn.com/news/anthrax/5.asp>, accessed 15 June 2005.

CHAPTER TWO

THE ANTHRAX THREAT

> Imagine, a September 11 with weapons of mass destruction. It's not 3,000 dead. It's tens of thousands of innocent men, women and children.
>
> Secretary of Defense Donald Rumsfeld

INTRODUCTION

Anthrax is an infectious and often fatal disease normally contracted from contact with infected grazing animals such as sheep, goats, cattle and horses, or by contact with contaminated animal products. It has been called wool sorter's disease because it normally occurs in textile and tanning industries where workers that handle contaminated animal wool, hair, and hides become exposed when they cause anthrax spores to be circulated into the air during processing. Additionally, it can be contracted by exposure to anthrax spores manufactured as a biological weapon.

Anthrax derives its name from the Greek word for coal, named after the black scab that manifests from the cutaneous (skin) infection of the disease. Recorded instances of anthrax go back more than five thousand years and it was likely the fifth and

sixth plagues brought upon Egypt that were cited in the Old Testament as well as the Black Bane that swept through Europe in the Middle Ages.[26]

The disease is caused by spore-producing, rod-shaped bacterium known as Bacillus anthracis. Anthrax spores may lie dormant in soil for years before they infect grazing animals that ingest or breathe the bacteria. The spores are incredibly resistant to heat, cold, and even disinfectant. The persistence of the bacteria was demonstrated by the fact that anthrax spores have been found in locations where infected cattle were buried 140 years earlier. British and American scientists tested anthrax as a biological warfare agent on Gruinard Island, off the coast of Scotland, during World War II. Despite having incinerated the remains of sheep that were used during the test and setting fire to the small island to kill any remaining agent, anthrax spore counts in the soil were at the same level years later. Gruinard remained uninhabitable for more than 40 years and, only after soaking portions of the island in formaldehyde and seawater, was it deemed safe for human visitation.[27]

Anthrax infections in the United States are rare and usually restricted to people in occupations with high risk of exposure to anthrax spores such as veterinarians, those working with cattle, and woolworkers. During the last 20 years, anthrax cases in the U.S. have been less than 1 per year and only 18 cases of inhalational anthrax were recorded in the U.S. during the 20th century with the last fatal case in 1976. There were 224 cases of cutaneous anthrax recorded in the U.S. during a fifty-year period between 1944 and 2000, and only 5 between 1984 and 2000. In 2001, as a result of the anthrax letter attacks, there

[26]Marilyn W. Thompson, *The Killer Strain* (New York: HarperCollins Publishers, 2003), 8.

[27]Leonard A. Cole, *The Anthrax Letters* (Washington, DC: Joseph Henry Press, 2003), 25.

were 22 identified cases of anthrax infection. Eleven were inhalational anthrax cases and eleven were cutaneous anthrax. Five of the victims of inhalational anthrax died as a result of their infection.[28]

Internationally there are much greater numbers of anthrax cases, despite vaccination programs, especially in underdeveloped countries. In 1958, there were 100,000 cases of anthrax worldwide. Additionally, there have been intermittent epidemics that are sometimes the result of human origin. The largest recorded outbreak occurred in Zimbabwe between 1979 and 1985. Approximately 10,000 people were infected in what was initially considered to be the result of the failure of veterinary vaccination programs, however, it is suspected to be the result of a germ warfare experiment by the Rhodesian military. The accidental release of anthrax spores from a biowarfare laboratory in Sverdlovsk, Russia, killed 66 local inhabitants.[29]

THE THREE DIFFERENT TYPES OF ANTHRAX

Infection in humans occurs in one of three forms: Cutaneous Anthrax, where the bacteria enters through a break in the skin or via biting flies and infection spreads through the bloodstream; gastrointestinal and oropharyngeal anthrax. The victim ingests anthrax

[28]eMedicine Clinical Knowledge Base, under the term "anthrax," URL: <http://www.emedicine.com/emerg/topic864.htm>, accessed 1 June 2005; Abigail Freedman and others, "Cutaneous Anthrax Associated With Microangiopathic Hemolytic Anemia and Coagulopathy in a 7-Month-Old Infant," in *Bioterrorism: Guidelines for Medical and Public Health Management*, eds. Donald A. Henderson and others (Chicago: AMA Press, 2002), 53.

[29]eMedicine Clinical Knowledge Base, under the term "anthrax;" Thompson, 8.

contaminated meat; inhalation anthrax. Contracted by inhaling anthrax spores during the processing of wool for textiles or inhaling aerolized, weaponized anthrax.[30]

The incubation period for all clinical manifestations in humans is 1-6 days following exposure. Prodrome for the disease includes fever, malaise, and adenopathy. Inhalational anthrax, which is the most deadly form of the disease, causes initial symptoms similar to influenza. Unlike the flu, however, victims of inhalational anthrax are not contagious, do not have sore throats or runny noses, but they will have shortness of breath and vomiting.[31]

Cutaneous (Skin) Anthrax

After entering through a break in the skin, cutaneous anthrax bacteria spreads through the bloodstream and may cause fever, shock, cyanosis, sweating, meningitis, and death. It is the most common form of anthrax, accounting for 95% of cases. The incubation period is 2-5 days.

Initial symptoms are a nondescript papule that becomes a 1 to 3 cm vesicle within 2 days. Edema is occasionally severe and, if present in the neck, can lead to airway compromise. In addition to becoming edematous, the skin in the infected areas may become necrotic. Skin lesions will develop and rupture after a week, at which point they will develop into the characteristic black eschar. The skin infection usually remains localized, but occurs despite treatment with antibiotics. Without treatment lesions could disseminate. The eschar usually loosens in 1 to 3 weeks and separates, leaving a

[30]Science Coalition Glossary, under the term "anthrax," URL: <http://www.sciencecoalition.org/glossary/glossary_main.htm>, accessed 2 May 2005.

[31]eMedicine Clinical Knowledge Base, under the term "anthrax."

permanent scar. Skin anthrax is rarely fatal and can be effectively treated with antibiotics. The mortality rate without treatment could be as high as 20%; with treatment it is less than 1%.[32]

Figure 4. Lesion Caused by Cutaneous Anthrax. On left, 8 days after exposure. At right, 15 days after exposure displaying the black eschar of cutaneous anthrax.

Source: Abigail Freedman and others, "Cutaneous Anthrax Associated With Microangiopathic Hemolytic Anemia and Coagulopathy in a 7-Month-Old Infant," in *Bioterrorism: Guidelines for Medical and Public Health Management,* eds. Donald A. Henderson and others (Chicago: AMA Press, 2002), 57.

Gastrointestinal (GI) Anthrax

GI anthrax is contracted from eating infected, undercooked meat. It is extremely rare and accounts for less than 1% of known cases. Only 11 cases have been reported, all of which were in underdeveloped countries. Symptoms, which usually occur a few days after ingestion of the contaminated meat, are abdominal pain and fever, followed by nausea, vomiting, and diarrhea. Without treatment death is rapid with an untreated mortality rate of 50%. Oropharyngeal anthrax is a more common form of GI anthrax

[32]CDR Gregory J. Martin and CDR Aileen M. Marty, "Clinicopathologic Aspects of Bacterial Agents," in *Clinics in Laboratory Medicine: Laboratory Aspects of Biowarfare,* ed. Aileen M. Marty (Philadelphia, PA: W.B. Saunders Company, 2001), 517; eMedicine Clinical Knowledge Base, under the term "anthrax;" Freedman in *Bioterrorism,* 58.

where the infection is limited to the Oropharyngeal (throat) area. There have been epidemic cases of GI anthrax. 24 cases of GI anthrax occurred concurrently with 52 cases of cutaneous anthrax in Thailand in 1982, though
all 24 cases were treated, 3 died. The mortality rate for oropharyngeal anthrax ranges between 12-50%.[33]

Inhalation Anthrax and Its Effects

The most lethal form of anthrax, inhalation anthrax, has a 95% mortality rate if untreated. Treatment must begin almost immediately due to the rapid onset of life threatening symptoms once the bacteria manifests itself. Like GI anthrax, inhalation anthrax is rare and accounts for 5% of reported cases.
The most likely method of a terrorist attack using anthrax would involve an aerosol delivery of anthrax spores resulting in inhalation anthrax.

The potential lethality of inhalational anthrax was demonstrated by the accidental release of anthrax spores at a biological research lab at Sverdlovsk in the Former Soviet Union. At least 77 people were infected and 66 died. In addition, livestock died of anthrax out to a distance of 50 kilometers from the release point.[34]

Once inhaled, anthrax spores are engulfed by macrophages, part of the immune system which attacks invading microorganisms, and then carried to the hilar and mediastinal lymph nodes near the lungs. After an incubation period of 1-6 days, spores

[33]eMedicine Clinical Knowledge Base, under the term "anthrax."

[34]George W. Christopher and others, "Biological Warfare: A Historical Perspective," in *Biological Weapons: Limiting the Threat*, ed. Joshua Lederberg (Cambridge, MA: The MIT Press, 1999), 31.

undergo germination and begin to produce toxins, eventually overwhelming the lymph nodes. The blood becomes infected with bacteria and death occurs quickly.[35]

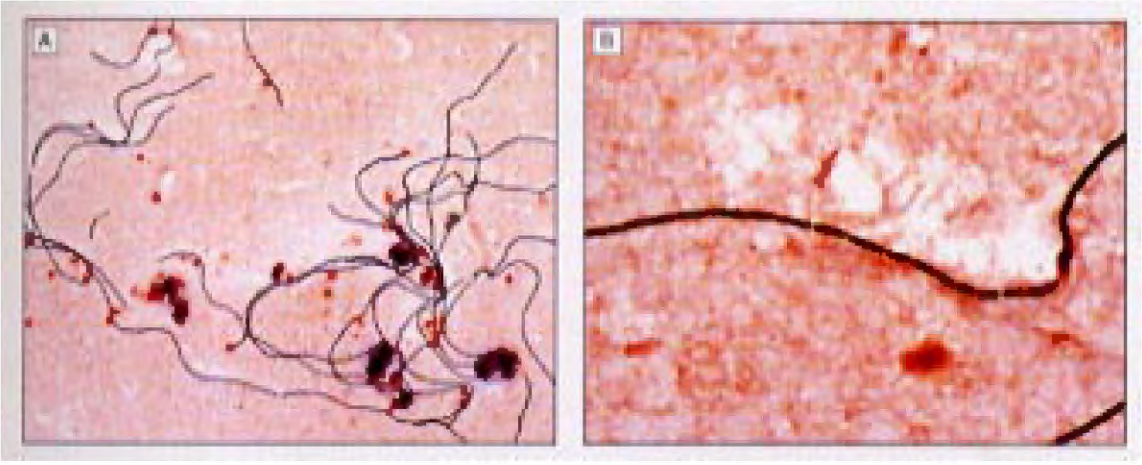


Figure 5. Anthrax Blood Cultures. On the left, blood culture showing positive infection of bacilli in long chains. On the right, an enlarged view showing the typical "jointed bamboo rod" appearance of Bacillus anthracis.

Source: Luciana Borio and others, "Death Due to Bioterrorism – Related Inhalational Anthrax," in *Bioterrorism: Guidelines for Medical and Public Health Management,* eds. Donald A. Henderson and others (Chicago: AMA Press, 2002), 23.

Symptoms usually occur in two phases. Early symptoms are muscle pain, fatigue, nonproductive cough, chest pressure, and fever. These symptoms may be followed by some improvement in condition for two to three days or may progress directly to the abrupt onset of severe respiratory distress with breathing difficulty, perspiration, and cyanosis. The lymph nodes located in the mediastinal area (between the lungs) become enlarged making breathing difficult and pleural effusions occur, where liquid filled with bacteria collects in the space surrounding the lungs. Septic shock, meningitis (in

[35]David R. Franz and others, "Clinical Recognition and Management of Patients Exposed to Biological Warfare Agents," in *Biological Weapons: Limiting the Threat*, ed. Joshua Lederberg (Cambridge, MA: The MIT Press, 1999), 44-45; eMedicine Clinical Knowledge Base, under the term "anthrax."

approximately half of cases), and death usually follow within twenty-four to thirty-six hours. Once symptoms of inhalational anthrax appear, treatment is almost invariably ineffective. In addition to anecdotal reports of patients surviving after early, aggressive therapy, early recognition and treatment of the 2001 victims likely contributed to a better than average recovery rate.[36]

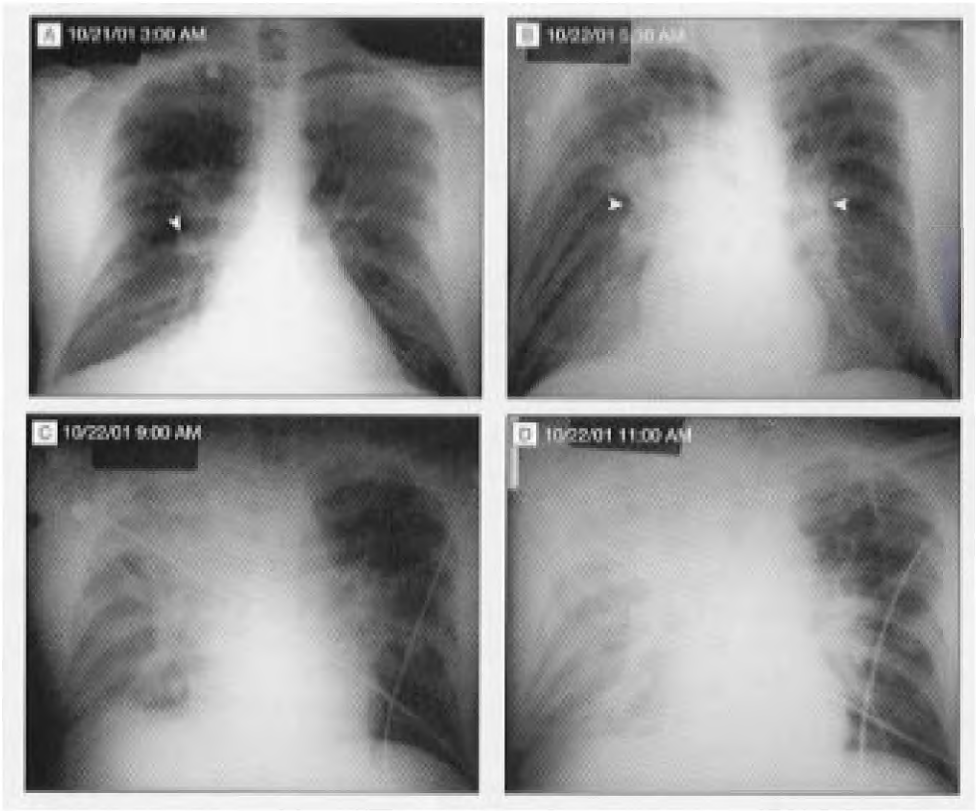


Figure 6. Chest Radiographs. Radiographs display a progressively widening mediastinum over an 8-hour period.

Source: Borio in Bioterrorism, 20.

[36]Franz in *Biological Weapons*, 44-45; Martin in *Clinics in Laboratory Medicine*, 517.

IDENTIFICATION OF AN ANTHRAX EVENT

Experience with, or knowledge of anthrax infection by modern physicians is extremely limited. Many of the doctors who treated patients in the 2001 attacks were initially confused by the symptoms of anthrax infection. Now, with the increased threat of bioterrorism, many are more aware of the conditions signifying a biological attack. Still, medical experience with anthrax infections is not very comprehensive. Low numbers of inhalational anthrax in recent history provide only minimal data. Most of the information available was derived from the vaccine tests done in the 1980s, scattered outbreaks of the disease, some data available from the exposure to citizens of Sverdlovsk in 1979, and data from the victims of the 2001 attacks.[37]

Despite the fact that anthrax is one of the most studied biological weapons, there is little medical experience with treating inhalational anthrax. As opposed to 2,000 cutaneous anthrax cases reported each year, there have only been 18 cases of inhalation anthrax recorded in the U.S. in the twentieth century. Many of these were before the introduction of aggressive antibiotics that could be used in combating the disease today. The rapid administration of these antibiotics to some who were exposed in the 2001 attacks, may explain the better than expected survival rate. Rather than the normal 90% fatality rate, only 5 of the 11 infected people died. Early detection and treatment also appeared to increase chances of survival in the Sverdlovsk cases.[38]

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[37]Tara O'Toole and others, "Why Understanding Biological Weapons Matters to Medical and Public Health Professionals," in *Bioterrorism: Guidelines for Medical and Public Health Management,* eds. Donald A. Henderson and others (Chicago: AMA Press, 2002), 2.

[38]O'Toole in *Bioterrorism*, 2.

Diagnosis

Detection and treatment of an anthrax biological attack would likely be difficult. In the case of a covert attack, the symptoms may not demonstrate for several days, at which point the victim may already be beyond the capacity of medical personnel to rehabilitate. Since symptoms of the first stage of the disease are similar to the flu, a delay in diagnosis and treatment of a disease, that normally lasts only three days before death, could prove fatal.

