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AND PROCEDURES 3-10.26

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Tactical Doctrine

BIOLOGICAL AGENT AEROSOL COLLECTION AND IDENTIFICATION

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APPLICATION: This publication applies to all Air Force active duty, Air National Guard, and Air Force Reserve Command units. This Air Force Tactics, Techniques, and Procedures document is nondirective. However, suggested procedures, actions, or tasks may be presented in directive language to improve readability and understanding by simplifying sentence structure. Except when specified actions are mandated by Air Force or Department of Defense directive publications, units may modify the actions, directions, tasks, and worksheets to suit their needs.

Chapter 1

GENERAL

1.1. Purpose. This Air Force Tactics, Techniques, and Procedures (TTPs) document details a layered defense system designed to provide commanders multiple opportunities and avenues to be informed of and make decisions on specific biological warfare attacks in time to effectively implement the appropriate medical countermeasures and non-pharmaceutical interventions, when available.

1.1.2. This Air Force Tactics, Techniques, and Procedures document has been developed cross functionally and provides an agreed upon methodology for collection and testing of environmental samples that might contain biological warfare agents across the full range of military operations: major combat operations, deployed contingency operations, special events, Homeland defense/security, etc.

1.1.3. Installations will apply the applicable procedures from this Air Force Tactics, Techniques, and Procedures document to develop biological detection plans and supplement biosurveillance unique to their location. Successful protection of the force will depend upon having well-trained personnel capable of effectively handling the wide variety of potential scenarios across the threat spectrum e.g., attacks occurring early in the deployment process, not all functional areas or biological identification resources available at the site at the time of attack, etc.

1.2. Overview.

1.2.1. This Air Force Tactics, Techniques, and Procedures document implements portions of Department of Defense Instruction 3020.52, *Department of Defense Installation Chemical, Biological, Radiological, Nuclear, and High-Yield Explosive Preparedness Standards* and Department of Defense Instruction 6490.03, *Deployment Health.* This document is complementary to the response and recovery activities outlined in Air Force Manual 10-2608, *Disease Containment.*

1.2.2. Some processes and procedures are unique to the Air Force and have been developed to meet Air Force requirements to ensure mission continuation and force survivability.

1.2.3. This Air Force Tactics, Techniques, and Procedures document is designed to be used in development of response plans as well as to execute specific tasks following a possible Biological warfare event. The target audience is primarily Subject Matter Experts tasked to collect potential biological samples and analyze them in an environmental laboratory environment, using currently fielded technologies.

1.3. Background.

1.3.1. There are four major components to Air Force biological agent aerosol collection and identification operations: intelligence, collection/detection, identification, and medical surveillance.

1.3.2. Intelligence. The intelligence component of this concept is designed to work “left of boom,” or in other words, before a Biological warfare attack occurs at a specific installation. This could include early warning of an inbound threat; information on an adversary’s threat intentions; or even using data gathered from one attack location to assist other installations at

a later time. The Air Force's integrated utilization of the full array of intelligence resources provide the foundation for early warning of a potential Biological warfare attack, deliberate planning activities, and resource allocation decisions.

1.3.3. This component primarily contains the equipment items capable of directly collecting or facilitating the environmental identification of biological warfare agents. The primary collection items in this category are ambient air samplers to include: dry filter units, and/or Fido B1 (or similar).

1.3.3.1. Collection. The Air Force only runs collectors at installations when warranted by a threat or special condition(s). The initiating factor for use of the collectors will be a trigger event (e.g. conflict with enemy nation state, credible terrorist threat, etc.) that prompts specified sample collection protocols for the purpose of agent identification.

1.3.3.2. Detection. For the purposes of this Air Force Tactics, Techniques, and Procedures document, the detection component applies to biological warfare aerosol contamination only. Air Force Manual 10-246, *Food and Water Protection Program*, and Air Force Manual 48-138, *Sanitary Control and Surveillance of Field Water Supplies*, provide guidance and some water quality standards (using only Total Coliforms, *Escherichia coli* (*E. coli*), and chlorine levels as basis for criteria) in regards to potable water and safe food delivery. Air Force Manual 10-246 and 48-138 primarily address detection of physical tampering to indicate potential of introduction of a biological warfare agent and not necessarily detection of the agent itself.

1.3.3.2.1. Although not considered to be a likely occurrence, the physical observation of a biological attack (for instance, a person employing a backpack sprayer) is also a subset of detection.

1.3.3.2.2. When considered from a national perspective, the detection component of this document works in tandem with the BioWatch Program, a network of environmental sensors emplaced to detect biological weapons attacks against major cities in the United States. The detection component also provides a line of defense against the threats associated with the For Official Use Only National Planning Scenarios: #2, Biological Attack – Aerosol Anthrax; and #4, Biological Attack – Plague.