Early diagnosis may also be impeded by presentation of nonspecific symptoms. Early manifestations of the disease in the 2001 cases included severe headache, abdominal pain, drenching sweats, and rapid heart rates that were out of proportion to the fever. The 2001 cases did provide medical personnel with some baseline characteristics of inhalational anthrax exposure. While not all of victims had a widened mediastinum (7 of 10 did), all 10 patients studied did have a chest radiograph abnormality and all ten had pleural effusions. Data from 42 autopsies at Sverdlovsk also show mediastinal edema and pleural effusions in the victims.[39]

Cases of cutaneous anthrax, which will likely coincide with inhalational anthrax cases, may also be misdiagnosed in its initial stages. The papule which develops in the first two days of exposure is easily mistaken for an insect bite. However, cutaneous anthrax infection may be distinguished from insect bites and cellulites by the large extent of the associated edema. Additionally, lesions associated with an anthrax infection remain painless. The anthrax threat working group suggests that anthrax be considered in

[39]O'Toole in *Bioterrorism*, 2. Inglesby in *Bioterrorism*, 72, 83; Martin in *Clinics in Laboratory Medicine*, 520.

the differential diagnosis of acute progressive inflammatory disorders of the skin as well as other syndromes[40]

Finally, one other factor may limit capabilities to respond to an anthrax attack. As the Soviet experience in Sverdlovsk illustrates, cases occurred out to 43 days past the initial date of an exposure**.** Though germination of the B. anthracis organism will usually occur within 1 to 3 days, they may occur as long as 60 days after the spores have been transported to the lymph nodes. According to Cordesman, primate data indicates that weaponized spores can produce lethal effects 58-98 days after exposure.[41] Therefore, large scale biological attacks will require long-term prophylaxis, for at risk individuals, to be administered out to 60 days.

[40]Martin in *Clinics in Laboratory Medicine*, 517; Inglesby in *Bioterrorism*, 60-61.

[41]Thom A. Mayer and others, "Clinical Presentation of Inhalational Anthrax Following Bioterrorism Exposure," in *Bioterrorism: Guidelines for Medical and Public Health Management*, eds. Donald A. Henderson and others (Chicago: AMA Press, 2002), 15; Cordesman, 32.

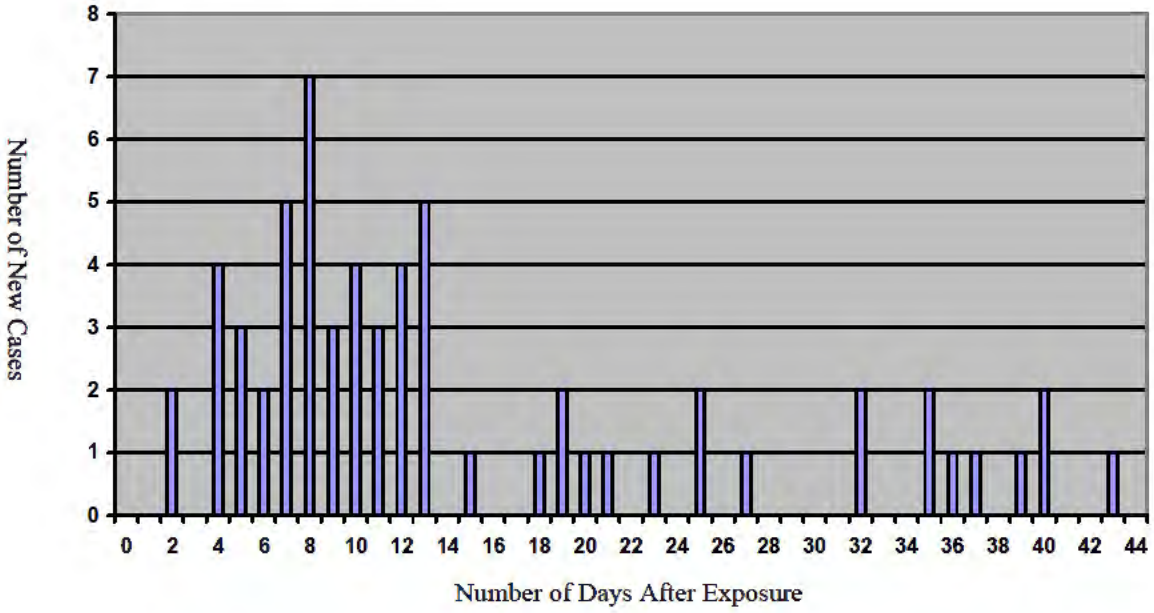

Figure 7. Sverdlovsk Inhalational Anthrax Cases.

Source: Thomas Inglesby and others, "Anthrax as a Biological Weapon," in *Bioterrorism: Guideline for Medical and Public Health Management*, eds. Donald A. Henderson and others (Chicago: AMA Press, 2002), 90.

Due to the delay in the onset of symptoms and the difficult diagnosis of anthrax infection, it is likely that a covert attack could go undetected for several days. Furthermore, the possible long-term incubation of spores in the human body and the ability of spores to remain dormant outside of a host for considerable lengths of time, make the magnitude of the attack and the extent of exposure difficult to initially assess.

Even with early diagnostic testing, it would take 6-24 hours to confirm an anthrax infection. Once symptoms manifest themselves, a few hours delay in administering antibiotics could be fatal.[42] Therefore, medical personnel, who may be the first to identify signs of an exposure, must rapidly and accurately diagnose symptoms by

[42]Cordesman, 32.

determining multiple pieces of evidence of possible exposure to an anthrax agent. A list of anthrax attack indicators is covered in Chapter Five.

Anthrax Infection

In order for anthrax spores to infect a human being with inhalational anthrax, the spores must be of a specific size, between 1 and 5 microns. Anything larger than 5 microns will likely be blocked from reaching deep into the lungs by the respiratory tracts filtration hairs. Anything smaller is too small to be retained and will be expelled during exhalation.[43] Spores are so tiny that a cluster of thousands, which may be a lethal dose, are barely visible to the naked eye. A cluster of 50,000 spores would be smaller than the eye of an ant.[44] The criteria of a weaponized anthrax agent will be discussed in Chapter Four.

During tests with monkeys to develop a vaccine, the U.S. Army Medical Research Institute for Infectious Diseases (USAMRIID) estimated an infectious dose of inhalation anthrax to be at least 2,500 spores and from 8,000 to 50,000 for a fatal dose. That quantity could be inhaled in single breath. However, David Franz, former USAMRIID commander, cautions that there are many unknowns due to incomplete data. “There's a lot of holes in that data; for example, we didn't go down to see the low doses. "What if you get a hundred spores? Would any monkeys die, or get infected?”[45]

[43]LTC James M. Madsen, ““Toxins as Weapons of Mass Destruction,” in *Clinics in Laboratory Medicine: Laboratory Aspects of Biowarfare,* ed. Aileen M. Marty (Philadelphia, PA: W.B. Saunders Company, 2001), 594.

[44]Cole in The Anthrax Letters, 28.

[45]Thompson, 29; Cordesman, 32.

Other studies add to the confusion on the high or low numbers of spores it would take to become infected. Prior to mandatory vaccinations in the 1960s, U.S. goat hair mill workers in first half of the 20th century were heavily exposed to aerosolized spores, but only 13 cases of inhalational anthrax were reported. One study showed workers at a goat hair mill inhaled up to 510 B. anthracis particles of at least 5 microns per day, but no cases of inhalational anthrax occurred during the study.[46]

The anthrax infections and deaths of two women who had no association with the post office and no evidence of anthrax spores in their homes or place of employment indicates that they were infected from cross-contamination of mail that was processed at the same mail facilities. Additionally, an office worker contracted cutaneous anthrax from a cross-contaminated letter processed at the facility. The conclusion being that very low numbers of spores can cause lethal infections. Additionally, some of the postal workers who were infected did not handle the letters and the contamination was due to spores leaking out of the letters and contaminating their work areas. Twenty eight people were exposed to anthrax from the opening of the letter to Senator Daschle. Many were not in the office, but merely in the vicinity of the letters.[47]

The working group stated that it is still uncertain what a minimum dose would be and it may theoretically be as few as 1 to 3 spores. Jeffrey Koplan, the director of the CDC during the 2001 attacks, was skeptical of low spore count infections stating, “It would take a lot more than a few spores to cause inhalation anthrax.” Harvard microbiologist Matthew Meselson disagrees and stated, “There is no justification for

[46]Inglesby in *Bioterrorism*, 89-90.

[47]Inglesby in *Bioterrorism*, 91; Cole in *The Anthrax Letters*, 110.

assuming there is any threshold at all, a single organism has a chance of initiating infection."[48] One series of tests with primates showed a lethal dose as low as 100 spores and recent data published from primate data suggested that as few as 1 to 3 spores may be sufficient to cause infection.[49]

TREATMENT AND RESPONSE

Post-exposure Treatment

Most naturally occurring strains of anthrax are sensitive to penicillin and, historically, penicillin has been the treatment for inhalation anthrax. Some animal studies suggest that the addition of streptomycin may have additional benefit. All naturally occurring strains tested have also been sensitive to erythromycin, chloramphenicol, gentamicin, and ciprofloxacin. Additionally, doxycycline has been effective in animal studies. Since some anthrax strains may have been bioengineered to resist penicillin and tetracycline-class antibiotics, the working group recommended that ciprofloxacin be used until laboratory testing demonstrated otherwise.[50]

Following the 2001 attacks, the Centers for Disease Control (CDC) recommended 2 or 3 antibiotics in combination to treat inhalational anthrax. Though limited by the number of people who developed inhalational anthrax, it is possible that patients treated with 2 or more antibiotics had a greater chance of survival. The CDC also recommended

[48]Inglesby in *Bioterrorism*, 91; Cole in *The Anthrax Letters*, 92, 110.

[49]Inglesby in *Bioterrorism*, 68.

[50]David R. Franz and others in *Biological Weapons: Limiting the Threat*, 45; Inglesby in *Bioterrorism*, 80.

that ciprofloxacin or doxycycline be considered the standards for treating inhalational anthrax. The working group concurred with this and additionally recommended a 60-day post-exposure therapy because of the risk of delayed germination of spores.[51]

Two victims of the 2001 attacks, were treated with ciprofloxacin, revamping, and clindamycin. Neither had developed the typical symptoms of fever, difficulty in breathing, profound respiratory distress, and shock. Although it is possible that neither victim had been exposed to a lethal dose of anthrax spores, early diagnosis and aggressive therapy contributed to their recovery, again emphasizing the importance of early recognition of attack.[52]

An anthrax attack against a large population center will present health officials will additional, significant public health issues. During the 2001 attack, identifying the anthrax exposure and delivering antibiotics to large numbers of potentially exposed individuals prevented additional deaths, but also likely helped control much of the public anxiety that is associated with this type of an event. A larger scale attack would require officials to calm the general population's fear of a bioterror incident, however, it would also require large amounts of antibiotics to be issued as a precautionary measure.

During the 2001 incidents, laboratories had to identify thousands of samples of suspicious powders that were the result of angst in the population of any white powder that might be viewed with suspicion and several hoaxes that appeared after the actual anthrax letters. This is in addition to the clinical samples needed to identify cases of exposure and to identify the source of the letters.

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[51]Inglesby in *Bioterrorism*, 80-81.

[52]Mayer and others, in *Bioterrorism*, 16.

The USAMRIID performed 19,000 anthrax assays in the weeks following the anthrax letter attacks. Thousands were tested for anthrax exposure and 33,000 people were initially placed on antibiotics. 10,000 were urged to complete a 60 day prophylaxis regimen. Furthermore, additional numbers of health officials had to respond to anthrax related events or hoaxes.[53]

Vaccination

A vaccine approved by the FDA in 1970 may be used to inoculate high-risk individuals. It is administered in a series consisting of six doses at zero, two, and four weeks, then at six, twelve, and eighteen months, followed by annual boosters. Studies in rhesus monkeys indicate the vaccine is protective against inhalation anthrax. A recombinant vaccine is being developed as a potential replacement product for use in the future.[54]

A test with monkeys indicates that the vaccine may be effective in treating victims even after exposure to anthrax. In a study of 60 monkeys exposed to anthrax, 9 out of 10 monkeys in the control group died and 8 of 10 that were treated with the vaccine alone died. 29 were treated with doxycycline, ciprofloxacin, or penicillin for 30 days and none died during the treatment, but 5 developed anthrax after the antibiotic treatment ceased. The remaining 24 died when rechallenged. 9 others receiving

[53] O'Toole in *Bioterrorism*, 2-3.

[54] David R. Franz and others in *Biological Weapons: Limiting the Threat*, 45.

doxycycline for 30 days, plus vaccinations at baseline and at day 14 after exposure did not die from anthrax infection even after being rechallenged.[55]

The Institute of Medicine published a report stating that the vaccine is effective against inhalational anthrax and, if administered with appropriate antibiotic therapy, it may help prevent the disease from developing after exposure. The anthrax biological weapons medical recommendations working group notes that to date there has been no reported cases of anthrax infection among those exposed in the 2001 attacks who took prophylactic antibiotics and also concluded that vaccination of persons exposed to anthrax in conjunction with antibiotics would provide optimal protection against the disease.[56]

Psychological Effects

The psychological impact of an anthrax attack upon a civilian population is difficult to measure. The limited number of attacks and the relatively low number of victims in historical examples of victims of biological attacks provides only a small sample of case studies. This level of uncertainty fuels some of the paranoia associated with a biological attack.

The inventor of gas warfare, Fritz Haber, noted that fear would tend to exaggerate the effects of poison gas and the use of gas weapons was associated with psychiatric

[55]Thomas V. Inglesby and others, "Anthrax as a Biological Weapon: Updated Recommendations for Management," in *Bioterrorism: Guidelines for Medical and Public Health Management*, eds. Donald A. Henderson and others (Chicago: AMA Press, 2002), 77-78.

[56]Inglesby in *Bioterrorism*, 79.

combat casualties. Biological weapons, even if they do not kill large numbers, have the ability to terrify the populace.[57]

Not only are victims of a biological attack likely to have increased risk of Post-Traumatic Stress Disorder (PTSD), depression, bereavement, and anxiety; other victims of psychological illness could include victim's relatives and first responders to an attack.[58]

Table 2. Psychological Factors Associated with the Use of Biological Agents[59]

Horror	Scapegoating
Anger	Social isolation
Panic	Demoralization
Paranoia	Attribution of arousal symptoms to infection
Fear of invisible agents	Magical thinking about microbes and viruses
Fear of contagion	Loss of faith in social institutions
Anger at terrorists/government	

Since symptoms of a biological attack may not appear immediately, once the attack is discovered and news leaks out via the media, a large portion of the population may attribute similar flu-like symptoms as to having been exposed to the bacteria. All would have to be tested or treated. The significant number of individuals reporting symptoms would overwhelm many health care facilities. Health officials will have

[57]Harry C. Holloway and others in *The War Next Time*, 251.

[58]Harry C. Holloway and others in *The War Next Time*, 252-253.

[59]Harry C. Holloway and others in *The War Next Time*, 253.

difficulty gauging the extent of the outbreak due to the significant number of concerned individuals or localizing areas of the outbreak.

Medical personnel and disaster first-responders will likely have to deal with some personal psychological distress. An anthrax attack will require medical responders to work in protective clothing and masks. Caring for patients while wearing protective suits will increase the risk of heat, fatigue, and isolation stress for medical personnel. Furthermore, medical personnel may have to deal with a lack of training or unfamiliarity with biohazard equipment.[60]

The 2001 Attacks

Postal workers during the 2001 attacks and victims of previous anthrax hoaxes, cited frustration with the lack of, or confusing, information provided to them by health care and government officials on the extent of the worker's exposure and the conditions of their work centers. They stated the confused state of first responders and of their increased anxiety and fear as they imagined their possible exposure to this near-fatal disease. During the initial days after an anthrax agent had been determined in the Brentwood postal facility, workers were afraid to go back to work despite reassurances on their safety. The Morgan postal facility in New York had a 30 percent absentee rate.[61]

In addition to the severe physical debilitation of the aftereffects of anthrax infection including extreme fatigue and memory loss, victims report psychological stress and anxiety long after the attacks. Many suffer from the symptoms of PTSD. Diagnosis

[60]Harry C. Holloway and others in *The War Next Time*, 257-258.

[61]Cole in *The Anthrax Letters*, 48, 58, 75, 77, 79-81, 86, 98, 176.

of more anthrax victims led some to wonder if the new cases were victims from the first attack or that perhaps there were new attacks underway. The hospital where one of the cross-contaminated victims worked was shut down for a week for testing of anthrax spores, losing $1 million in revenue. Over 2,000 people were screened and placed on antibiotics. Patients reported enormous fear that they had been infected.[62]

Several anthrax hoaxes around the country following the 2001 attacks brought more fear and paranoia to many citizens. Pharmacies near where an attack had occurred had increased demand for ciprofloxacin. New York Mayor Rudy Giuliani, commenting on the mass trepidation over anthrax stated, "A balance has to be struck here between sufficient precautions and making people so frightened and so upset that they're not going to be able to conduct their lives, which means having people walking around in spacesuits all over New York."[63] Despite the non-communicability of anthrax to spread from person to person, doctors of victims began taking antibiotics as a precautionary measure.[64]

Psychologically stressed individuals may experience rapid breathing, sweating, and anxiety and may also inappropriately misdiagnose themselves. Added to the number of actual victims of the attack, the numbers will likely overwhelm healthcare facilities. However, initial triage management may minimize the risk for development of psychological problems. In addition to a rapid prophylaxis program, Harry Holloway

[62]Cole in *The Anthrax Letters*, 87, 98-99.

[63]Cole in *The Anthrax Letters*, 48, 54.

[64]Cole in *The Anthrax Letters*, 103.

provides a list of methods to help avoid psychological distress after an bioweapons attack (See Table 3).

Table 3. Acute Psychiatric Interventions Following a Biological Attack[65]

Prevention of group panic
Careful, rapid medical evaluation and treatment
Avoidance of emotion-based responses (e.g. "knee-jerk" quarantine)
Effective risk communication
Control of symptoms secondary to hyperarousal
    Reassurance
    Diazepam-like anxiolytics for acute relief, as indicated
Management of anger/fear
Management of misattribution of somatic symptoms
Provision of respite as required
Restoration of effective, useful social role-perhaps as worker at triage site
Return to usual sources of social supports in the community

Post-Attack Cleanup

The disruptive effects and financial cost of an anthrax attack, even one of a small scale, would be quite significant. The extent of an anthrax attack and the required clean-up would be determined by several factors: The quality of the anthrax agent, the method of delivery, the environment where the agent is released, ventilation and air conditioning systems, meteorological conditions (if released outside), and cross-contamination. The exceptional quality of the anthrax agent used in the attack on the Senate building caused a large amount of contamination with a only small amount of agent. Given the amount of time that anthrax spores can lay dormant and the significant effort to decontaminate what was limited to five acres at Gruinard Island, the clean-up from even a small amount of agent could be monumental.

[65]Harry C. Holloway and others in *The War Next Time*, 255.

The agent from the seven letters mailed in 2001 contaminated the Hart Senate building, the Brentwood postal facility in Washington, the Hamilton, New Jersey postal facility, the American Media building, and cross-contamination from spores were found in 21 other mail facilities. Mail facilities and buildings were closed for at least three months and mail delivery to the U.S. Capitol was disrupted for weeks. The American Media Building is still closed.

Small scale clean-up in the 21 cross-contaminated postal facilities were accomplished with surface scrubbing with a cleaning solution. However, the facilities at Brentwood and Hamilton were infested throughout. Decontamination for the two postal centers will likely cost $150 million. The Hart Senate building was closed for over three months and the bill for the decontamination of that building alone was over $41 million. It took three fumigation attempts with chlorine dioxide to kill the spores.[66]

The overriding lesson from 2001 stands out. Preparedness and swift diagnosis are essential to dealing with another anthrax attack. The first case in the 2001 attack was diagnosed by a physician and laboratories that had recently completed bioterrorism preparedness training. It is not only essential that medical professionals and laboratories are linked with a communication network that allows rapid exchange of data indicating a possible attack, but intelligence personnel can use multiple indicators to isolate and possibly prevent or mitigate an attack.

[66]Cole, 214-215.

Figure 8. Taking Cover.

Source: Terrorist Humor Web Page, URL: <http://www.sodamnfunny.com/terrorist/anthrax.html>, accessed 15 June 2005.

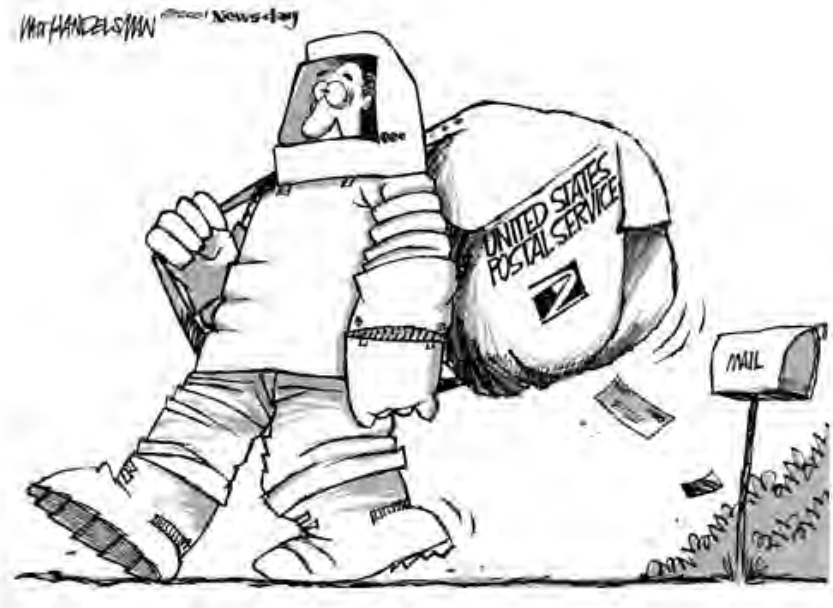

Figure 9. Delivering the Mail.

Source: Daryl Cagle's Professional Cartoonist's Index, under the term "anthrax," URL: <http://cagle.slate.msn.com/news/anthrax/1.asp>, accessed 15 June 2005.

CHAPTER 3

MOTIVATION AND CONSTRAINTS TO USING CBRN

> When conventional tactics are altered unexpectedly according to the situation, they take on the element of surprise and increase in strategic value.
>
> Sun Bin, *The Lost Art of War*

> Chemical and biological weapons are the poor man's atomic bombs and can easily be produced. We should at least consider them for our defense. Although the use of such weapons is inhuman, the war taught us that international laws are only scraps of paper.
>
> Former Iranian leader Hashemi Rafsanjani, October 1998

IN PURSUIT OF ASYMMETRIC WARFARE

After the United States defeated Iraq in 1991, the Chief of Staff of India's Air Force made the observation that the lesson for future adversaries of the U.S. should be, "do not fight the United States without nuclear weapons."[67] Author Barry Schneider states that perhaps the general was too specific and suggests "don't fight the United States by conventional means; use an asymmetrical strategy and unconventional weapons

[67]Barry R. Schneider, "Asymmetrical Rivals: The Enemy Next Time," in *The War Next Time: Countering Rogue States and Terrorist Armed with Chemical and Biological Weapons*, eds. Barry R. Schneider and Jim A. Davis (Maxwell AFB, AL: USAF Air Force Counterproliferation Center, April 2004, 1.

to offset U.S. conventional military superiority."[68] Schneider reiterates that the decisive U.S. victories against Iraq, Serbia, and the Taliban all serve notice to its opponents that to take the U.S. head on in a conventional war is regime suicide. Future enemies are thus driven to seek asymmetric means of force against superior U.S. forces.

The consideration of an asymmetric strategy is often developed in response to an ever-increasing possibility of defeat or to gain a superior advantage. In warfare, a weaker opponent may resort to unconventional means to enhance the probability of victory. When confronting a superior foe, it would be illogical not to bring the greatest force possible to bear upon your enemy to prevent defeat. As evidenced during World War I, the Germans were willing to use chemical weapons in order to break a stalemate on the battlefield. The Iran-Iraq War is an example of the disruptive effects caused by chemical weapons. Although the number of casualties from chemical weapons use were low when compared with total war casualties, the demoralizing effects were enough to degrade a unit's capabilities and force the outcome of a battle in the attacker's favor. By the end of the war, Iraq was able to stave off defeat from a numerically superior enemy with the use of chemical weapons.[69]

Although Schneider was providing his advice to state actors, the same advice would hold true for non-state actors as well. The act of terrorism itself is often used as a tactic by a weaker side in order to win concessions, if not victory, in a conflict. The 11 September attacks demonstrated that terrorists are willing to invest great efforts, time, and money in an attempt to level the playing field. To confront a vastly superior military

[68] Schneider in *The War Next Time*,1.

[69] Al Mauroni, Chemical and Biological Warfare: A Reference Handbook (Santa Barbara, CA: ABC-CLIO, 2003), 152-153.

superpower, terrorist pursuit and use of CBRN capabilities is a logical extension of the asymmetrical warfare concept.

MOTIVATION

Although there are few examples of biological weapons use by non-state actors, many analysts believe that the threat of biological attacks by non-state actors is increasing. In addition to greater access to technology in bioscience, some analysts feel there appears to be an increase in terrorist groups interested in developing CBRN capabilities. Joseph Foxell believes that there is an ideological shift in the orientation of terrorism. In the past, terrorist groups were based on a political/social ideology or motivated by independence movements. Groups have wanted to hold the moral high ground and not wanted to alienate their supportive constituencies.[70] According to Foxell, many groups are no longer interested in appealing to potential followers within a larger audience; rather, they see themselves acting unilaterally for the zealous faithful.[71] Additionally, many of the groups emerging today, Al Qaeda for instance, are seeking to defend the Islamic faith against what they see as an encroachment by western democracies; a struggle between cultures. In this case, attacking an ideological enemy such as the U.S., may still be cheered by many Moslems, not just extremists. This philosophy is not restricted to groups like Al Qaeda, as other groups such as right-wing Christian groups, neo-Nazis, and millenarian cults attempt to rationalize their attacks on

[70]Joseph W. Foxell, Jr., "The Debate on the Potential for Mass-Casualty Terrorism: The Challenge to U.S. Security," *Terrorism and Political Violence* 11, no. 1 (Spring 1999): 94-109.

[71]Foxell, 95.

large populations with contrary principles or beliefs. Foxell believes this paradigm shift in terrorist's goals and motivations may influence their decision to engage in mass casualty attacks.

Terrorism, by definition, is to use violence (or the threat of violence) to intimidate and instill fear against civilians in order to attain goals that are political, religious, or ideological in nature. Biological weapons bring with them apocalyptic visions of mass casualties and invisible bacteria to a population that expects the government to provide a certain level of protection and security. Al Mauroni states that a weapon of mass destruction does not have to create mass casualties or destroy buildings in order to create havoc. Chemical or biological weapons released in small amounts become what he calls "weapons of mass disruption" and are still very effective in instilling fear and terror in the populace.[72]

A series of anthrax hoaxes in the late 1990s had the positive affect of motivating the U.S. government to begin enacting legislation to limit the ability of non-state actors to develop chemical and biological weapons. Ironically, the publicity surrounding the hoaxes inspired many to use fake anthrax mailings to blackmail and terrorize organizations, groups, or government agencies. The significant publicity that was sure to follow a mailing of a suspicious white powder was what the perpetrators were attempting to generate. Media coverage of anthrax threats declined prior to September 2001, however, in October, the media hyperbole created large numbers of hoaxes and also paranoia in many citizens. According to Senator Joe Biden, the FBI responded to over

[72]Mauroni, 117.

7,000 suspicious anthrax letters in the fall of 2001.[73] For some, the anthrax attacks presented a new method to instill fear among the population. The low probability of being arrested using this method made it all the more attractive. Clayton Waagner, who will be discussed later, stated that the media coverage following the 2001 anthrax attacks gave him the inspiration and incentive to mail anthrax simulants in the fall of 2001.[74]

CONSTRAINTS

Several factors have constrained terrorists from acquiring or using a biological agent, such as anthrax, in the past. Primary among them is probably the fear that using mass casualty weapons, especially those as horrific as chemical or biological weapons, runs the risk of the terrorist group becoming a pariah and losing any public support or sympathy they are attempting to generate for their cause, even from its previously sympathetic audience. The 1972 Biological Weapons Convention described their use as "repugnant to the conscience of mankind"[75] and Croddy states that to many if not most people the unleashing of a disease causing bacterium, virus, or other biological agent on humanity is the epitome of evil.[76] Most terrorists groups have not been willing to take the step towards using CBRN weapons. According to one of his aides, even Osama bin Laden told his followers that acquiring WMD was like "a genie in a bottle" and could have untold consequences for Al Qaeda. He was eventually persuaded by hardline

[73]Cole in *The Anthrax Letters*, 180.

[74]Cole in *The Anthrax Letters*, 183.

[75]Cole in *The Anthrax Letters*, x.

[76]Croddy, 193.

supporters that such weapons would give Al Qaeda a powerful propaganda tool and Al Qaeda eventually attempted to acquire a WMD capability.[77]

Despite the abhorrence of biological weapons on moral grounds, biowarfare is seen by a select few as an instrument of power; a force equalizer. As Croddy highlights, "It could be said that a nation-state, or perhaps even a terrorist organization or religious cult, when armed with chemical and biological weapons, will neither be trifled with nor ignored on the world stage… almost any organization has strategic clout. [chemical and biological weapons] are powerful tools in the hands of those who feel themselves to be dispossessed, defeated, overwhelmed, or outgunned."[78]

Moral Constraints

Vannevaar Bush, commenting on the reluctance of nations to employ biological warfare during World War II, remarked, "Without a shadow of a doubt there is something in man's make-up that causes him to hesitate when at the point of bringing war to his enemy by poisoning him or his cattle and crops or spreading disease. Whether it is because of some old taboo ingrained into the fiber of the race… The human race shrinks and draws back when the subject is broached. It always has, and it probably always will."[79]

There are some, however, who are the antithesis to Bush's belief in the good of humanity and it is less likely a taboo then for other more practical reasons. Individuals

[77]Nick Fielding, "Bin Laden's Dirty Bomb Quest Exposed," *Sunday Times of London*, online ed., 19 December 2004, URL: <http://www.timesonline.co.uk/article/0,,2089-1409055,00.html>, accessed 15 January 2005.

[78]Croddy, 9.

[79]Vannevar Bush, *Modern Arms and Free Men* (New York: Simon and Schuster, 1949), 142.

like Saddam Hussein showed no reluctance to using chemical weapons against the Kurds and the Iranians. It is more likely that the use of biological weapons has been restricted by the fear of the retaliatory response with similar weapons. Unleashing poisons on someone with a similar capability was likely to provoke a response in kind against your own population. This was probably the key factor in Saddam Hussein's reasons for not using WMD in the first Gulf War. In dealing with non-state actors, like Al Qaeda or lone terrorists, the inability to strike at power bases or centralized command structures makes retaliation to WMD use nearly impossible.

PERSONALITY TYPES

According to Dr Jerold Post, because of the diversity of terrorist groups and causes, it is difficult to determine the "type" of terrorist who might resort to CBRN. Post, in his studies on the terrorist mindset, states that there are nearly as many variants of personality who become involved in terrorist pursuits as there are variants of personality.[80] Similarly, though most terrorists may avoid the use of CBRN weapons for various reasons, a select number consider it a valid weapon in conducting asymmetric warfare.

Post, who has done numerous interviews with terrorists, thinks that most terrorists feel constrained from using weapons of mass destruction because their goal is to bring positive attention to their cause, not to ostracize themselves. Additionally, though some think it may be nice to have a weapon that could kill 10,000, the idea is also an anathema

[80]Jerrold M. Post, "Notes on a PsychodynamicTheory of Terrorist Behavior," *Terrorism: An International Journal* 7, No. 3 (1984): 242.

to some of them. One religious terrorist told Post that the Koran forbids poisoning therefore it is against his religion.[81]

Post believes that there are two types of terrorists who are less constrained to using CBRN capabilities: The religious extremist and the lone right-wing scientist with a gripe. The latter description is how many, including the FBI, describe the 2001 anthrax killer. If the 2001 attacks were committed by such an individual, Post states that his motives could be personal, perhaps to include the possibility of revenge.[82]

Clayton Lee Waagner is someone who falls somewhere in-between Post's description of right-winger and religious extremist. Waagner was apprehended in December 2001 while preparing to threaten abortion clinics with anthrax attacks. Over the past two months, he had sent more than 550 threat letters to abortion clinics in 24 states, attempting to shut the clinics down. The white powder that Waagner was mailing in his most recent attacks was an insecticide called Bacillus thuringiensis. It was not harmful to humans, but shared some characteristics with anthrax and would usually test positive for anthrax in initial tests, thereby closing the clinics for longer periods of time.[83]

Waagner is someone that believes he is serving a larger purpose. He believes that killing is justified when protecting the "unborn" and labels himself as a soldier in the "Army of God."[84] Other terrorists in the past have had similar motivations of someone who is committing the acts for a cause greater than himself. Ted Kaczynski fighting modern technology, militia members like Timothy McVeigh combating what he

[81]Cole in *The Anthrax Letters*, 207-208.

[82]Cole in *The Anthrax Letters*, 208.

[83]Cole in *The Anthrax Letters*, 183.

[84]Cole in *The Anthrax Letters*, 183.

considered to be an unjust U.S. government, the 11 September hijackers opposing Western democracies and encroachments on their values.[85] Though he used a harmless powder in his anthrax letters, Waagner stated that if he had real anthrax, he would have mailed it in the letters. Someone with access to anthrax and Waagner's level of motivation would have the potential to kill thousands. Someone acting on religiously inspired terrorism might be motivated by what Bruce Hoffman calls religious imperatives.[86]

RELIGIOUS AND EXTREMIST TERRORISM

Like Jerold Post, Bruce Hoffman states that there is no "single" terrorist personality type. Though personality types may be difficult to discern, terrorist motivations may be more easily identified. Hoffman defines a terrorist is an altruist. He is attempting to achieve a greater good and not acting for his own personal benefit. The cause can range from opposing abortion to remaking society. He may be part of a group or a lone individual.[87]

Hoffman states that one of the most important changes affecting international terrorism today is the proliferation of terrorist groups motivated by religious imperatives, where "violence is regarded by its practitioners as a divine duty or sacramental act, and embraces markedly different means of legitimization and justification than that

[85]Cole in *The Anthrax Letters*, 181, 184.

[86] Cole in *The Anthrax Letters*, 205.

[87]Cole in *The Anthrax Letters*, 205-207.

committed by secular terrorists."[88] The growth of religiously inspired terrorism has led to the increasing lethality of terrorist acts and is also eroding the constraints to using CBRN weapons.

Secular terrorists, who have been motivated by political / ideological grounds, have limited themselves to conventional weapons and though several groups have toyed with the idea of using CBRN weapons, very few have gone so far as to acquire or use them. Most seem to live by terrorism expert Brian Jenkins' dictum that, "Terrorists want a lot of people watching and a lot of people listening and not a lot of people dead."[89] Hoffman, however, believes that the rise in the number of high casualty attacks by religiously inspired terrorists and the justifications, mindsets, and characteristics of these groups would make them the most likely to use WMD.

He notes the fact that acts of religious terrorism are resulting in a higher number of fatalities, which may be because of the different value systems, moral concepts, justification, and legitimization amongst religious terrorists. First, since the terrorist act is a divine duty, the perpetrator is not held to account to anyone but his God or his religious duty. Not being held to political or moral constraints, he would have less qualms about causing mass casualties, losing public support, or killing himself in the act. He also notes that, in many religiously motivated terrorist attacks, there is the attempt to have the terrorist act sanctified or legitimized by clergy prior to carrying them out.[90] If the terrorist believes the act is justified by God and he has earned a place in Paradise,

[88]Bruce Hoffman, "Terrorism and WMD: Some Preliminary Hypotheses," *The Nonproliferation Review* (Spring-Summer 1997), 45-53; Bruce Hoffman, *Inside Terrorism* (New York: Columbia University Press, 1998), 88.