1.3.4. Identification. Within the context of the Air Force biological defense operations, this component contains the equipment items capable of identifying biological warfare agents. The primary items in this category are individual Hand Held Assay panels and Department of Defense Biological Sampling Kits, and, for pathogens only, the current molecular diagnostic testing capability, to include PCR and other amplification techniques. If an installation does not possess identification capability, this identification will be fulfilled through alternative methods (i.e., transport of the sample to another Air Force installation, a sister service site, a civilian/host nation laboratory, state laboratory, etc.). Under some circumstances, the Air Force may expand existing food and water-monitoring protocols through the selected use of the current Polymerase Chain Reaction identification system to identify biological warfare agents in food and water.

1.3.5. Medical Surveillance. The Air Force Medical Surveillance System includes a functional capacity for data collection and the analysis and dissemination of information linked

to military preventive medicine and Force Health Protection support of operational commanders. The Air Force program directly supports related Department of Defense and U.S. national-level surveillance systems (see Air Force Instruction 48-105, *Surveillance, Prevention, and Control of Disease and Conditions of Public Health or Military Significance*). The objectives of the medical surveillance system related to biological warfare detection are to identify attacks that were not detected through other means, provide insight into the potential extent of casualties, and the probable disease progression timeline.

Chapter 2

THREAT ESTIMATION

2.1. General. In order to develop and execute an effective biological collection and identification scheme, personnel must understand their unique threat environment. Specifying and quantifying the precise biological warfare threat across the full range of military operations is an on-going challenge for the Air Force.

2.2. Intelligence. The following areas comprise the primary subcomponents of the intelligence component in regards to biological defense operations.

2.2.1. General Military Intelligence. The Air Force uses a variety of resources to assess biological warfare threat, to include Air Force intelligence assets at all levels as well as Department of Defense and national resources such as the Defense Intelligence Agency and the Central Intelligence Agency.

2.2.1.1. The Air Force uses this type of information to gain insight into adversary capabilities and intentions. For example, since the U.S. does not have an offensive biological warfare capability, it would be useful for the Air Force to know that enemy troops had been vaccinated against a specific biological warfare agent in the weeks or months leading up to a conflict. This information would be indicative of which biological warfare agent the enemy could potentially employ.

2.2.1.2. For the purpose of deliberate planning, the Air Force uses the latest edition of the "Defense Intelligence Agency CBRN Warfare Capstone Threat Assessment" document as the source for ascertaining the biological warfare capability for countries of concern. This document is located on the Defense Intelligence Agency Athena website and the content is approved by Defense Intelligence Agency, Central Intelligence Agency, Federal Bureau of Investigations, National Security Agency, Director of National Intelligence, Defense Special Missile and Astronautics Center, National Geospatial-Intelligence Agency, National Air and Space Intelligence Center, and the National Reconnaissance Office.

2.2.1.3. United States Northern Command is the Department of Defense consolidator and distributer of intelligence data from other Governmental agencies (Federal Bureau of Investigations, National Security Agency, Department of Homeland Security Fusion Centers, etc.). United States Northern Command/J2 distributes intelligence data to the Air Force through the Air Component, First Air Force (Air Forces Northern). Air Forces Northern in turn distributes the information to the Headquarters Air Force Operations Center and the Major Commands. If not already accomplished by Air Forces Northern, the Major Commands then distribute the data to the appropriate installations. Key leadership will likely receive data from these sources through the Threat Working Group at each installation.

2.2.1.4. At locations within the United States, the Air Force Office of Special Investigation in conjunction with the Federal Bureau of Investigations are additional sources of timely information. Local, State and Urban Area Federal Fusion centers may be the first intelligence processing bodies to recognize a likely biological warfare threat within the United States.

2.2.2. Medical Intelligence. Medical intelligence is the category of intelligence resulting from collection, evaluation, analysis, and interpretation of foreign medical, bio-scientific, and environmental information. The Air Force's primary source for this type of intelligence is the Defense Intelligence Agency's National Center for Medical Intelligence.

2.3. Overview of Threat during Peacetime at U.S. Locations. The biological warfare threat to U.S. locations is assessed as low by most threat agencies. There are a number of reasons for that assessment, to include the need to acquire biological material and then disseminate the agent(s) in a size and manner that would be effective against a portion of the population. Attacks tend to be targeted against food, water, and commodities during production or limited contamination at the point of sale.

2.4. Overview of Threat During Major Combat Operations or Other Non-Major Combat Operations Contingency Operations. Installations and higher headquarters are likely to function within one or more of three separate threat environments. Refer to section 3.3. for details on these operating environments.

2.5. Determining the Local Threat.

2.5.1. J2 intelligence estimates should be used to depict applicable threat categories. Many High and Medium chemical, biological, radiological, and nuclear Threat Areas are vulnerable to biological agents.

2.5.2. The local intelligence community can assist in researching and keeping personnel apprised of updates. Oftentimes, the Intel Community is not fully aware of the information that is useful to biological warfare defense planning and response communities. They can assist in Requests for Information and monitoring intelligence reports for certain words or phrases provided to them if working relationships are built prior to an event. The Threat Working Group traditionally has the responsibility for determining the threat and identifying trigger points that would indicate a possible reassessment from the current posture should be considered. The Threat Working Group provides information/decision briefings and recommendations for senior leadership consideration. Intelligence data, medical surveillance, and commander's risk tolerance provide important inputs to decision-making. As a major combat operations, or an expeditionary operation develops, the quality and quantity of actionable information on the risk factors in this table can affect concern about the benefit of turning on dry filter units. Commanders balance the risk from attacks with the resources and cost for sample collection and processing.