[89]Hoffman in "Some Preliminary Hypotheses," 45.

[90]Hoffman in *Inside Terrorism*, 88.

there is less hesitation in carrying out the act. However, Hoffman does not exclude the possibility that the anthrax letters could have been mailed by a lone individual motivated by a political cause.[91]

Prior to the nineteenth century, religion was the most common justification for terrorist acts. As David Rapoport points out, religious terrorists were motivated to satisfy their religious code, their god, or their supreme leader, but did not need recognition or approval from their fellow citizens to justify the destruction of evil unholy races, pagans, or heretics. The shift in motivation of terrorists and the reemergence of larger numbers of religious terrorist groups may create a change in tactics and a consideration for using CBRN weapons.[92]

Terrorism expert Jessica Stern also believes that terrorists seeking greater acts of violence are increasing in numbers.[93] Like Hoffman, she also believes that Brian Jenkin's theory of terrorist motivations may no longer be true and there are new types of terrorists motivated by religious conviction or with a violent right-wing ideology. These types are more likely to use WMD.[94] In her interviews with American militia groups, she states that some American right-wing [extremist] movements are thinking about the use of biological weapons all the time.[95]

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[91]Cole in *The Anthrax Letters*, 206.

[92]Holloway in *The War Next Time*, 251.

[93]Cole in *The Anthrax Letters*, 206-207.

[94]Cole in *The Anthrax Letters*, 206-207.

[95]Cole in *The Anthrax Letters*, 206-207.

CROSSING THE LINE

A report published in June 2000 by the National Commission on Terrorism stated that the very nature of terrorist organizations had changed significantly in the last twenty years. In the 1970s and 1980s most terrorist organizations had clear political objectives and would only produce enough bloodshed to bring attention to their cause, but not alienate public support. The report went on to say that there are a growing number of attacks that were designed to kill as many people as possible.[96]

According to Harry Holloway, the terrorist groups that are more likely to use chemical or biological weapons will probably exhibit some of following characteristics: a constituency whose reaction to a biowarfare attack does not concern the terrorist group; a perception that conventional attacks are no longer effective and that a higher form of violence or a technique is needed; and a willingness to take risks by experimenting with and using unfamiliar weapons.[97]

The types of groups that exhibit these characteristics would be doomsday religious cults, global revolutionary groups, and neo-Nazi and white supremacist groups. These groups are less concerned with the public condemnation that would result from the use of a biological attack and are also more likely to seek an event that would give them the greater amount of attention they desire. Groups like Aum Shinrikyo, who were attempting to set in motion an eventual Armageddon, as well as preoccupy or topple the Japanese government were not concerned with the public response to their actions. Another example is white supremacist Larry Wayne Harris who obtained vials of bubonic

[96]Croddy, 60-61.

[97]Holloway in *The War Next Time*, 240.

plague virus and anthrax. In an interview Harris warned that Aryan Nation members would use biological weapons to achieve their goal of creating a separate nation for the white race.[98]

Finally, Holloway agrees with Stern, Hoffman, and others, and does not exclude other types of groups from being likely aspirant users of bioweapons.[99] He states that religious extremists, state-sponsored terrorists groups, and individual criminals could also attempt to use biowarfare agents. If the terrorist believes he is politically and morally justified in inducing mass casualties, than that may provide him with the incentive for using WMD. Additionally, criminals who may be seeking revenge or trying to extort large sums of money might also be candidates for biowarfare use.[100] For these groups who have bypassed or overcome the moral and ethical taboos to using bioweapons, they would then have to overcome the technical and financial restrictions to acquire, develop, and deploy biological weapons. These will be discussed in detail in Chapter Four.

SUMMARY

As illustrated above, a non-state actor's motivations to obtain or use biological weapons are influenced by multiple factors such as moral and ethical restraints, religious or secular beliefs, intent to produce mass casualties, and the technical limitations to actually acquire or employ biological materials.

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[98]Holloway in *The War Next Time,* 240-241.

[99]Holloway in *The War Next Time,* 241.

[100]Holloway in *The War Next Time,* 241.

The number of instances of biological terrorism are so low that there may be the supposition that the past occurrences were minute anomalies and that the relatively low death tolls associated with past chemical or biological use do not offer any more advantage to terrorists than conventional weapons. While it may be true that the most deaths that have occurred have been less than 15 for any single attack, the psychological aspects of a chemical or biological attack have certainly been significant. Aum Shinrikyo's attacks in Tokyo, though grossly mismanaged, terrified large portions of the residents. The 2001 anthrax attacks demonstrated the ability to shut down the U.S. Congress, portions of the U.S. Postal System, instill fear in large portions of the population, and degrade confidence in the government with only a few grams worth of anthrax.

Cordesman notes that few religious extremist movements turn to the kind of radical terrorism that involves the potential use of WMD.[101] That being said, several terrorist experts including Bruce Hoffman, Joseph Foxell, and Jessica Stern, have all noted that there appears to be a rise in non-state actors seeking weapons with the capacity for creating higher numbers of casualties. The significant increase in the number of anthrax hoaxes in recent years has shown that terrorists recognize the disruptive effects of a biological weapon. Crenshaw notes that terrorists, "learn from the experiences of others, usually communicated to them via the news media. Hence the existence of patterns of contagion in terrorist incidents."[102] While some may still be restrained by

[101]Cordesman, 26.

[102]Crenshaw, 11.

moral or ethical considerations, others are only being held back by the financial or technical limitations of using an anthrax weapon.

The key motivator for an individual or group would be whether or not they feel they have been driven to the point where they believe that less lethal methods have not achieved their objectives or greater casualties are necessary in order to do so. As Crenshaw notes, "terrorism is the selection of asymmetric warfare when conventional methods have failed. It is often the last in a sequence of choices. It represents the outcome of a learning process… Terrorism is likely to be a reasonably informed choice among available alternatives, some tried unsuccessfully."[103]

It is analogous to using greater and greater amounts of force to reach one's goals. If a group or individual feels the only way they can be heard is by killing multitudes of people, then they may begin seeking to develop or obtain a biological weapon. Non-state actors who elect to use biological weapons would certainly get noticed on the world stage.

[103]Crenshaw, 11.

Figure 10. Germ Warfare

Source: Daryl Cagle's Professional Cartoonist's Index, under the term "anthrax," URL: <http://cagle.slate.msn.com/news/anthrax/7.asp>, accessed 15 June 2005.

CHAPTER FOUR

Acquiring weapons for the defense of Muslims is a religious duty. If I have indeed acquired these weapons then I thank God for enabling me to do so. And if I seek to acquire these weapons, I am carrying out a duty. It would be a sin for Muslims not to try to possess the weapons that would prevent the infidels from inflicting harm on Muslims.

Osama bin Laden

ANTHRAX DEVELOPMENT

The use of a biological agent by a non-state actor is not a difficult task. It merely entails taking a highly destructive germ found in nature and employing it against a target. For example, the Baghwan Shree Rajneesh cult in Oregon used salmonella to taint restaurant salad bars in Oregon and 751 people became infected. The salmonella was cultivated by a nurse and lab technician in an incubator. However, though the concept of a terrorist using a biological weapon may appear simple, it is exceptionally more difficult to develop and employ an anthrax agent that could create mass casualties.

After making the decision to attempt to use an anthrax agent for a terrorist attack, a non-state actor would have to overcome many difficulties to acquire a virulent anthrax agent, develop sufficient quantities, and disseminate it effectively. The ability to do this is still a daunting challenge, especially while trying to remain covert, and would likely discourage most from attempting it.

The level at which a non-state actor chooses to employ a biological weapon is related to the amount of damage he wants to inflict. Additionally, the more damage he wants to inflict typically raises the level of difficulty associated with developing and employing a more lethal agent. The Rajneesh cult did not intend to cause mass murder, but only to sicken the townspeople in order to sway a local election in their favor. On the other hand, Aum Shinrikyo attempted to kill as many people as possible on several occasions.[104] A non-state actor intending to kill a significant number will likely attempt to acquire or develop the most lethal agent possible, employ the greatest amount, in the most efficient (destructive) manner. How ambitious he is in seeking the most casualties is a matter of scale associated with his goals. The 2001 anthrax attacker could have inflicted far more casualties and done far-more significant financial damage had he so desired. The attacker limited himself to sending only seven letters and probably less than seven grams of agent. As illustrated in Chapters One and Two, if produced in sufficient quantity and disseminated efficiently and undetected, anthrax could easily kill thousands.

KNOWLEDGE AND SKILL LEVEL REQUIRED

Once a terrorist has committed himself to using an anthrax weapon, he must acquire an agent, either by developing it himself or finding someone to develop it for him. Much has been written about "weaponized" anthrax and the level of difficulty it would require for a non-state actor to develop weapons grade anthrax. Another fear for bioterrorism experts is an antibiotic resistant or genetically engineered "superbug." In a

[104]Cordesman, 26.

2002 National Defense University study, biowarfare experts concluded that a "junior scientist" could genetically engineer bacterial agents. Although it is doubtful terrorists would master the skills required to bioengineer agents, the fear is that they will outsource to scientists seeking financial gain from, for example, the former Soviet Union.[105]

Though the possibility exists for such a scenario, anthrax in its naturally occurring state is a highly efficient killing machine and acquiring and producing a natural yet lethal strain of anthrax is difficult though not impossible. Biowarfare experts such as Ken Alibek state that a dedicated, experienced individual could manufacture a liquid or dry agent.[106] Richard Danzig notes that, though there are about 10,000 people with experience working on biological weapons, there are perhaps millions of scientists who could construct bioweapons with modest laboratory equipment.[107] Mother Nature has already done the hard work.

Aum Shinrikyo is often cited as a group that had significant financial resources and graduate level scientists working on their anthrax program, yet they failed to cause any casualties on at least four attempts to deploy anthrax in terrorist attacks. Aum's failures were due to a highly mismanaged program that failed on many levels in its development and dissemination techniques to use WMD. The 2001 anthrax killer's success contradicted the Aum example at the level of means and resources that are required to develop and deploy an agent. Additionally, it should be noted that Aum did

[105]Mintz, "Technical Hurdles," A1+.

[106]*Bioterror: The Invisible Threat*, Produced by Markus Belin, Directed by A. J. Jokinen, Solar Films, 1999, videocassette.

[107]Mintz, "Technical Hurdles," A1+.

manage to manufacture and disseminate anthrax on a large scale. Their only failure in this regard was using a vaccine strain of the disease that was harmless.[108]

Biological weapons expert Richard Spertzel stated that he believes, outside of a state run laboratory, there are maybe only four or five people in the entire U.S. that could manufacture anthrax as pure as that which was found in the Daschle and Leahy letters. With a good lab and staff, he said it would take him a year to develop as good a product. Other experts such as Matthew Meselson and Ken Alibek who have seen micrograph pictures of the spores, contradict Spertzel's assessment and believe that any skilled microbiologist could do it.[109] In a paper published in 1946, U.S. biowarfare scientists warned that someone with modest lab skills in biology could produce agents quickly and cheaply and using microbes available in nature. Today, with access to the Internet or technical literature, advances in bioscience, and the large pool of competent scientists the threat may be greater.[110]

Recruitment / Outsourcing

Biowarfare experts believe that terrorists may choose to outsource or recruit "rogue" scientists to aid them in developing biological weapons. According to Defense and State Department officials, there are 15,000 underpaid scientists and researchers in the former Soviet Union. These scientists have access to specialized equipment and large collections of dangerous pathogens. Iran and other countries have investigated these

[108]Cordesman, 26.

[109]Cole in *The Anthrax Letters*, 202.

[110]Ed Regis, The Biology of Doom (New York: Henry Holt and Company, 1999), 114.

sources for their own biological programs, however, the threat is not limited to state actors. Additionally, deteriorated security at former bioweapons research labs makes them vulnerable to theft of pathogens. Fifty former weapons labs exist in the former Soviet Union, today. Though many have converted to non-military related research, The Russian Ministry of Defense still manages four and continues to bar the U.S. from inspecting them.

In order to curb the risk of proliferation, the U.S. grants assistance to Russian non-military biological institutes. While 30 institutes have received funding, at least 15 have not. It is estimated that as many as 5,000 scientists could pose a proliferation risk and another 10,000 that have weapons related skills.[111] Many of these centers conduct legitimate public health research using dangerous live pathogens. The dire financial conditions faced by many Russian scientists makes them vulnerable to non-state actors attempting to purchase pathogens. Further scientists could emigrate or seek employment with groups outside of Russia, thus reducing the risk of discovery. The significant reduction of funding for biological research institutes in the former Soviet Union increases this possibility. The budget for Russia's State Research Center for Applied Microbiology dropped from $25 million in 1991 to 2.5 million in 1999. Many of the scientists salaries ranged from $40 to $80 a month.[112]

Within the United States, a survey of 1400 U.S. academic institutions found that 16% possessed pathogens on the Biological Weapons Convention's list of biological agents, 11% have high-level containment facilities, and 5% perform research for

[111]Cordesman, 23.

[112]Cordesman, 23.

government agencies to develop defenses against bioweapons. Additionally, there are 1,300 U.S. biotechnology companies that employ over 100,000 people. This does not include the growing number of foreign biotechnology firms. Finally, at least 75,000 Russian scientific workers emigrated between 1989-1992 and more have emigrated since. Some of these scientists may be working in Iran or North Korea. Officials at some of the Russian Institutes state that they have been approached by representatives of countries of U.S. proliferation concern in seeking questionable research. Though these scientists refused the offers, for many others it may be a tempting proposal.[113]

There is a wide variance in the opinions of biowarfare specialists over the level of scientific and technological expertise it would take for non-state actors to acquire or use a lethal form of anthrax agent. Though some predict that the likelihood of an attack may be increasing each day, dedicated individuals and terrorist groups have failed on several occasions to acquire of effectively use anthrax. Prior to the 2001 attacks, many counter terror experts felt that an effective deployment of a biological weapon would require a team of experts to include microbiologists with biowarfare training, an aerosol physicist, and a meteorologist.[114] On the other hand, the 2001 attacker was exceptionally capable in his methods and ability to remain anonymous after four years and, according to the FBI, probably acted alone or with only one other person. The success of a biowarfare attack with anthrax would be dependent on the virility of the strain, the quality of the agent (whether dried or slurry), the size of the spores (clumped or non electro-static), and the dissemination method.

[113]Cordesman, 23, 43-44; Eric Croddy and others, 35.

[114]Cordesman, 42.

EQUIPMENT

Any group attempting to develop an agent capable of inflicting mass casualties would probably need sophisticated laboratory equipment. According to Cordesman, necessary equipment would include fermenters for growing the germs, and lyophilizers (freeze driers) and centrifuges for manufacturing dry powders.[115] This is in addition to the safety equipment that would be required to avoid self-contamination.

The estimates for the cost of such a laboratory range between $200,000 and $2,000,000.[116] The DOD reported that three defense employees with some technical skills, but without expert knowledge of bioweapons, manufactured a B. anthracis simulant in less than a month at a cost of $1 million.[117]

Much of the equipment needed to produce biological weapons is also used for biomedical research, pharmaceutical purposes, and for food processing. This dual use equipment creates difficulties in isolating attempts by non-state actors to develop bioweapons. Fermenters, centrifuges, and purification equipment are used by biomedical research centers as well as wineries, milk plants, pharmaceutical companies, and agricultural researchers. The same fermenters used to produce insulin could be used to produce large quantities of bioweapons.[118] Equipment found in brewing pubs could be

[115]Cordesman, 42.

[116]Cordesman, 42.

[117]Inglesby in *Bioterrorism*, 64.

[118]Cordesman, 45.

used to cook germs. Agricultural fertilizer sprayers could be tested at a farm to see how well an agent could be aerosolized.[119]

There is a growing number of laboratories equipped to work with biowarfare agents. Though their purpose is to develop defenses against a biological agent, there is apprehension that it increases the chances of biological agents getting in the wrong hands. Rutgers biochemist, Richard Ebright states, "It is difficult to conceive of scenarios under which increasing the number of persons with access to, and training with, agents such as Bacillus anthracis, Yersinia pestis, and francisella tularensis would enhance—rather than degrade—national security."[120]

[119]Croddy, 12.

[120]Cole in *The Anthrax Letters*, 158.

Figure 11. Types of Equipment Found in a Biological Weapons Laboratory.

Source: Central Intelligence Agency, (U) *Terrorism: Guide to Chemical, Biological, Radiological, and Nuclear (CBRN) Weapons Indicators,* CD-ROM (Washington, DC: 2002),15-18; Oregon Institute of Marine Biology Homepage under facilities and research equipment, URL: <http://darkwing. uoregon.edu/ ~oimb/equip.htm>, accessed 7 July 2005.

Figure 12. Personal Protective Equipment.

Source: Central Intelligence Agency in (U) *Terrorism: Guide to Chemical, Biological, Radiological, and Nuclear (CBRN) Weapons Indicators*, 5.

Spertzel does not believe that anthrax could be adequately processed in a small room. His list of necessary equipment would include: a refrigerator, incubator, spray dryer, and possibly a scanning electron microscope. He estimates the developer would need a space of 20 x 50 feet.[121] Since someone may not be able to surreptitiously work in a commercial or university lab without drawing attention to himself, he might have to maintain a small laboratory in a discrete location.

The sender of the 2001 letters appears to have had access to a laboratory between the first and second set of mailings (18 September and 9 October 2001). The first set contained dead vegetative anthrax organisms and other debris mixed with the spores. The second set contained purely prepared spores that more easily became aerosolized in

[121]Cole in *The Anthrax Letters*, 204.

addition to being more lethal (See page 17, under Dissemination).[122] Therefore the perpetrator had access to a lab when he further refined the second set of anthrax agent.

Figure 13. Types of Equipment Found in a Small Biological Weapons Laboratory.

Source: Central Intelligence Agency in (U) *Terrorism: Guide to Chemical, Biological, Radiological, and Nuclear (CBRN) Weapons Indicators,* 15-16; Oregon Institute of Marine Biology Homepage under facilities and research equipment, URL: <http://darkwing.uoregon.edu/ ~oimb/equip.htm>, accessed 7 July 2005; Drytec Dryers, Compact laboratory spray dryers, URL: <http://www. drytecdryers.com/ pilot.htm>, accessed 7 July 2005; ThomasNet Industrial Newsroom under "compact centrifuge," URL: < http://news. thomasnet.com/fullstory/29522>, >, accessed 7 July 2005.

[122]Cole in *The Anthrax Letters*, 187.

GETTING GERMS

Weak Versus Virulent Forms

Aum Shinrikyo attempted to genetically engineer the vaccine strain of anthrax into a virulent form and failed.[123] However, a terrorist would not need to attempt to genetically engineer a germ that is quite deadly in its natural state and had a 90% fatality rate. Even the strains which are susceptible to antibiotics would be enough to cause deaths and follow-on panic in the general population. Because of the heightened fear of anthrax and the delayed onset of symptoms, a less virulent form of the disease could still cause significant terror among the populace.

Obtaining a lethal strain would be one of a non-state actors most significant barriers. Truly virulent, highly lethal forms which were weaponized (made more efficient for delivery on the battlefield) were part of the Soviet Union and United State's biological warfare programs during the Cold War. If a non-state actor does not have access to U.S. or former Soviet stores of weaponized anthrax, this does not limit his ability to develop, or have someone else develop, a small amount of a non-weaponized, but still potentially lethal agent.

Learning from Aum's mistakes, terrorists would need to obtain a virulent anthrax sample for a bioterrorist attack. Some ways non-state actors could obtain anthrax are:

- Purchase a sample from the large number of commercial culture collections. This is difficult today because of the heightened awareness of bioterror. However, before tighter controls were in place, countries such as Iraq were

[123]Cordesman, 26.

able to obtain samples of the Ame's Strain of the virus from the United States. Additionally, they could obtain anthrax cultures from culture collections outside the U.S. where controls may be less stringent;

- Obtain a sample from a rogue state, however a state may be reluctant to give a lethal germ to terrorists with the risk that it could be traced back to the source;
- Steal a sample from a research laboratory. Officials from the Departments of State and Defense cited a nongovernmental report identifying instances of theft or diversion of pathogens including smallpox, plague, and anthrax from institutes in Russia, Georgia, and Kazakhstan;[124]
- Dig in soil where livestock had recently died of the disease. Once spores are found, a competent microbiologist can cultivate them. However, Aum Shinrikyo attempted doing this in the Australian outback, but were unsuccessful.[125]

With heightened awareness at culture collection institutes preventing purchase of anthrax bacteria and the probable reluctance of most states to provide a virulent bacteria, terrorists could develop it from a natural source. With the technical difficulties involved in processing and developing a natural strain and wanting to ensure the likelihood of getting a truly virulent strain, the best method for obtaining a substantiated, virulent anthrax bacterium would be getting a sample from a research institute or university

[124]Cordesman, 23.

[125]Mintz, "Technical Hurdles," A1+.

laboratory which may have the bacterium for testing, either by stealing it or perhaps getting it from a disgruntled scientist.

In recent years, efforts to guard biological pathogen stocks have increased. However, many pathogens, including anthrax, may already be in the hands of disreputable sources. Stocks of anthrax were purchased by Iraq in 1986 and 1988 from the United States. In 1998 British journalists posing as Moroccan scientists were able to find a firm in the Czech Republic willing to sell botulism toxin for $25. Though they did not attempt to buy anthrax, it was probably available.[126]

Once a virulent source is obtained it must be processed to deploy as a weapon. As Ken Alibek states, "the most virulent culture in a test tube is useless as an offensive weapon until it has been put through a process that gives it stability and predictability. The manufacturing technique is, in a sense, the real weapon, and it is harder to develop than individual agents."[127] According to a GAO report, terrorists working outside of a state-run laboratory would have to overcome extraordinary technical and operational challenges to successfully process and deliver an agent to cause mass casualties.[128]

"Building" Germs

Anthrax bacterium rapidly multiplies and consumes nutrients from its infected host while emitting toxins which kill that host within 2-3 days. Once the host dies, the germ no longer has a food source and is eventually exposed to oxygen. At this point, the

[126] Croddy and others, 11.

[127] Cordesman, 41.

[128] Mintz, "Technical Hurdles," A1+.

germ begins the process of sporulation. It forms a copy of its chromosomes and builds a hard shell around the copy forming a spore. The original "mother germ" dies and withers away leaving a spore. Protected spores can then lie dormant for years until they are ingested into a new host and they begin to germinate and repeat the killing cycle.[129] Acquiring anthrax spores would be as simple as finding where a dead animal has died from the disease and digging up spores from the surrounding soil. However, acquiring spores in this manner does not guarantee a virulent form of the disease, as stated above, Aum Shinrikyo failed to collect anthrax spores by this method.

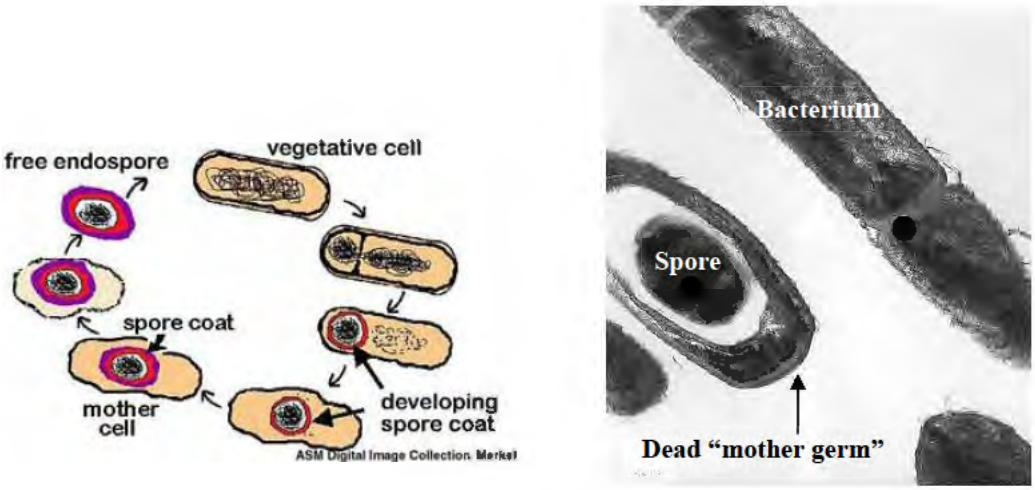

Figure 14. Sporulation of Anthrax Bacterium. At left, the process of sporulation. At right a live anthrax bacteria and a formed "dormant spore.

Source: Edward G. Lake, *Analyzing the Anthrax Attacks* (Racine, WI: N.p., 2005), 41.

[129]Edward G. Lake, *Analyzing the Anthrax Attacks* (Racine, WI: N.p., 2005), 41-42.

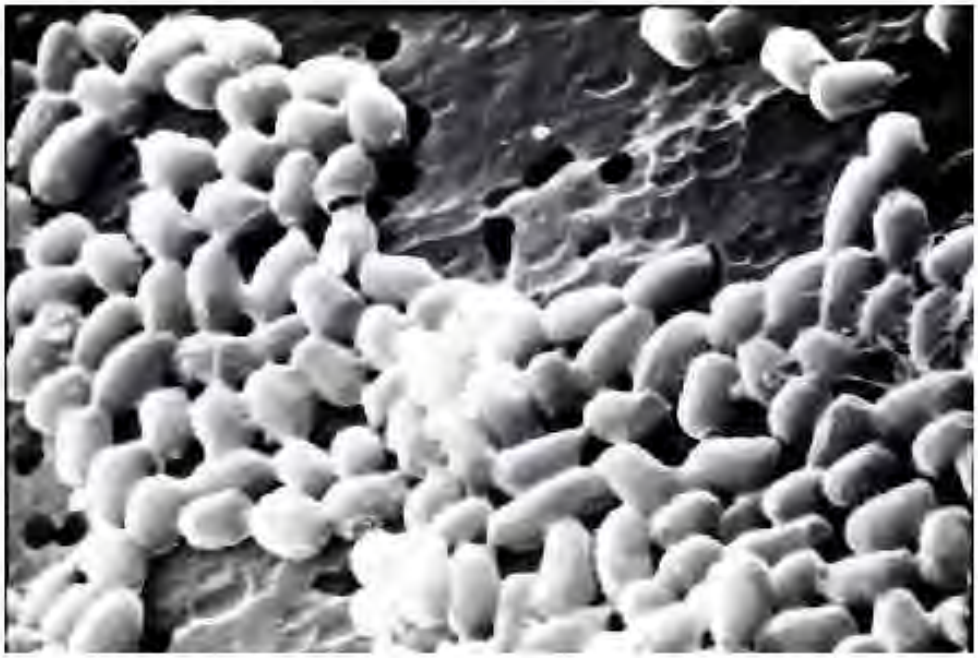

Figure 15. Anthrax spores.

Source: Edward G. Lake, *Analysis of the Anthrax Investigation*, <http://www.anthraxinvestigation.com/index.html>, accessed 7 July 2005.

The ability to collect and grow anthrax is not a modern medical achievement. In the 1870s, German scientist Robert Koch isolated anthrax bacillus and demonstrated that they produced spores that could lie dormant and later infect other animals. Louis Pasteur took anthrax laden blood and grew bacterium demonstrating how the germ multiplied. In 1882, he developed an anthrax vaccine for sheep.[130]

Once a sample of anthrax bacteria is obtained, an additional amount would need to be cultivated in a laboratory and processed for use as a weapon. Agents are produced in a wet state (slurry) and, if needed, can be converted to a dry state (powder). Slurry is more easily produced, but less efficient to distribute and cells suspended in slurry lose

[130]History Learning Website, under Robert Koch, URL: <http://www.historylearningsite.co.uk/robert_koch.htm>, accessed 7 July 2005; ; David V. Cohn, Life and Times of Louis Pasteur, URL: <http://www.louisville.edu/library/ekstrom/special/pasteur/cohn.html>, accessed 7 July 2005.

virulence relatively quickly. Conversely, powdered anthrax is significantly more difficult to manufacture, but has excellent distribution qualities. A dry agent would require a smaller amount and be easier to disseminate, but still poses greater manufacturing difficulties.[131]

Producing anthrax in either form would be difficult to mass produce, however producing dry powders involves additional risks. Processed anthrax powder is easily aerosolized and adheres to surfaces, increasing the risk to someone handling the agent.[132] Iraq possessed dryers and grinders capable of producing anthrax powder, but all of its munitions were filled with slurry.[133] It is possible that they were not able to overcome the technical difficulties with producing a powder or preferred to use an agent that was less difficult to handle. Both slurry and powder can be disseminated in an aerosol cloud.

As detailed in Chapter 2, anthrax spores must be between one and five microns in order to infect humans. In nature, the spores themselves are generally around one micron, however weaponizing the spores requires several technically challenging steps. When anthrax is manufactured in a laboratory it is grown in fermenters. After a sufficient amount of the bacteria are grown, large amounts of processed air would have to be pumped through the fermenters in order to get the bacterium to sporulate. The air has to be filtered in order to avoid other bacteria from growing with the anthrax. The air would have to be sterilized.[134]

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[131]Cordesman, 42-43; Mintz, "Technical Hurdles," A1+. Raymond A. Zilinskas, "Iraq's Biological Warfare Program: The Past as Future?" in *Biological Weapons: Limiting the Threat,* ed. Joshua Lederberg (Cambridge, MA: The MIT Press, 1999), 143-144.

[132]Cordesman, 43; Mintz, "Technical Hurdles," A1+.

[133]Zilinskas in *Limiting the Threat*, 144.

[134]Regis, 57.

After the anthrax bacteria are forced to sporulate, the spores contained in a damp mass must be further processed. The U.S. government bioweapons method involved freeze drying the mixture which produced dried bricks of spores. The bricks are then milled down to break up into smaller and smaller clumps until they are broken down into 1 to 3 micron particles. The milling process creates an electro-static charge causing the spores to stick together as well as reducing the aerosolization qualities. The final step in the process is to add an anti-static agent, such as silica, to prevent spores from clumping due to the static and makes them more easily dispersible in the air.[135] The pharmaceutical industry uses silica compounds in manufacturing inhalational medicines.[136]

According to Spertzel, in order to produce an agent like the one in the Senate letters, the silica would have to be added during the drying process using a method called spray drying. He further stated that while it may not be complicated, it requires a lot of trial and error to get the desired particle size. Routine spray drying might produce particles of varying sizes, some of them 20 microns. The process would require a "co-current" dryer which would mix heated air with material to be dried. The two streams coming together would determine the particle size. Increasing the heated air relative to the material being dried would produce a smaller particle. The process would require repeated adjustments to the heated air flow and examination of the particle size to attain the proper setting.[137]

[135]Croddy, 68-69. Lake in *Analyzing the Anthrax Letters*, 48-49.

[136]Cole in *The Anthrax Letters*, 203.

[137]Cole in *The Anthrax Letters*, 203-204.

Amount of agent needed

Throughout this paper, the lethality of anthrax has been expressed in small amounts, usually less than 5 kilograms. In addition to the difficulties with producing even that amount, to effectively contaminate a city effectively on a mass scale might require larger amounts. Wind and weather conditions, method of delivery, population density in the covered area might all limit the number of infections. Still producing only a few grams of virulent agent would allow a terrorist to create panic.

Unlike chemical weapons which would require large volumes to inflict mass casualties, biological agents generally require only a small amount of agent to produce a high number of casualties. The small amount of agent eases the level of difficulty in choosing the method of distribution.

DISSEMINATION

DOD determined that the most efficient method for disseminating a biological agent is via an aerosol, either as liquid droplets or by dry powders. In addition to infecting a large number of people in the target area, powdered anthrax would remain airborne for a long period and be transported over long distances. Tests showed that an aerosol cloud of 2-5 micron particles behaved like a gas, penetrating into interior spaces. The release of an agent from a ship, aircraft, or tall building could achieve some lethality over distances from 50 to 100 miles. The amount of agent used could be as small as one gram.[138] The Sverdlovsk accident is the only known aerosol release of a virulent anthrax

[138]Cordesman, 38.

agent and demonstrated the lethal potential of a small amount of anthrax dispersed in a city.

Terrorists could spread anthrax using crop sprayers, commercial aircraft, or helicopters or use commercial aerosol generators to disperse an agent into the air inlet ducts of a building.[139]. They could use sprayers from the tops of tall buildings similar to Aum Shinrikyo's attempts to dispense slurry.

Slurry could be dispensed in a liquid form using sprayers, but it is difficult to effectively disseminate aerosolized liquid agents with the right particle size without reducing the mixture's strength. Liquid agents would also require larger amounts of agent and larger dissemination vehicles that would increase the possibility of detection. Additionally, slurry would have to be kept continuously refrigerated until it is used and unless it is extremely pure material, the slurry may settle at the bottom of a container and clog the sprayer. This is what happened to Aum when they attempted to spray anthrax from atop a building in Tokyo. The difficulties of dispensing slurry could be overcome by using a dry agent disseminator capable of spreading it.[140] Though a disseminator capable of doing this might be technically difficult for terrorists, having a dry agent would also provide a wider variety of other methods for dispensing the agent, including low-flying airplanes and the U.S. mail.

Sprayers used to spray insecticides, for example those driven through areas of South Florida during mosquito season, could be modified to spray bacteria. An airplane would also be a method for spreading anthrax over a populated area. Finally, a sprayer

[139]Cordesman, 39.

[140]Cordesman, 41-43.

could be mounted on the back of a truck or a boat. The U.S. Army and Navy conducted tests in 1950 using an anthrax simulant that was sprayed off the coast of U.S. cities. In Virginia, Navy ships sprayed simulant over the cities of Hampton, Norfolk, and Newport News. A second test was conducted off the coast of San Francisco. The tests concluded that nearly everyone of the 800,000 people in San Francisco inhaled 5,000 or more particles. Particles were found as far as 23 miles inland.[141] Though a terrorist might not have the significant amount of agent required to reproduce the process on such a large scale, the tests proved the feasibility of this method.

[141]Regis, 118.

Figure 16. Methods of Disseminating an Anthrax Agent.

Source: Central Intelligence Agency in (U) *Terrorism: Guide to Chemical, Biological, Radiological, and Nuclear (CBRN) Weapons Indicators*, 7.

Weather

As demonstrated in Table One located in Chapter One, the meteorological conditions and time of day will significantly enhance or diminish the number of potential casualties from an anthrax agent. An agent disseminated outside would be influenced by sun, rain, mist, and wind conditions.[142] Strong winds could disperse the agent erratically and it would not reach its intended target in sufficient quantities or it could be washed away by rain. Terrorists would have to account for several meteorological factors to properly disseminate the agent for maximum effectiveness (See Table 1, Chapter 1).[143]

Though sophisticated methods of dispersal would create the most casualties, a Canadian government study in 2001, demonstrated that "low-tech" delivery systems, such as opening an anthrax laden envelope, are potentially capable of distributing a high concentration of spores within a localized area. During the test, quantities of anthrax simulant ranging from 0.1 to 1 gram were sealed in envelopes and shaken to simulated mail handling. The letter was then open and the letter removed to test the extent of bacterial contamination. The stimulant spread throughout the room and onto the clothing and breathing filter of the test subject. The report concluded with a statement that, "It is only a matter of time until a real 'anthrax letter' arrives in some mail room."[144]

Both this test and a follow-on test by another agency noted that powder leaked out through the flaps of the envelope and there was a risk of the contamination even with unopened letters. Neither anticipated the fine 1 to 3 micron spores leaking directly

[142]Cordesman, 41.