2.5.3. It is also important to consider that turning on the dry filter unit network may provide benefits other than just a detect-to-treat capability. Installations can employ dry filter unit sampling after an attack to establish that the primary aerosol cloud has passed, and if a residual aerosolized hazard remains on the airbase as time passes. While results from dry filter unit collection activities will enable installations to get a rough idea of the area that was in the hazard area, we will not know with full accuracy which resources were in the area at the time of cloud passage and what resources were subsequently affected or unaffected by resuspension of the biological material.

2.5.4. Installations can deploy dry filter unit sampling prior to an attack to determine if background contaminants exist naturally in the area. This can be done in the hours or days

leading up to an event, or accomplished more methodically over a longer timeframe i.e., collecting background information throughout the year.

2.5.5. Clearly, unambiguous intelligence knowledge and confidence regarding the existence of an offensive program with the intent to employ biological weapons simplify commander decisions, but this information is not always readily available. While the risk factors identified above provide a general frame of reference, the details of the knowledge of these issues greatly influence the confidence that the intelligence community has in the data collected.

2.5.6. If the movement of biological weapons is observable and reportable by tactical intelligence assets (such as moving biological agent-filled weapons to firing positions), clearly the decision to deploy dry filter units and commence sampling should be implemented before first use. Detection of "first use" is a major, strategically important milestone for national response and the international community.

2.5.7. Homeland Defense Biological Threat Criteria. In Accordance With guidance contained within Air Force Instruction 10-245, *Antiterrorism*, "commanders and equivalents must be aware of evolving threats against their command and continually review their antiterrorism posture using the Integrated Defense Risk Management Process to manage risk and appropriately adjust the posture of elements and personnel subject to their control. Integrated Defense Risk Management Process is addressed in Air Force Instruction 31-101, *Integrated Defense*. The next level up the chain of command must be notified to mitigate or accept any antiterrorism risk that cannot be controlled to an acceptable level within a commander's resources." Within the context of biological defense operations at home station, this means commanders and their advisors will have to consider the benefits and risks of holding large public events such as air shows if a potential biological threat exists. If the inclination is to go forward with the event, installations must ensure they have a credible biological detection capability and an executable incident response plan before finalizing the decision.

2.6. Threat Trigger Points. The installation level threat assessment includes triggers that will initiate specific response activities (e.g., siting the biological agent sampling resources in their proper locations). Ideally these locations have been pre-identified and samples have been collected and analyzed to establish a background. The trigger points help the installation to transition to meet the threat in a timely manner while ensuring all tasked functions are following an established process. Some of these trigger points are unique to the location and are based on the threat, vulnerabilities and level of acceptable risk.

2.6.1. Table A2.1 below provides a graphic representation of a decision tree, using the risk factors and levels identified in Table 2.1. Commanders should use this decision tree in conjunction with the Threat Working Group to balance the risk of not identifying a biological attack at an earlier point and relying on clinical detection, against the resource commitments of employing dry filter units and environmental laboratory assets.

Table 2.1. Risk Factors Supporting Decision Tree for Deploying Dry Filter Unit Sampling.

Risk Elements	*High Risk of Adversary Biological Warfare Attack*	*Moderate Risk of Adversary Biological Warfare Attack*	*Lowest Risk of Adversary Biological Warfare Attack*
Technical capability of Biological Warfare program	Active offensive program with stockpiled/rapid production of agent and delivery systems	Research and development of agents and potential delivery systems, but no production capability or programs.	No known biological program to identify, research, or develop aerosol delivery
Stage of conflict/adversary's perception of strategic and tactical success in a Major Combat Operations	Regime survival at risk, or perceived to be little or no possibility of victory without resort to biological weapons at onset of hostilities	Tactical situation deteriorating or conflict extending beyond adversary's expectations	Adversary's perception that conflict is proceeding as desired with favorable outcome expected
Military and/or political leadership planning and intent to use Biological Warfare in a Major Combat Operations	Biological warfare use is integrated into Adversary's national strategic guidance, military doctrine for combat operations, and tactical planning	Assess confidence in reported result.	No planning or intention to use Biological Warfare agents evident
Testing of biological agents, delivery systems, and medical countermeasures	Active offensive Biological Warfare field testing program supported by laboratory support 1. Agent development 2. Weapons development 3. Detection 4. Medical	No active offensive Biological Warfare field testing, but laboratory testing conducted	No testing known to exist

Risk Elements	***High Risk of Adversary Biological Warfare Attack***	***Moderate Risk of Adversary Biological Warfare Attack***	***Lowest Risk of Adversary Biological Warfare Attack***
Training for operations in a Biological Warfare environment	Military offensive doctrine and training, fire planning guides, target selection guidelines established, trained, and exercised	Military defensive doctrine and Tactics, Techniques, and Procedures established	No doctrine or training for defensive response
Development of force protection capability	Vaccination and/or pre-exposure prophylaxis distribution planning (for military and adversary civilian populations) established	Limited medical prophylaxis, but development or robust medical treatment capabilities known to exist	No medical prophylaxis or treatment capability exists

Chapter 3

ASSUMPTIONS AND PLANNING FACTORS

3.1. General.

3.1.2. Personnel awareness of assumptions and understanding of the expected outcomes are critical knowledge components of a successful biological detection strategy. The items identified below are not all inclusive but are a representative example of these factors. The assumptions and planning factors should be used as a basis for planning activities and, at the time of execution, a review of each item should take place with the appropriate subject matter experts to decide if each is true for the situation and threat at hand.

3.2. Assumptions.

3.2.1. Installations will resume critical mission operations following biological attacks during major combat operations.

3.2.2. Significant advance warning of attack will be limited and might not always be possible.

3.2.3. Air Force commanders will direct action (establishment of biological detection network, implementation of medical countermeasures, etc.) based on available information. Leaders will not delay making time sensitive decisions because they have not received data from external organizations (laboratory support for instance).

3.2.4. Personnel involved in the biological detection strategy planning will be knowledgeable of the environmental laboratory's throughput capabilities. **Note**: There is no force health protection benefit to collecting more samples than the environmental laboratory can process in a given time.

3.2.5. Trained personnel will be available when the equipment is on site. The availability of trained personnel will affect response activities in major combat operations and non-major combat operations.

3.2.6. The existence or lack of collective protection will not dramatically affect the casualty-producing impact of a covert biological attack. The presence of collective protection systems, if not already in operation, will not dramatically affect the casualty-producing impact of a covert biological attack.

3.2.7. Established Air Force installations will have locations for placement of detection/collection equipment pre-identified.

3.3. Planning Factors.

3.3.1. Personnel should use the force structure associated with current Defense Planning Guidance force sizing and shaping construct(s) when accomplishing generalized planning activities for events in the mid to far term. Personnel should use the force structure associated with existing Operation Plans when accomplishing planning activities at specific sites for impending activities.

3.3.2. The number of dry filter units required at each site will depend in part on the Commander's intent. The answer will differ if the intention is to maximize the probability of

detecting the passage of a biological hazard cloud across any portion of the installation versus only protecting areas where the majority of the population exists.

3.3.3. The Air Force will use Polymerase Chain Reaction technology, when available, to screen air filters and/or other media for pathogens. Personnel will use HHA or similar technologies as the primary method for identifying toxins.

3.3.4. While some risk remains because of the differences between chemical and biological agents, mask fit testing for personnel will continue using the criteria established for chemical warfare agent. To date, neither Department of Defense nor the Air Force has established an appropriate fit factor for biological warfare Agents.

3.3.4.1. In Accordance With Air Force Manual 10-2503, *Operations in a Chemical, Biological, Radiological, Nuclear, and High Explosive Environment*, commanders have the authority to make or modify protective posture declarations based on the hazard(s) involved. For example, leaders may declare the "mask only" option if an active, on-going biological threat exists but the threat of a Chemical Warfare attack is minimal to non-existent.

3.4. Anticipated Operating Environments.

3.4.1. The specific components and actions used during biological defense operations will depend on the situation at the installation and the biological warfare-related threat environment at the time of execution. In terms of existing infrastructure, Air Force personnel may be located at installations within the United States, at fully-established main operating bases, at forward operating sites that have had at least a limited Department of Defense presence in the past, or at cooperative security locations that have not had a Department of Defense presence in the past and have very limited facilities, power, etc. Table 3.1 and the following paragraphs describe the primary operating environments as well as the corresponding biological detection components anticipated for use within each scenario.

Table 3.1. Primary Operating Environments.

Components of Biological Defense Operations	**Major Combat Operations**			**Non-Major Combat Operations Deployed Contingency Ops**		**Peacetime Operations**	
	Full CBRN Threat	Low Biological Warfare Threat	Biological Warfare w/o Chemical Warfare Threat	Biological Warfare Threat exists	Low Biological Warfare Threat	Credible Biological Warfare Threat	No Credible Biological Warfare Threat
Intelligence	X	X	X	X	X	X	X
Collection	X		X	X		X	
Identification	X		X	X		X	
Medical Surveillance	X	X	X	X	X	X	X

3.4.2. Major Combat Operations. Installations and higher headquarters are likely to use biological defense operations within the context of major combat operations activities in three separate threat environments (or some combination of threat environments in the case of Major

Command, Air Component or Head Quarters Air Force organizations). Those threat environments are:

3.4.2.1. Combined chemical, biological, radiological, and nuclear threat exists. This anticipated operating environment will be one in which attacks involving chemical, biological, radiological, and nuclear materials might occur at any time for an indefinite period of time, although the Air Force will use a 10- to 30-day time period as the initial planning factor for this phase of the conflict. The adversary Biological Warfare attack profile might be disguised or hidden through utilization of covert dissemination techniques and/or inclusion of Biological Warfare materials in attack sequences that also involve high explosive, chemical, or radiological components. Installations operating within this environment are likely to use all components and subsets of Air Force biological detection capabilities.