[143]Cordesman, 14; Al Mauroni, *Chemical and Biological Warfare: A Reference Handbook* (Santa Barbara, CA: ABC-CLIO, 2003), 115; Croddy, 69.

[144]Cole in *The Anthrax Letters*, 110-111.

through the 20 micron spores of the envelope paper.[145] As was the case in the 2001 Senate letters, due to the risk of cross-contamination of follow-on letters, a relatively small amount of anthrax (less than two grams) could spread some levels of the bacteria all over the United States.[146] The Hamilton and Brentwood facilities processed 85 million pieces of mail from the day the first letters were mailed till the facilities were closed. Anthrax spores were found in the mailbox in Trenton, New Jersey 10 months later. The sorting machine at a postal facility which processed the Senate letters had anthrax spore contamination in 4 out of 13 sorters. One machine was heavily contaminated with approximately 3 million spores (600 possible infectious doses).[147]

The U.S. Postal System processes 200 billion pieces of mail per year through 38,000 post offices, much of the mail going through major distribution centers like Hamilton and Brentwood.[148] If sorters became contaminated, theoretically, anyone could end up handling a cross-contaminated letter and be at risk.

A study in 2002, to test the effects of cross-contamination of mail, concluded that the number of particles that attached to secondary mail would be high initially, but would reduce over time and successive mailings.[149] This may decrease some of the anxiety over the threat of cross-contamination because a small amount of anthrax distributed over multiple locations might reduce the concentration of sufficient spores to create infections. However, the cases of cross-contamination of facilities and the possible low number of

[145]Cole in *The Anthrax Letters*, 111-112.

[146]Cole in *The Anthrax Letters*, 111-112.

[147]Cole in *The Anthrax Letters*, 109.

[148]Cole in *The Anthrax Letters*, 74.

[149]Cole in *The Anthrax Letters*, 112-113.

spores that may cause infection in some individuals, make even a small amount of anthrax spread through the mail a cause for concern.

Prior to the 2001 anthrax attack, the U.S. mail was not considered the best method for dispensing anthrax. Though, the individual opening the letter and those nearby might be infected, the widespread contamination in 2001 was not anticipated by bioterror experts. Anthrax hoaxes used liquid in a petri dish or fine powders, but nothing that had the aerosolization properties in the Daschle and Leahy letters. The anthrax used in the two letters sent to the Senators was of a much finer grade than that of the previous five. The first set of letters caused 3 cases (or 25%) of inhalation anthrax and 9 cases of cutaneous anthrax (or 75%). The Senate letters, on the other hand, created 2 cutaneous cases (20%) and 8 inhalational cases (80%). The conclusion being that the second mailing had a higher likelihood of causing inhalational anthrax.[150] Furthermore, the fine grade of the spores leaking out of the Senate letters likely led to the contamination of at least five mail distribution centers and the cross-contamination infection of three other individuals who received mail through the same centers.[151]

It is likely that the perpetrator did not even realize that the letters would contaminate the postal service centers or postal workers near the letters. Postal workers did not become infected during the first mailings, but several that were just in the vicinity of the processing machines during the second mailings became infected. Even though he sealed the Senate envelopes and folded the anthrax within the internal letter, he probably

[150]Lake in *Analyzing the Anthrax Attacks*, 68-69.

[151]Cole in *The Anthrax Letters*, 92.

did not foresee the possibility that the high grade of anthrax consisting of 1-5 micron spores could actually leak through the 20 micron pores of the envelope.[152]

Anthrax spores pose the greatest risk to humans when they are aerosolized. After settling on surfaces, there is a risk of secondary aerosolization due to activity around the contaminated area. Indoor ventilation and air conditioning also run the risk of re-aerosolizing spores that have settled and spreading them throughout a building.[153] A test was done in Senator Daschle's office before it was decontaminated to measure the risk of secondary aerosolization. Detection plates were placed around the office and normal office activity was simulated. Sixteen of seventeen plates tested positive for B. anthracis.[154] The spread of anthrax spores throughout the Senate offices, AMI building, and the New Jersey and Washington postal facilities demonstrate the extent to which a small quantity of anthrax can contaminate a building.

Releasing anthrax in an enclosed space or densely crowded area is one of the most efficient methods for dispensing the agent to inflict mass casualties. In 1966, the U.S. Army released a harmless bacterial stimulant in the New York Subway System, in order to test the extent of contamination during a biological attack. The air currents from the trains quickly spread the bacteria throughout the subway system and the trains. Overall, more than one million citizens were exposed. Ken Alibek stated that the Soviets performed a similar test in the Moscow Subway. Several hundred grams were used in the test and within two hours the entire metro system was contaminated. The test concluded

[152]Tara O'Toole and others in *Bioterrorism.*

[153]Inglesby in *Bioterrorism*, 88.

[154]Inglesby in *Bioterrorism*, 91.

that there would be about 10,000 deaths.[155]

Fort Detrick scientists conducted a test in 1949 to assess the vulnerability of the Pentagon. Agents carrying sprayers hidden in camera bags and suitcases pretended to conduct "air pollution tests" while spraying bacteria simulant into the air conditioning system. The air filtration system did not stop the bacteria from being dispersed throughout the Pentagon.[156] Terrorists would not be able to penetrate a military installation so easily, however access to most large office buildings would be unrestricted. To obtain maximum effect in this scenario, the terrorists would need to study the aerodynamics of the building, for example the air exchange rate and filtration systems.[157]

One other method of attack which may be less likely, but an efficient publicity or blackmail tool, would be contaminating cattle. In 1943, the United Kingdom manufactured anthrax filled cattle cakes for possible use against Germany. The small biscuits made from ground linseed and laced with anthrax spores would be dropped over Germany's prime cattle-grazing pastures.[158] During World War I, German agents attempted to infect horses bound for allied forces overseas.[159] A terrorist wishing to make a point, but wanting to limit the level of human casualties could use this method to

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[155]*Bioterror: The Invisible Threat*, Produced by Markus Belin, Directed by A. J. Jokinen, Solar Films, 1999, videocassette.

[156]Regis, 117.

[157]Cordesman, 41.

[158]Regis, 48.

[159]Terrance M. Wilson and others, "Agroterrorism, Biological Crimes, and Biowarfare Targeting Animal Agriculture," in *Clinics in Laboratory Medicine: Laboratory Aspects of Biowarfare*, ed. Aileen M. Marty (Philadelphia, PA: W.B. Saunders Company, 2001), 551.

do so. The event would be fairly localized, as they would not be able to disperse the cakes in bombers like the UK plan, but it would simplify many of the difficulties involved in dispensing an agent. The attack might also be initially mistaken as a natural outbreak of the disease.

SUMMARY

There are a large number of "ifs" associated with a bioterror attack using anthrax. If a non-state actor could acquire a virulent anthrax strain, process it in a large enough quantity while maintaining secrecy, and could find a way to disseminate it effectively, then the U.S. would be at significant risk of a bioterror attack. But only after all of these seemingly difficult steps are accomplished.

While the technical challenges are not insurmountable, they are neither so simple that anthrax use will become commonplace. There are technical obstacles that would prevent most terrorists from getting beyond the theoretical stage of biowarfare development. Some of those obstacles prevented Aum Shinrikyo from deploying anthrax successfully. The likelihood of a non-state actor developing large quantities of anthrax, as in our worst case scenarios using 50 kilograms and contaminating a city, is extremely low. However, it has been demonstrated how dangerous only a few grams can be and, though the likelihood of an attack is fairly low, the consequences of a small attack could have devastating results. The 2001 anthrax attacks proved that someone has demonstrated the capability to acquire a virulent strain, process it, and disseminate it effectively.

Figure 17. Anthrax Detection.

Source: Daryl Cagle's Professional Cartoonist's Index, under the term "anthrax," URL: <http://cagle.slate.msn.com/news/anthrax/4.asp>, accessed 15 June 2005.

CHAPTER 5

KEY INDICATORS OF PROCUREMENT AND DEVELOPMENT

> The one that scares me to death, perhaps even more so than tactical nuclear weapons, and the one we have the least capability against is biological weapons.
>
> Colin Powell, 1993

THE PAST

Long before the 2001 anthrax attacks, many biowarfare experts warned of the dangers of a biological attack by terrorists. The low number of actual attacks demonstrate the difficulty non-state actors have with developing and employing biological weapons effectively. Aum Shinrikyo's eight attempts at using biological weapons were all failures. Nonetheless, Aum's lacks of successes were cited more as failures in management and less in capability. They developed both chemical and biological agents and deployed them with the intent to induce mass casualties. As noted in Chapter Four, Aum revealed that non-state actors do have the ability to pose a biological warfare threat to the U.S. and other nations.

Immediately after 11 September 2001, the Secretary of Health and Human Services (HHS) held a meeting with Doctor D.A. Henderson and others to discuss the

possibility of follow-on terrorist attacks. The group felt that there could be a sequel to the 11 September events and it could very well be a biological event. Despite the recent appreciation of the threat of bioterrorism, the HHS secretary felt that the country was "grossly unprepared for a biological attack."[160] His concerns were reiterated by others in the public health community.[161]

Since the late 1990s and the U.S. government's growing recognition of the bioterror threat, funding for biological terror research had increased dramatically. Despite the criticism on the initial response to the 2001 anthrax attacks by the CDC and the FBI, the increase in funding towards management and prevention of bioterrorism certainly better prepared America for the events in Fall 2001.[162] Stephen Morse, director of the CDCs, bioterrorism preparedness and response program, stated "It was fortunate that the perpetrators waited until we were ready."[163] Since the attacks, America is appreciably better prepared for dealing with a bioterror attack.

Doctor Kenneth Bernard, the director of health and bioterrorism at the White House Homeland Security Council, stated that the U.S. is dramatically better prepared now for dealing with a biological warfare attack. Government funding for bioterrorism-related research programs at the National Institutes of Health has increased from $340 million in 2002 to $1.7 billion in 2003. Research programs from vaccine development to methods for blocking paths of infection are underway. Sensors are being developed for

[160]Cole in *The Anthrax Letters*, 117.

[161]Cole in *The Anthrax Letters*, 126.

[162]Cole in *The Anthrax Letters*, 220.

[163]Cole in *The Anthrax Letters*, 131.

distribution around the country to detect a possible biological attack and medical treatments for infections of biological warfare diseases are being developed.[164]

Still much work remains to prepare the U.S. for another attack. Individuals like Doctor Tara O'Toole, feel the nation lacks a coordinated program to protect citizens. She believes that people do not fully appreciate the extent of the biowarfare threat and that there needs to be "a more explicit articulation of the nature of the threat." Additionally, she stated that medical and public health communities need to be better prepared. There needs to be stockpiles of medicines in case of a biological attack and that medical and public health communities should be ready for mass casualties.[165]

THE FUTURE

The results of a biological attack generally results in delayed effects in the forms of signs and symptoms. Indicators of a covert anthrax attack would present itself in an unusual appearance of human cases of infection to health care providers, hours to days after the agent has been dispersed.[166] Advances in medical biological defense technology and diagnostics research are striving to develop new methods for detecting attacks while they are occurring, or detecting infections as soon as possible after exposure. Such methods would be necessary to rapidly identify and treat cases before the onset of symptoms.

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[164]Cole in *The Anthrax Letters*, 143, 222.

[165]Cole in *The Anthrax Letters*, 221.

[166]Randall C. Culpepper and William D. Pratt, "Advances in Medical Biological Defense Technology," in *Clinics in Laboratory Medicine: Laboratory Aspects of Biowarfare*, ed. Aileen M. Marty (Philadelphia, PA: W.B. Saunders Company, 2001), 684.

Some more recent efforts in biowarfare prevention research include faster means for detecting pathogens. For example, efforts are underway to identify the specific genes that are activated when bacteria, such as anthrax, cause infection. Thus blood samples could quickly identify within hours, possibly minutes, if the blood has been infected.[167] Other medical detection measures such as a biowarfare breathalyzer for analyzing biological pathogen exposure through breath expiration and DNA genomic sequencing tests that could read the entire genome of a biological agent in seconds are under development. Additionally, tissue-based biosensors to detect physiological changes occurring to cells or tissues are being developed.[168]

How Serious is the Threat?

The extent of an anthrax attack in the U.S. would be based on many factors and a non-state actor's abilities. Acquiring a lethal form of the disease, producing a significant amount of agent and dispensing it effectively would all influence the success or failure of such an attack. Although terrorists have restrained from acquiring or using biological weapons in the past, it appears that some are beginning to recognize the characteristics and capabilities that these weapons offer (See Table 4).

[167]Cole in *The Anthrax Letters*, 143.

[168]Culpepper and Pratt in *Clinics in Laboratory Medicine*, 686-687.

Table 4. Summary of Biological Weapons Characteristics[169]

- Some biological weapons are so lethal, they potentially approach the lethality of nuclear weapons.
- While the technical skills involved in making such agents are high, biological weapons can be relatively easy to manufacture if such skills are present, and such skills and the required equipment are becoming increasingly common.
- Biological weapons are hard to detect and characterize, particularly if more than one type of weapon is used, or the nation is not on the alert.
- Defense is difficult at best. Effective vaccines and treatment are often not available, or must be administered very quickly. Casualties often require intensive and long-term care and therapy, possibly saturating available care.
- The impact of an attack can be timed in ways that favor the attacker. The time before the effects of an attack varies. It may be hours, days, or weeks before an attack is apparent, and this could severely restrict warning, detection, and the value of treatment.
- The US would find it extremely difficult to estimate the seriousness of the attack and react accordingly. It is difficult to characterize the scale of the threat and its impact until symptoms appear and the casualties can be judged by the number of sick or poisoned.
- Unprotected medical and emergency personnel are highly vulnerable if they enter areas they do not know have been attacked, or attempt treatment when no cure is available.

Additionally, Jonathan Tucker identifies certain advantages that biological pathogens have over other weapons of mass destruction, such as nuclear weapons, and limitations of safeguarding against them. Table 5 summarizes some of the advantages.

[169]Center for Strategic and International Studies, *Homeland Defense: Asymmetric Warfare & Terrorism*, (Washington, DC: CSIS, 24 September 2001), 65-66. Cited hereafter as CSIS, Asymmetric Warfare & Terrorism.

Table 5. Possible Advantages of Biological Agents as a Mass Casualty Weapon[170]

- **Pathogens occur naturally.** Most biological pathogens (with the exception of the smallpox virus) can be obtained from natural sources, such as diseased animals or even soil. Thus, bioterrorists would not have to rely exclusively on stealing pathogens from a research laboratory or culture collection, although obtaining a known, well-characterized strain from such a source would increase their confidence in the desired properties.

- **Pathogens are dual-use.** Many pathogens that could be stolen or diverted for malicious ends have legitimate applications in biomedical research or for the development, production, and testing of vaccines, drugs, and diagnostic tools. The equipment used to cultivate and process pathogens is also dual-use.

- **Pathogens can reproduce.** Infectious microorganisms reproduce rapidly under the right conditions, so that a small "seed culture" of anthrax bacteria could be cultivated under optimal growth conditions to yield a large quantity of agent in a matter of days. For this reason, the theft of even minute quantities of a pathogen can pose a security threat.

- **Pathogens are not detectable at a distance.** Fissile materials give off ionizing radiation that can be picked up by sensitive instruments up to several feet away, making it possible to detect nuclear smuggling at a facility exit or a border crossing. In contrast, biological pathogens and toxins have no comparable signatures that can be detected at a distance with currently available technologies. A terrorist could smuggle freeze-dried pathogens in sealed plastic vials through a security checkpoint with little risk of detection.

- **Pathogens are present in many types of facilities.** Dangerous pathogens and toxins are stored and manipulated in thousands of facilities) including hospitals, universities, clinical laboratories, biotechnology firms, and state and federal laboratories. A terrorist organization wishing to steal pathogens would probably target a particular facility either because it had lax security or housed a highly virulent strain that was not available elsewhere.

- **Accountability of Dangerous Pathogens may not be precise.** Infectious agents may be dispersed in several locations, including storage freezers, laboratory incubators, living experimental animals, animal carcasses, and waste materials. For these reasons, the total inventory of a pathogen being utilized in a research lab cannot be determined precisely at any given time. Accounting of biological pathogens is particularly difficult when they are being subcultured and used for experimentation.

[170] Jonathan B. Tucker, *Biosecurity: Limiting Terrorist Access to Deadly Pathogens* (Washington, DC: United States Institute of Peace, 2003), 17-18.

The probability of a future biological attack would be conjecture, however the efforts by extremists and disturbed individuals to acquire and use biological weapons on a small scale are likely to continue.[171] According to the Center for Strategic and International Studies (CSIS), advances in biotechnology, associated delivery and weaponization technology, and the proliferation of these technologies are steadily increasing the ease with which terrorist groups can acquire the means to make biological weapons. Additionally, genetic engineering is introducing a whole new set of risks.[172]

The 2001 anthrax attacks took the threat of bioterrerism from books and Hollywood movies into reality and may have motivated non-state actors to explore the potential of this asymmetric weapon. A dedicated terrorist could find even more efficient and lethal methods for delivering an anthrax agent, be it in a subway, via a cropduster, or in a building's ventilation system. The attacks further raised concerns that well-funded non-state actors could obtain or manufacture biological materials for an attack, however, some analysts question whether non-state actors have the ability (without the support of a nation-state) to develop such a high-grade agent, with a high spore concentration, low electrostatic charge, and efficient delivery system required to produce mass casualties. Michael Daly identifies the essential attributes of a biological weapon that meets the criteria for a WMD. They are: high virulence coupled with high host specificity, high degree of controllability, lack of timely countermeasures to the attacked population, and

[171]CSIS, Asymmetric Warfare & Terrorism, 65.