3.4.2.2. Low Biological Warfare Agent threat exists. This anticipated operating environment represents a situation in which either the adversaries involved do not possess an offensive biological warfare capability, or the location is outside the range of the enemy's biological warfare agent delivery capacities (missiles, special operations force incursions, etc.). In this instance the Collection and Identification components of the biological defense operations would not be implemented. However, installations should monitor intelligence and medical surveillance sources (as available) to gauge whether there is any change in the biological warfare threat to the installation. The installations will use the reporting segments of the "intelligence" component to maintain situational awareness.

3.4.2.3. Biological Warfare Agent threat exists, without a corresponding Chemical Warfare threat. Of the projected major combat operations-related environments, this is the least likely to occur. This operating environment likely represents a situation in which the installation is outside the range of the enemy's overt biological warfare delivery capacities (e.g., missiles or aircraft) but a credible covert biological warfare threat exists through the potential use of special operations force or sympathizers. Installations operating within this environment are likely to use all components and subsets of Air Force biological detection capabilities. Should this unlikely situation manifest itself, at the time of execution, the Air Force may tailor the content of the CBRN defense equipment unit-type codes so that only biological warfare detection assets are deployed. The Air Force will use a 10- to 30-day time period as the initial planning factor for required availability of biological warfare detection resources.

3.4.3. Non-Major Combat Operations Deployed Contingency Operations. Examples include personnel involved in the provision of specialized intelligence, surveillance, and reconnaissance assets; treaty enforcement (peacekeeping); post-conflict recovery activities; enforcement of no-fly zones; extended humanitarian assistance; etc. This environment could be either permissive or non-permissive, but if a biological warfare threat exists the adversarial hazard profile contains special operations force or sympathizer attacks as opposed to the more robust attack profiles associated with major Combat Operations activities. The major combat operations-related guidelines apply to Non-major combat operations Deployed Contingency Operations as far as the use of biological defense operations components are concerned.

3.4.4. Peacetime Operations. The Homeland defense/security operating environment involves day-to-day peacetime activities at home station. Within the context of Air Force biological

detection activities, this also includes Air Force installations that are located outside the U.S. The Air Force believes the operating environment will have a variable threat scale, ranging from installations not being subjected to credible biological warfare threats the vast majority of time, to specific installations and/or special events occasionally having a potential biological warfare threat. Consequently, the Air Force anticipates almost all installations will normally only use the medical surveillance component for biological warfare detection, supplemented by the intelligence component for situational awareness. In the event that a credible biological threat exists, the affected installation(s) will use all available biological detection capabilities. Depending on the situation, the installation may facilitate the completion of identification-related activities through the use of external support (for instance, a sister service laboratory that has agreed to accept environmental samples for analysis). As a general planning factor, the Air Force does not anticipate installations employing dry filter units, or other surveillance equipment during Homeland defense/security operations unless a special event such as an air show or base open house is taking place at the same time that a credible biological warfare threat exists. Installations should establish local procedures to leverage civilian agency programs, e.g. BioWatch.

Chapter 4

FIELDED EQUIPMENT OPTIONS

4.1. Air Samplers.

4.1.1. The purpose of the air sampler within this Air Force Tactics, Techniques, and Procedures document is to collect airborne particles from the ambient air onto a filter. Subsequently, that filter will be taken to an environmental laboratory and analyzed for the presence of biological hazards. In order to provide the greatest probability of identifying that a biological incident has taken place it is important that the air collection be continuous. Continuous air sampling guards against missing collection of a biological agent cloud as it passes by the air sampler and also allows for the air sampler to obtain the highest possible concentration of biological agent material at its given location.

4.1.2. Highlighted in this procedure is the dry filter unit. This is due to the widespread availability of this type of system in the Air Force and its relative ease of use and low cost to operate and maintain. There are other air sampling systems available which are less widespread. There is a recognition that future programs could potentially deliver new air sampling systems that will improve upon the probability of detection that the dry filter unit provides while maintaining a low cost burden for procurement and operation/maintenance.

4.1.2.1. Dry Filter Unit Overview. The purpose of the dry filter unit is to collect airborne particles from ambient air and thereby enable identification and subsequent notification of a biological attack in time for Air Force commanders to successfully implement effective medical treatment protocols for the military population. This "detect-to-treat" capability will enhance force health protection and mission continuation at Air Force installations. Table 4.1 provides an overview of the potential usefulness of dry filter units across a range of Biological Warfare attack scenarios.

Table 4.1. Usefulness of Dry Filter Units for Biological Detection across Different Scenarios.

Scenario	Dry Filter Unit Useful
Threat of airborne release	YES
Food and/or water contamination	NO
Fomite delivery	NO
Vector delivery	NO
Sentinel Casualty	NO
Intelligence threat with unspecified delivery method	POTENTIALLY

4.1.2.2. Additional information on dry filter units can be found in Technical Order 11H1-11-2, *Operator's and Unit Maintenance Manual*.

4.1.2.3. Capabilities.

4.1.2.3.1. The dry filter unit is capable of sampling for long periods of time (virtually non-stop except for filter collection and minor maintenance checks) at high rates of airflow (up to 1000 liters per minute depending on the number of filters installed). The

dry filter unit uses a standard 47 millimeter (1.85 inch) diameter polyester felt filter with a 1.0 micron pore size.

4.1.2.3.2. The collection efficiency depends primarily on the size of the particle. During operation, each filter is able to trap at least 97% of passing particles whose size is one micron or greater.

4.1.2.3.3. There are two versions of the dry filter unit: the Dry Filter Unit 1000 and the Dry Filter Unit 2000. Unlike the Dry Filter Unit 1000, the Dry Filter Unit 2000 includes a weather tight casing allowing use both inside and outside, and a pre-separator that filters out debris from the outdoors while collecting air at a height above ground level. The Pre-Separator excludes everything larger than 150-200 microns without reducing airflow.

4.1.2.3.4. One of the changes integral to the biological warfare defense operations is the use of Dry Filter Unit 2000's as opposed to Dry Filter Unit 1000's. The advantage of the Dry Filter Unit 2000 is the ruggedized container that protects it from the elements. The Dry Filter Unit 2000 is more suitable for the environments needed by the Air Force. Dry Filter Unit 1000's are a reasonable option when collecting samples inside a facility.

4.1.2.4. Limitations.

4.1.2.4.1. The dry filter unit is not a stand-alone system. It does not provide any indication of when a biological attack occurred. Consequently, the installation does not receive a warning of any kind from the dry filter unit. Even when used in conjunction with a biological agent identification system, the best data that senior leadership can receive is a window, typically 12-24 hours in duration, of when the incident occurred as opposed to a specific time of attack.

4.1.2.4.2. Tasks associated with filter removal and replacement or preventative maintenance checks cannot be done remotely. As a result, the use of the dry filter unit system is a manpower-intensive endeavor. Personnel must physically travel to each collector location to remove/replace filters, ensure the device is operating, etc.

4.1.2.4.3. The dry filter unit requires an electrical connection as opposed to having an internal battery capability. Critical support items (extension cords, availability of electrical outlets, generators, etc.) are required to power the system. This means that dry filter units may not always be placed in the optimum collection locations, and that power outages will likely have a devastating impact on the network unless generators are acquired, employed, fueled, and maintained in conjunction with each dry filter unit.

4.1.2.4.4. Do not extend dry filter unit sample collection times beyond 12 hours due to sample quality concerns such as excessive dirt or debris build up on the filters. Additionally, sample collection time extension would decrease the time available to effectively implement medical countermeasures following a positive identification.

4.1.2.5. Training. From an Air Force-wide perspective, the Air Force Qualification Training Emergency Management (3E9X1) Module 16.2.2.2, Dry Filter Unit 1000, provides instruction on dry filter units. This Air Force Qualification Training package uses

Technical Order 11H1-11-2 as its primary reference as this document covers inspecting, maintaining, and operating the dry filter unit.

4.2. Polymerase Chain Reaction.

4.2.1. Polymerase Chain Reaction analysis of biological pathogens is the most accurate biological warfare agent identification method currently available within the Air Force. While the time to results for Polymerase Chain Reaction technology is longer than that provided through use of a Hand Held Assay, the accuracy of Polymerase Chain Reaction results far exceeds those provided from a HHA. It is not recommended that HHAs be used for pathogen identification (except in particular circumstances) due to their inherent reliability concerns. Polymerase Chain Reaction systems will continue to be the methodology utilized for identification. Future programs will deliver technologies that provide similar or improved identification capabilities while maintaining similar cost burden for procurement, operation, and sustainment.

4.2.1.1. System Capabilities.

4.2.1.1.1. The current platform is capable of analyzing samples within 70 minutes, including preparation time, once delivered to the lab.

4.2.1.1.2. Identification time from sample receipt to results ranges may vary based upon the matrix (form) the sample was received in (air filters are simpler to process than tuna salad, for example). Time may also vary due to the proficiency of the technician, the quantity of samples needing to be processed, and the number of pathogens for which one is testing.

4.2.1.1.3. Appropriate test reagents and detection kits will be obtained through the Defense Biological Program Assurance Office (formally the Critical Reagents Program) on-line via the Ordering System for Critical Reagents Program Assays and Kits. Current test kits available are found in Attachment 12. The unit is used in combination with test reagents and detection kits obtained through the Defense Biological Program Assurance Office (formerly the Critical Reagents Program) on-line via the Ordering System for Critical Reagents Program Assay and Reagents. The available test kits are shown in Table 4.2.