[172]CSIS, Asymmetric Warfare & Terrorism, 66.

high degree of resistance to adverse environmental forces.[173]

On average, non-state actors would have to gather a significant financial base, obtain a virulent anthrax strain, somehow acquire the technical skill to develop it, access or build facilities, gather equipment, and then test their agent. Even those who believe that another biowarfare attack will happen, concede that the ability to develop biological weapons is beyond the means of most terrorists. Furthermore, a non-state actor attempting to develop an agent while remaining discreet, even if he could overcome the technical difficulties, would likely be confined to only being able to produce a small amount of agent. While he could use a small amount to cause significant panic, it would not create mass casualties.[174]

The Deputy Commander of the Army's Medical Research and Materiel Command testified in 1998 about the difficulties for non-state actors to using WMD, stating that "an effective, mass-casualty producing attack on our citizens would require either a fairly large, very technically competent, well-funded terrorist program or state sponsorship." The Director of Central Intelligence stated in 1997 that, "while advanced and exotic weapons are increasingly available, their employment is likely to remain minimal, as terrorist groups concentrate on peripheral technologies such as sophisticated conventional weapons." According to Cordesman, interest among non-state actors in biological and chemical weapons is growing and the possibility that they may use chemical or biological weapons may increase. However, most terrorists are likely to

[173]Michael J. Daly, "The Emerging Impact of Genomics on the Development of Biological Weapons: Threats and Benefits Posed by Engineered Extremophiles," in *Clinics in Laboratory Medicine: Laboratory Aspects of Biowarfare,* ed. Aileen M. Marty (Philadelphia, PA: W.B. Saunders Company, 2001), 621.

[174]Mauroni,, 116.

continue using conventional explosives, at least in part because of the difficulties in weaponizing chemical and biological agents and their unpredictable results.[175]

Nevertheless, the 2001 attacks demonstrated that terrorists are willing and able to use advanced technologies and to attempt mass casualty attacks. The presumption that the non-state actors could not or would not use such weapons is no longer valid. Even in the case of a small-scale attack, the effects could be sufficient to create the panic and fear that the terrorist is striving for. Documents and computer hard drives seized in 2003 during the capture of Al Qaeda operational planner Khalid Shaikh Mohammed revealed that the organization had recruited a Pakistani microbiologist, acquired materials to manufacture botulinum toxin, and developed a workable plan for anthrax production.[176]

According to Doctors O'Toole, Inglesby, and Henderson, anthrax is one of the most studied agents and is, arguably, the simplest and most accessible bioweapons pathogen.[177] Furthermore, if in the case of a larger more coordinated attack than the one in 2001, the doctors question the ability of the U.S. health care system's ability to deal with a surge of hundreds or thousands of potential victims.[178] Though biological weapons production may be dangerous and technically difficult, Cordesman notes it can be relatively cheap and, most importantly for terrorists, easy to hide.[179] In addition, as

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[175]Croddy and others, 66; Cordesman, 1.

[176]Tucker, 11.

[177]Tara O'Toole and others, "Why Understanding Biological Weapons Matters to Medical and Public Health Professionals," in *Bioterrorism: Guidelines for Medical and Public Health Management*, eds. Donald A. Henderson and others (Chicago: AMA Press, 2002), 4. Cited hereafter as "Why Understanding Biological Weapons Matters,"

[178]O'Toole and others, "Why Understanding Biological Weapons Matters," 2.

[179]Cordesman, 3.

noted in Chapter 2, the 2001 anthrax attacks had a significant psychological impact despite the low number of casualties.

In assessing the impact of the 2001 anthrax attacks, one needs to account for the fact that millions of people were affected to some degree by the attacks. Only a few grams of agent disrupted the mail system, shut down Congress, and fostered fear and paranoia. The ability of such a small amount of anthrax, distributed in such a low-tech, but surprisingly efficient method, hinted at the potential damage hundreds of letters could have caused if an individual like Clayton Lee Waagner or a religious extremist found the means to use such a weapon. Even more so if an antibiotic resistant strain is used or spread with a more efficient delivery method.

Terrorism analysts like Robert Kupperman and Walter Laquer suggest that CBRN use has become more probable.[180] Scott Lillibridge, a bioterrorism advisor to the Secretary of Health and Human Services, stated after the 2001 attacks, that he worries that a threshold has been crossed and others will be more inclined to commit acts of bioterrorism. He also stated that he worries about the explosion of new biotechnology and bioscience.[181]

In dealing with non-state actors and efforts to acquire a biological weapon capability, Cordesman notes that the ability of the U.S. intelligence community to provide warning is a difficult challenge.[182] The access to technology and the ability to develop and deploy biological weapons covertly minimizes the opportunity for

[180]Holloway, 249.

[181]Cole in *The Anthrax Letters*, 131.

[182]Cordesman 55.

intelligence collectors and analysts to detect a non-state actor's efforts to do so. The Center for Strategic and International Studies states that intelligence warning of the exact nature of probable biological attack can be absolutely critical to an effective response. Though exceptionally difficult, identifying the specific disease would simplify detection and treatment. In addition, establishing whether the attack was an unsophisticated attack or one using high grade "weaponized" agents may determine the effectiveness of the response.[183]

DETECTING ANTHRAX ATTACKS

Medical Health Care Professionals and First Responders

Unlike chemical weapons, which typically have immediate effects, symptoms from a biological weapon attack will not begin to appear for several days. Since the attack will likely be covert, the first people to notice indicators of an anthrax attack would likely be medical and health-care professionals. Given the rarity of anthrax cases in the U.S. and that very few doctors will have ever seen an actual case, they must be alert and cognizant to the symptoms and indicators and to the possibility of a biological attack.

Rapid recognition would be paramount to early response thus reducing the impact of the attack. This could take the form of treating a significant number of individuals reporting a rapid onset of illnesses with anthrax particular symptoms, as well as nontraditional information requests on how to treat an anthrax infection or pharmaceutical sales of particular antibiotics. Alert medical professionals who went against contemporary logic and treated 2001 victims early and aggressively for anthrax

[183]CSIS, Asymmetric Warfare & Terrorism, 62-63.

likely saved their lives, while at least two individuals who were sent home for a "flu-bug" died.

Maintaining vigilance after recognizing signs of possible exposure would decrease the ramifications of the attack. In addition to indicating the possibility of an attack, rapid deduction of anthrax infection will aid public health professionals in providing rapid care, focusing response, allocating scarce resources, containing panic, and determining the extent of the exposure.[184] Emergency physicians, dermatologists, laboratory specialists, infectious disease specialists, and primary care physicians that participated in the early recognition of infected patients demonstrated the critical role in identifying instances of bioterrorism. As Doctor Julie Gerberding notes, collectively, they provide an early warning system for public health and law enforcement agencies and are essential partners in detecting and preparing for bioterrorism.[185]

She also notes that for this system to function well, all clinicians must have enough basic information about clinical manifestations of the effects of particular high-risk biowarfare agents. Additionally, they must know how to diagnose these infections and how to report their suspicions to local public health and law enforcement.[186]

In addition to the opinion by experts that a biological attack by terrorists is becoming more likely, the number of hoaxes have increased significantly. Before 1997, WMD threats were rare. In 1997, the FBI investigated 74 WMD threats (24 biological). The following year they investigated 112 biological threats. In 1999, most of the

[184]Franz in *Clinics in Laboratory Medicine*, 463.

[185]Julie L. Gerberding and others, "Bioterrorism Preparadness and Response: Clinicians and Public Health Agencies as Essential Partners," in *Bioterrorism: Guidelines for Medical and Public Health Management*, eds. Donald A. Henderson and others (Chicago: AMA Press, 2002), 2.

[186]Gerberding, 30.

incidents were anthrax hoaxes. Even though they are hoaxes, the estimated cost or each event is $500,000.[187] With the increase in hoaxes, training on distinguishing anthrax symptoms from normal illnesses that may coincide with the timing of a hoax will aid health care professionals in preventing wide spread panic and quickly help restore public order and trust.

In the case of an infection in cattle mentioned in Chapter Four, though a remote possibility, health care workers would have to differentiate between a natural outbreak and one of human origins. The outbreak in Rhodesia, in which an animal outbreak coincided with a human, one is a prime example of such a scenario. Foot and Mouth disease would likely be more devastating to cattle, but might also be less attributable to natural causes rather than human intervention, thus mitigating the terrorists ability to claim credit. Although distinguishing the difference may be challenging, as Dr Terrance Wilson and others indicate, the epidemiologic investigation of a natural outbreak and a covert attack would be similar.[188]

When combined with other observations, certain characteristics may point to an intentional outbreak of the disease. Additionally, an unusual clinical presentation, perhaps from an atypical route of exposure, may also provide evidence of a possible attack. For example, the appearance of inhalational anthrax, a very rare occurrence in nature, in animals might serve as an indicator of an aerosol attack on humans or animals. Other factors could include: the concurrence with threats or hoaxes, virility and mortality

[187]Franz in *Clinics in Laboratory Medicine*, 463.

[188]Wilson in *Clinics in Laboratory Medicine*, 553.

rate, and geographic presentation of an outbreak.[189]

Responding to a bioterrorist attack, in addition to requiring significant cooperation among medical and health care officials and government agencies at all levels, would require cooperation among investigative and intelligence agencies to help identify the culprit and reduce the severity of the attack. During the 2001 attacks, government agencies, such as the CDC and FBI, initially dismissed indicators of new cases of anthrax infection. It was alert medical professionals who identified the infections and began treatment even before they received confirmation it was anthrax. Though bioterror events will likely be rare, prepared medical health professionals would be a key element to assessing the incidence and extent of a biowarfare attack.

FBI Profiling and Personality Types

Although it would be difficult even for a professional to identify a non-state actor trying to work with biological weapons by personality profiling, the FBI's personality profile of the anthrax killer linked with other pertinent indicators could aid in the direction of an investigation by identifying additional indicators or evidence of a program. FBI spokeswoman, Tracey Silberling, stated that the information on the FBI's "Amerithrax" website would educate people about the threat and perhaps "ring a bell with someone" who might then contact the bureau.[190]

The FBI behavorial assessment of the anthrax killer describes him as: Likely an adult male; possibly with a scientific background or at least a strong interest in science;

[189]Wilson in *Clinics in Laboratory Medicine*, 553.

[190]Cole in *The Anthrax Letters*, 188.

comfortable working with an extremely hazardous material; did not select victims randomly, but rather, carefully selected specific targets and may have communicated expressions of contempt for those targets to others; has access to a source of anthrax and possesses the knowledge and expertise to refine it, may work in a laboratory; possesses or has access to some of the laboratory equipment listed in Chapter Four. In addition, he has likely taken steps to ensure his own safety, which may include having gotten the anthrax vaccination or began taking antibiotics unexpectedly.[191]

According to the FBI site, it is also possible that this person's behavior might have changed significantly after an attack has been committed to include the following: Altered physical appearance; pronounced anxiety; atypical media interest; noticeable mood swings; more withdrawn; unusual level of preoccupation; unusual absenteeism; altered sleeping and/or eating habits. These behaviors would have been most noticeable during significant events, for example, the media reports of death of the first victim and the death of non-targeted victims.[192]

While the purpose of the FBI behavioral assessment is to profile the anthrax killer specifically, the behavioral patterns of another bioterrorist may follow some of the same behavior models. Furthermore, though there is the risk of an amateur detective or paranoid individual accessing the website and wrongly accusing someone of being a biowarfare terrorist, experienced investigators and intelligence agents working off

[191]FBI, "Linguistic/Behavioral Analysis of Anthrax Letters," FBI *Amerithrax Homepage*, 9 November 2001, URL: <http://www.fbi.gov/anthrax/amerithrax.htm>, Accessed 15 May 2005. Cited hereafter as FBI, Amerithrax Homepage.

[192]FBI, *Amerithrax Homepage*.

singular tips, can sift the facts on multiple pieces of intelligence to determine the likelihood of suspicious activity.

Investigation after the Fact

Modern scientific analysis provides some methods for determining the original source of an anthrax agent. Analysis of the 2001 agent revealed that it was developed from the Ame's strain of anthrax that originated in the U.S. However, this does not mean that the source used to develop the agent used in the attack was domestic since samples of the Ame's strain were sent to laboratories overseas, including England.[193] Additionally, carbon dating analysis revealed that the agent was less than two years old indicating that the perpetrator had access to a lab or a source where the agent was recently processed. DNA analysis and other methods can possibly further pinpoint the source of the anthrax to a specific laboratory or part of the U.S. [194]

Equipment

Pharmaceutical, chemical, and food manufacturers process their products with much of the same equipment that could be used to produce biological weapons. As summarized in Chapter Four, acquisition of this dual use technology by itself may have innocent meaning and would have to be associated with other indicators before a possible nefarious intent could be implied.

Lab cultivation, production, and dissemination equipment could range from small,

[193]Cole in *The Anthrax Letters*, 200.

[194]Lake in Analyzing the Anthrax Attacks, 50, 167-169.

simple, and easy to hide equipment to complex high volume equipment. Small labs could go undetected until an event has occurred. Larger labs would require significant space and equipment for production. Different types of equipment that may be associated with biowarfare development are pictured in Appendix A.

BIOLOGICAL WARFARE AND ANTHRAX ATTACK INDICATORS

Given the low numbers of attempts at using biological weapons, the U.S. has a limited database of experience for which to note indicators of attempts to acquire bioweapons. However, given the growing number of hoaxes in recent years and the growing threat of bioterrorism, there is a growing list of likely indicators of attempted biological warfare development and attack.

The purpose of this list is to aid intelligence analysts in recognizing the indicators that non-state actors are attempting to acquire, develop, or deploy an anthrax agent. The following list of indicators was developed from the previous chapters on what types of individuals might be seeking an anthrax agent, the type of equipment they would need, the indications of attempts to acquire an agent, and the signs that an attack may have already begun. No one indicator can be held in isolation as evidence that the subject is attempting to acquire a biological agent. There may be a plausible explanation that is not immediately apparent for why the person may have legitimate and legal reasons for their actions. However, multiple indicators would sharpen the focus on what the individual may be doing. Logical reasoning and further investigation will substantiate or disprove an attempt at biowarfare.

For example, indications of attempts to research crop-dusting aircraft alone, may be a legitimate, innocent act. When tied to other indicators of research into biological agents, such as purchasing of particular pieces of lab equipment would no doubt raise "red flags" for intelligence analysts. In hindsight, a doctor who treated one of the 11 September hijackers for a skin lesion believes the black scab may have been cutaneous anthrax.[195] While the above is conjecture, coupled with Mohammed Atta's inquiries into the capabilities of crop dusters, together they could indicate that terrorists were at least exploring the possibility of using chemical or biological weapons.[196]

Additionally, many of the indicators assume that the terrorist is looking for optimal conditions to deploy an agent in order to enhance the mass casualty effects of the amount of agent. For example, in optimum weather conditions when deployed outdoors, and in areas where there are high concentrations of people. While he can deploy it in any scenario, as mentioned in Chapter Four, research into the best conditions for dispersal would increase the lethality of a small amount of agent. This, however, should not preclude the possibility of an agent being dispersed in less than optimal conditions.

Medical Detection

As stated above medical indicators come from multiple sources. A case with symptoms of cutaneous anthrax may be associated with a case of possible inhalational anthrax symptoms from the same area or a zoological breakout and human cases occurring at the same time or geographical area. Given the possibility of a covert release

[195]Lake in Analyzing the Anthrax Attacks, 100-101.

[196]Lake in Analyzing the Anthrax Attacks, 101.

of an agent, a patient (or patients) seeking medical treatment for symptoms of inhalational anthrax will likely be the first indicators of a bioterrorist attack. Table 6 lists categories of diagnosis and findings indicating anthrax infections. Doctor Inglesby states that "The appearance of even a single previously healthy patient who becomes acutely ill with nonspecific febrile illness and symptoms and signs consistent with those listed in Table 6 and whose condition rapidly deteriorates should receive prompt consideration for a diagnosis of anthrax infection."[197]

Note: For detailed diagnosis and treatment of biological warfare agents consult *Bioterrorism: Guidelines for Medical and Public Health Management,* eds. Donald A. Henderson and others, and *Clinics in Laboratory Medicine: Laboratory Aspects of Biowarfare,* ed. Aileen M. Marty.

[197]Inglesby in *Bioterrorism*, 75.

Table 6. Diagnosis of Inhalational Anthrax Infection[198]

Epidemiology
- Sudden appearance of several cases of severe acute febrile illness with fulminant course and death
  or
  Acute febrile illness in persons identified as being at risk following a specific attack (for example, those in the 2001 attacks would include: postal workers, members of the news media, and politicians and their staff)

Diagnostic Tests
- Chest radiograph: Widened mediastinum, infiltrates, pleural effusion
- Chest computed tomographic scan: hyperdense hilar and mediastinal nodes, mediastinal edema, infiltrates, pleural effusion
- Thoracentesis: Hemorrhagic pleural effusions

Microbiology
- Peripheral blood smear; gram-positive bacilli on blood smear
- Blood culture growth of large gram-positive bacilli with preliminary identification of Bacillus species

Pathology
- Hemorrhagic mediastinitis, hemorrhagic thoracic lymphadenitis, hemorrhadic meningitis; DFA stain of infected tissues.

Cutaneous Anthrax

As noted in Chapter 2, due to the rarity of cases of cutaneous anthrax in the U.S., it may be difficult for medical professionals to recognize an infection until it has undergone biopsy or there has been extensive subspecialty evaluation. The most likely areas vulnerable to infection are areas of exposed skin, such as arms, hands, face, and neck.[199]

[198]Inglesby in *Bioterrorism*, 74.

[199]Martin in *Clinics in Laboratory Medicine*, 516.

INDICATORS OF A POSSIBLE BIOLOGICAL ATTACK OR PREPARATIONS FOR AN ATTACK[200]

Medical Indicators

- Cases of symptoms conducive to inhalational anthrax infections as indicated in Table 6 (for example, chest imaging abnormalities such as: mediasinal widening, pleural effusions)
- Combination of inhalational anthrax and cutaneous anthrax symptoms reporting, especially from the same geographic area
- Combination of human infection and zoological infection from same geographic area
- Syndromic groupings of diseases not based on specific diagnoses (for example: respiratory, fever, gastrointestinal)
- 911 or emergency calls for conditions such as respiratory distress
- Pharmaceutical usage rates and use of prescription, over-the-counter, and investigational new drugs
- Intensive care unit admissions
- Radiologic test ordering (chest radiographs)
- Laboratory test ordering for specific diseases
- Appearance of antibiotic resistant or highly virulent germs (may be indicative of genetically altered agents)
- Properties of virulence or toxicity not found naturally
- Appearance of edema and lesions indicative of cutaneous anthrax infection, especially on the face, neck, hands, and exposed skin (the most likely areas of cutaneous infection)

[200]David R. Franz and others, "Clinical Recognition and Management of Patients Exposed to Biological Warfare Agents," in *Clinics in Laboratory Medicine*, 462-463.

Behavioral Indicators

- School or work absenteeism
- Veterinary surveillance
- Internet access of health websites seeking treatment methods for anthrax infection
- Geographically isolating self from fellow members of own community seen as abnormal behavior
- Displaying abnormal level of curiosity (not of professional interest) in biological weapons development
- Focus on only one aspect of study by advanced biology students (for example, studying lethal pathogens)
- Unreasonable or unjustified interest in disease outbreaks or locations of disease outbreaks, especially by persons whose professional positions do not create a legitimate need for such information
- Unjustified or abnormal interest in U.S. response capabilities to a biological attack
- Gathering information or agricultural or commercial sprayers
- Active attempts to acquire knowledge regarding biological agents
- Making threats to attack a person or organization with biological weapons
- Previous attempts to acquire or use biological weapons (for example, Larry Wayne Harris acquiring plague and anthrax samples)
- History of targeting specific groups or persons with increasingly more lethal methods
- Membership in a group that advocates violent attacks on other groups, races, or the government (for example: White supremacists, and religious extremists)
- Embraces a religious ideology affiliated with an apocalypse or doomsday event
- Persons with radical ideology seeking information on WMD
- Seeking employment at labs that stock pathogens

- Collecting vast quantities of material, books, and knowledge on developing biological weapons

- Shows a willingness to take high risks to achieve goals, regardless of public condemnation or criminal prosecution

- Surveillance of potential CBRN targets such as subways, airports, military and industrial complexes, or economic and agricultural areas

Equipment and Laboratory Acquisition Attempt Indicators

- Queries about buying or leasing specific biological related equipment

- Large purchases of biotechnology supplies or lab equipment by parties who are not acting within their normal occupation. Especially notable if purchases are made with cash

- Purchase of growth cultures outside of normal laboratory customer base

- Middleman acting on behalf of third parties to acquire agents or laboratory equipment

- Attempts to increase privacy or access to labs

- Heightened or unusual security procedures at biotechnology facilities

- Scientists seeking unusual hours to access laboratories

- Unusual, abnormal, or significant attempts by biotechnology scientists, to hide their behavior or laboratory work

- Buying or renting additional commercial or residential property, especially in isolated or private locations

- Purchasing or attempting to purchase agricultural sprayers or crop dusters

- Laboratories with activity at unusual hours with low amount of oversight

- Attempts to increase power needs at laboratories or private properties

- Personal protection equipment that is out of the ordinary. Either too high a level for working with non-contagious materials or out of place (for example: small laboratory, warehouse, or garage)

- Significant use of disinfectants in unusual places
- Unusual equipment that appears to be biological related, but out of place, such as a home or small warehouse
- Unusual activity that appears to be biological related, but out of place, such as a home or small warehouse
- Unusual smells coming from homes or warehouses in conjunction with abnormal activity
- Grouping of unrelated equipment. For example: food service dryers collocated with laboratory equipment and sprayers
- Acquisition of growth medium or vessels
- Acquisition of agricultural sprayers by theft or purchase
- Unscheduled or unusual spraying, especially outdoors or during periods of darkness

Indicators of Attempts to Acquire or Develop an Anthrax Agent[201]

- Efforts to purchase or researching areas for purchase of bacterial agents
- Purchase of bacteria by persons outside of their normal business activities
- Theft of virile strain from culture collections or universities
- Acquiring or attempting to acquire strains of bacteria from universities, hospitals, or research centers
- Seeking locations of outbreaks of anthrax without a legitimate medical interest
- Traveling to area of natural disease outbreaks
- Lengthy stays in areas of high levels of outbreak. For example, Africa
- Seeking samples from natural outbreaks of the disease by collecting samples from dead animals or surrounding soil

[201] *Chemical, Biological, Radiological, and Nuclear (CBRN) Terrorism Reporting Guide,* (Washington, DC: N.p., 2004), 71-77.

- Attempting to access bodies of those killed by the disease such as grave robbing
- Unexplained, small-scale outbreak (possible indicator of trial test)
- Unusual acquisition or attempt to acquire quantities of antibiotics (penicillin, ciprofloxacin, and deoxycicline) outside of normal supply chain or absent disease symptoms. Especially significant in large amounts
- Attempts to acquire bacteria from culture collections outside the U.S.
- Attempts to acquire dosages of vaccine out of normal occupation or those not at high risk (non-veterinary or non-wool-workers)

Solicitation and Recruitment

- Solicitation of scientists to develop biological agents
- Solicitation on scientific methods for processing biological materials
- Impersonation or identity theft of scientific personnel with access to pathogens
- Unexplained or sudden withdrawal by advanced biology students from training or education
- Attempting to draw scientific aid by extortion or blackmail
- Unusual contacts or attempts to court biological scientists
- Individuals with the above behavioral indicators who have specialized training in medical, animal sciences, or agricultural science background
- Group emplacing members or sympathizers in medical institutions; research facilities; university laboratories; pharmaceutical, chemical, or agricultural plants
- Recruiting members or sympathizers that work or received training in the field or aviation
- Individuals obtaining training with aircraft and agricultural sprayers

APPENDIX A

SAMPLES OF TYPES OF EQUIPMENT USED FOR DEVELOPING A BIOLOGICAL AGENT

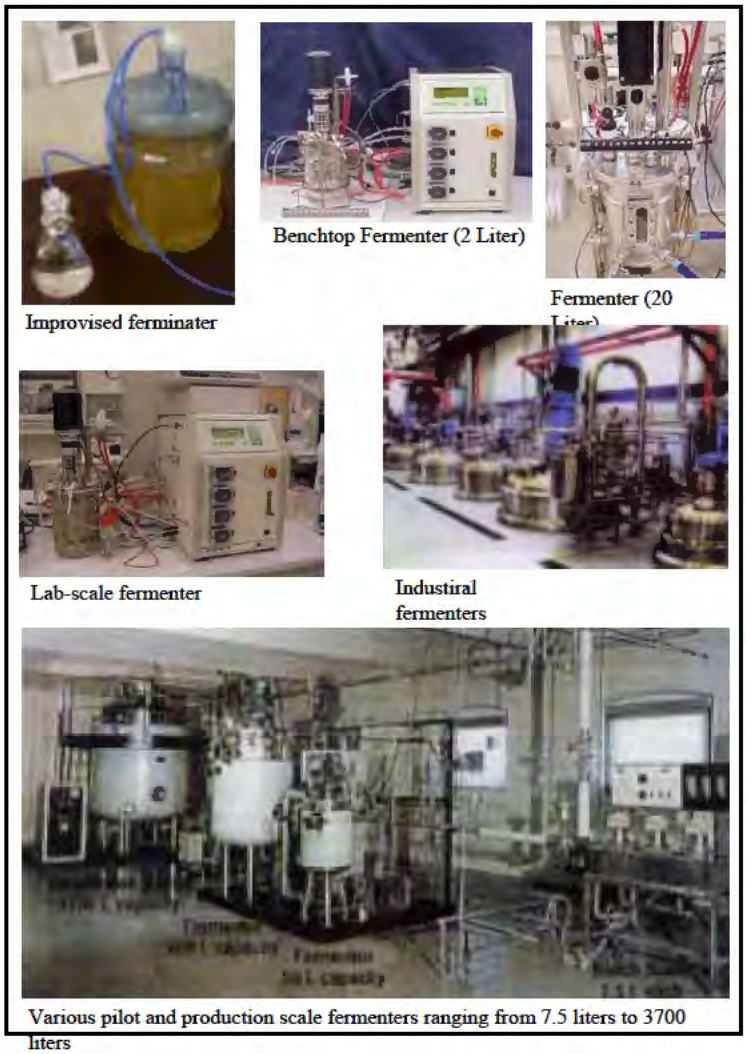

Figure 18. Various Sizes aud Types of Fermenters.

Source: ***Worldwide Biological Warfare Weapons Threat*** **(Washington, DC: N.p., 2001), 28-29;** ***Production Equipment for Chemical and Biological Materials*** **(Washington, DC: N.p., 2003), 18. Cited hereafter as** ***Worldwide Biological Warfare Weapons Threat.***

Biological safety cabinet with glove box

Biological safety cabinet with glove box

Small glove box

Sealed glove box for handling biologically tainted mail, available on the Internet

Improvised glove box

Figure 19. Various Sizes and Types of Glove Boxes.

Source: ***Worldwide Biological Warfare Weapons Threat*****, 28-29;** ***Production Equipment for Chemical and Biological Materials*** **(Washington, DC: N.p., 2003), 22. Cited hereafter as** ***Production Equipment for Chemical and Biological Materials*****; Central Intelligence Agency,** ***Terrorism: Guide to Chemical, Biological, Radiological, and Nuclear (CBRN) Weapons Indicators,*** **CD-ROM (Washington, DC: 2002). Cited hereafter as CIA,** ***CBRN Guide*****; PD Security Products ISO Box, URL: <http://www.pdsecurityproducts. com>, accessed 15 June 2005; Mbraun Technologies Workstations, URL: <http://www.mbraun.de/ workstations.htm>, accessed 15 June 2005.**

Figure 20. Centrifuge Separators.

Source: *Worldwide Biological Warfare Weapons Threat*, 30; ThomasNet Industrial Newsroom under "compact centrifuge," URL: < http://news.thomasnet. com/fullstory/ 29522>, accessed 7 July 2005; *Production Equipment for Chemical and Biological Materials*, 19; *The Biological and Chemical Warfare Threat* (Washington, DC: GPO, 1999), 4. Cited hereafter as *The Biological and Chemical Warfare Threat.*

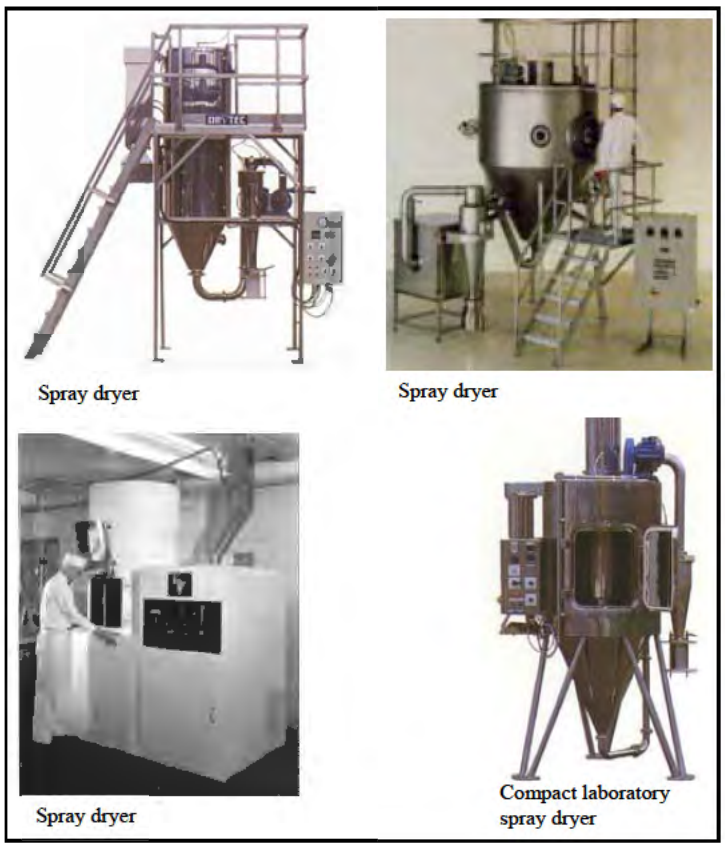

Figure 21. Spray Dryers

Source: *Worldwide Biological Warfare Weapons Threat*, 33; Drytec Dryers, Compact laboratory spray dryers, URL: <http://www. drytecdryers.com/ pilot.htm>, accessed 7 July 2005; Swenson Technology Spray Dryer, http://www.swensontechnology.com/ spraydryer.html, accessed 7 July 2005;

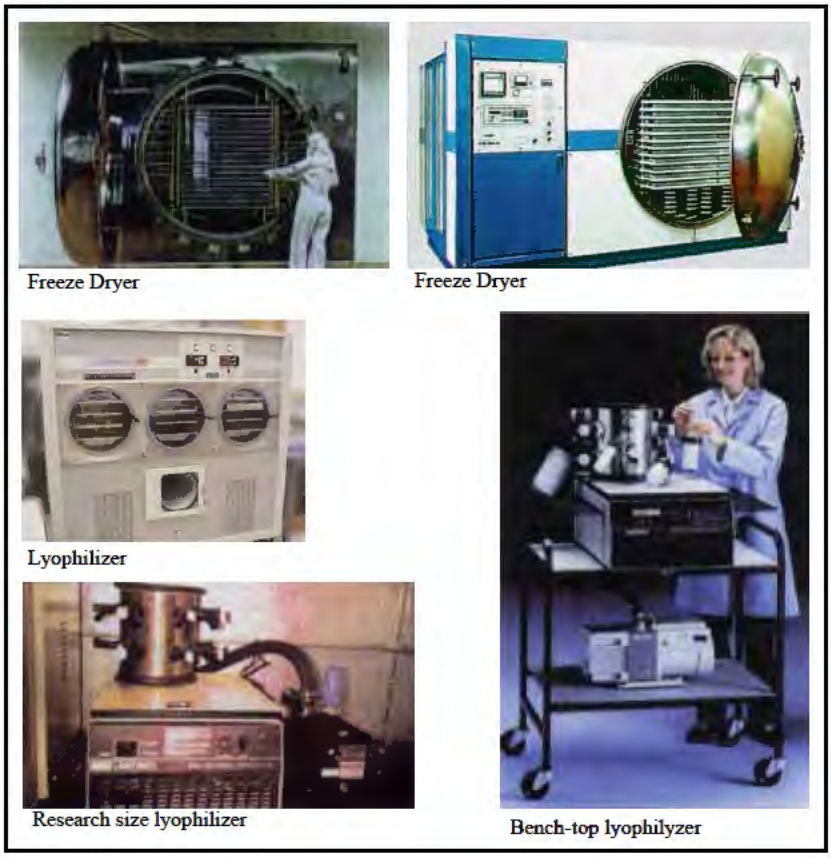

Figure 22. Various Sizes and Types of Drying Equipment.

Source: ***Worldwide Biological Warfare Weapons Threat*****, 33; CIA,** ***CBRN Guide*****;** ***Production Equipment for Chemical and Biological Materials*****, 19;** ***The Biological and Chemical Warfare Threat*****, 4.**

Ball mill

Improvised mill

Jet mill

Figure 23. Milling Equipment.

Source: ***Worldwide Biological Warfare Weapons Threat*, 34; *Production Equipment for Chemical and Biological Materials*, 19.**

GLOSSARY

Adenopathy	Any disease involving or causing enlargement of glandular tissues, especially one involving the lymph nodes. Swelling or morbid enlargement of the lymph nodes.
Anxiolytics	Medications used to reduce serious anxiety, tension, and agitation.
Cutaneous	Relating to or existing on or affecting the skin.
Diazepam	Generic name for the tranquilizer Valium.
Edema	Accumulation of fluid in organs and tissues of the body resulting in swelling.
Edematous	Marked by edema (an accumulation of an excessive amount of watery fluid in cells, tissues, or serous cavities).
Eschar	A thick dried scab that forms made up of dead tissue that forms, for example, on an area of skin that has been burnt or exposed to corrosive agents.
Febrile	Feverish or having a temperature.
Hilar	Root of the lung in mediastinal (center) part of the chest
Interstitial	Relating to or situated in the small, narrow spaces between tissues or parts of an organ.
Malaise	A generalized, nonspecific feeling of discomfort. A feeling of being sick or having a "flu-like" feeling often indicative of infection.
Mediastinal	The space within the chest located between the lungs, that contains the heart, major blood vessels, trachea and esophagus.
Necrotic	Relating to death of a portion of tissue. Dead skin or tissue, often the result of burns or infection.
Oropharyngeal	Having to do with the throat or throat area.

Papule	Small (less than 1 centimeter), circumscribed, raised skin lesion.
Prodrome	An early symptom that indicates the onset of a disease.
Purulent	Having or making pus. Containing, consisting of or being pus.
Syndromic Surveillance	Applies to surveillance using health-related data that precede diagnosis and signal a sufficient probability of a case or an outbreak to warrant further public health response. Though historically syndromic surveillance has been utilized to target investigation of potential cases, its utility for detecting outbreaks associated with bioterrorism is increasingly being explored by public health officials.

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