4.2.1.2. Limitations.

4.2.1.2.1. Polymerase Chain Reaction assays do not test for toxins and are limited to testing only those pathogens for which assays have been developed.

4.2.1.2.2. Polymerase Chain Reaction instruments require laboratory personnel with experience in Microbiology practices and formal training on Polymerase Chain Reaction technology to run and interpret the results of its analyses.

4.2.1.3. Training.

4.2.1.3.1. Information on Polymerase Chain Reaction System training requirements can be found on the MC-CBRN/HSMR Program Resources site at: **https://cs2.eis.af.mil/sites/11747/default.aspx**.

4.3. Antigen Antibody Immunoassays. The primary purpose of the HHAs (individual HHA panels or Department of Defense Biological Sampling Kits) is to identify the presence of selected

biological warfare agent toxins. In some specific scenarios, they can also be used for pathogen identification. There are HHAs for specific pathogens available but the Air Force does not take decisive action based upon HHA pathogen results, unless there is no other identification capability available in the area. If no other identification capability is available, two HHAs from different lots should be run before taking action. Using two separate lots is the preferred method. Efforts should be made to obtain two separate lots, e.g., purchasing of separate lots or sharing between Emergency Management and Bioenvironmental Flights or geographically co-located installations. In the event two separate lots are unable to be obtained, the same lot HHAs may be used.

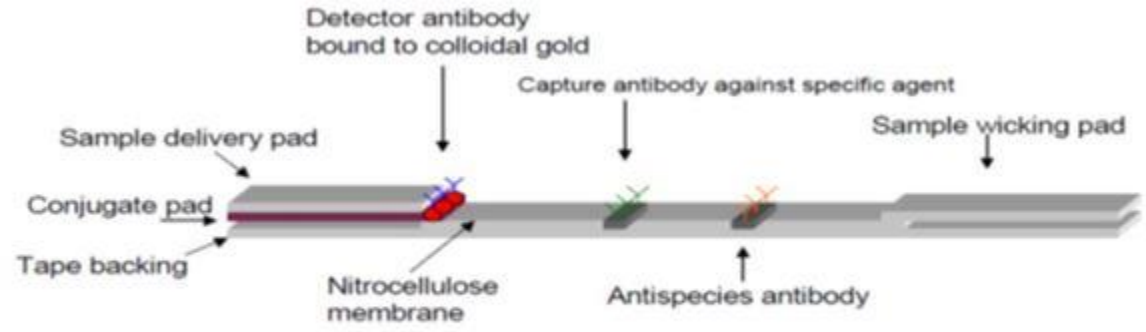
4.3.1. Description: The Department of Defense Biological Sampling Kit (Figure 4.1) and its associated HHAs (Figure 4.2) are composed of individual test strips that provide agent specific results when a small amount of sample is dropped in the sampling well. The effectiveness of HHA analysis of biological toxins far exceeds its accuracy and sensitivity for identifying pathogens and is currently the only technology widely available for use in the Air Force for the identification of toxins. In some scenarios, where Polymerase Chain Reaction technology is not available, HHAs can be used for pathogen identification; however, any positive findings from HHAs for pathogens should be presented with the caveats associated with the accuracy of the HHA pathogen identification to commanders to inform their decisions to implement medical countermeasures. HHA panels have been constructed in regionalized and toxin only configurations to reduce cost and conserve sample volume (by eliminating superfluous test strips from the package).

Figure 4.1. Department of Defense Biological Sampling Kit.

4.3.2. Capabilities.

4.3.2.1. Each individual HHA ticket is designed to identify one specific agent. For example, if a ticket designed for Botulinum Toxin (Bot Tox) was exposed to Staphylococcal Enterotoxin B, the test result would come back as negative (see Table 4.3 for a listing of available tickets). It is possible to specify the agents and number of panels desired within each Department of Defense Biological Sampling Kit. Consequently, Air Component Command and Major Commands must ensure their subordinate installation Department of Defense Biological Sampling Kits contain tickets for their projected biological warfare threat. **Note**: It is possible to obtain coded or un-coded HHA tickets from Ordering System for Critical Reagents Program Assay and Reagents. See Appendix 13 for Available HHA Tickets**.**

Figure 4.2. HHA Components.



The HHA ticket after removal from the plastic cassette.

-Sample Delivery Pad: Filters out large particulate matter, holds sample during wicking process.
-Conjugated Release Pad: Contains detector antibody, allows for visualization of the antibody.
-Nitrocellulose Membrane: Bound to this are the capture antibodies and anti-species antibodies.
-Capture Antibodies: Makes up test line for ticket. When antigen flows past it captures the antigen.
-Antispecies Antibody: Serves as the control.
-Sample Wicking Pad: Reservoir hold sample after it has been wicked across the Nitrocellulose Membrane

4.3.2.2. To increase the confidence in the HHA result it is recommended that the testing be performed in a controlled environment by properly trained technical personnel.

4.3.2.3. HHAs are reliable for toxin testing, inexpensive, rapid (~20 minutes, including sample prep), and easy to use. The technology requires no electrical power, and requires minimal to no sample preparation to test a sample. Figure 4.3 shows the possible test results.

Figure 4.3. HHA Test Results.

Read the results. The results of the assay are presented as visual pink lines on the HHA strip.

A. The presence of both the control line and the sample line indicates a positive result.

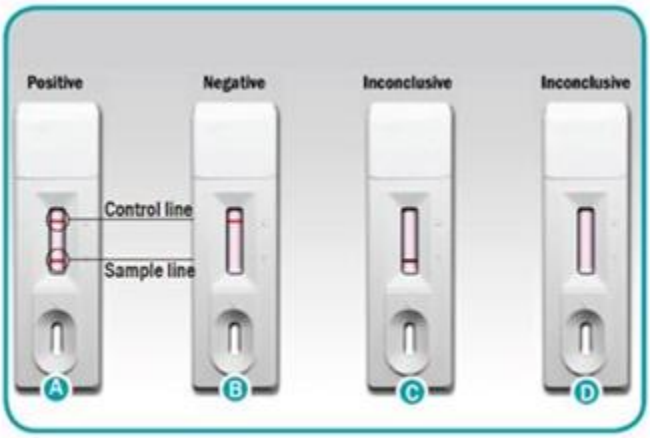
B. The presence of the control line without the presence of the sample line indicates a negative result.

C. The presence of the sample line without the presence of the control line indicates an inconclusive result.

D. The absence of both the control line and the sample line indicates an inconclusive result.

NOTE: The lines should be a pink color, if the line is gray the assay is inconclusive.

NOTE: It is generally recommended that all analysis be repeated to confirm results – follow your specific standard operating procedure for repeat testing.



4.3.2.4. Obtaining and interpreting test results: Step by step procedures can be found in Technical Order 11H1-11-2.

4.3.2.4.1. Observe the results after 15 minutes by interpreting the presence or absence of test (T) and control (C) lines.

4.3.2.4.2. All results (positive, negative and inconclusive) must be documented.

4.3.2.4.3. Used, unused, and expired assays must be treated as unclassified For Official Use Only materials, treated with a decontaminate solution, and destroyed by incineration. Disposal records must record at a minimum: description of products, quantity destroyed, date of destruction, and method of destruction.

4.3.2.4.4. Except under extreme circumstances, HHAs will not be used unilaterally to determine whether a pathogen is present.

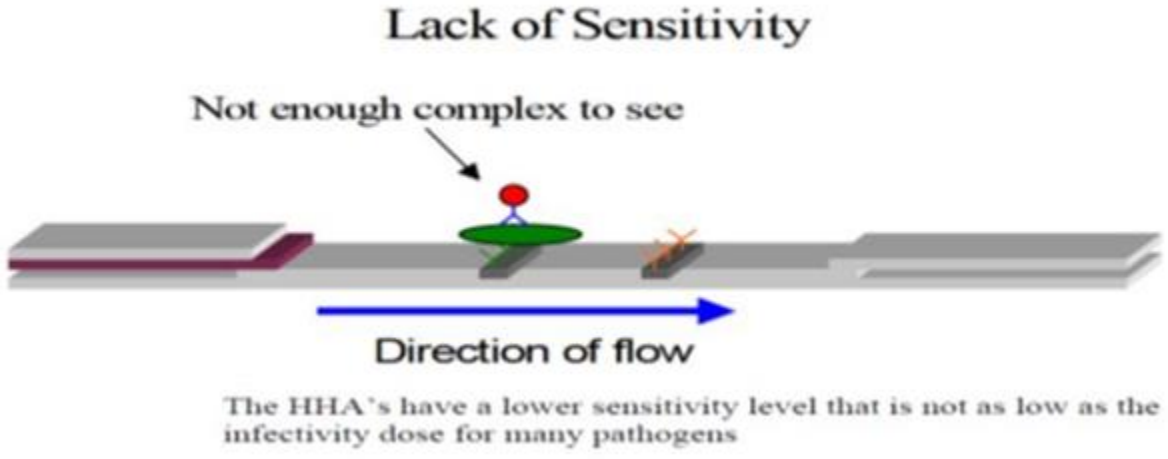
4.3.2.4.5. Follow-up with Polymerase Chain Reaction technology is desired, regardless of the HHA result.

4.3.3. HHA Limitations.

4.3.3.1. The HHA is quite accurate and sensitive in assaying environmental samples for toxins. HHAs are not nearly as sensitive in regards to pathogen identification. Further, there are some limitations with the HHA technique that could affect the accuracy of an analysis.

4.3.3.1.1. Sensitivity cutoff (see Figure 4.4). This means that for each different agent assay, there is a threshold concentration below which the assay will not detect the presence of the antigen. This can result in a false negative test result. A negative result on an assay does not mean there is no biological agent present, it could potentially mean there is not enough agent there to cause the assay to react. When providing recommendations based on assays for pathogens it should be prefaced with "based on the technology available" the results are positive, negative, or inconclusive.

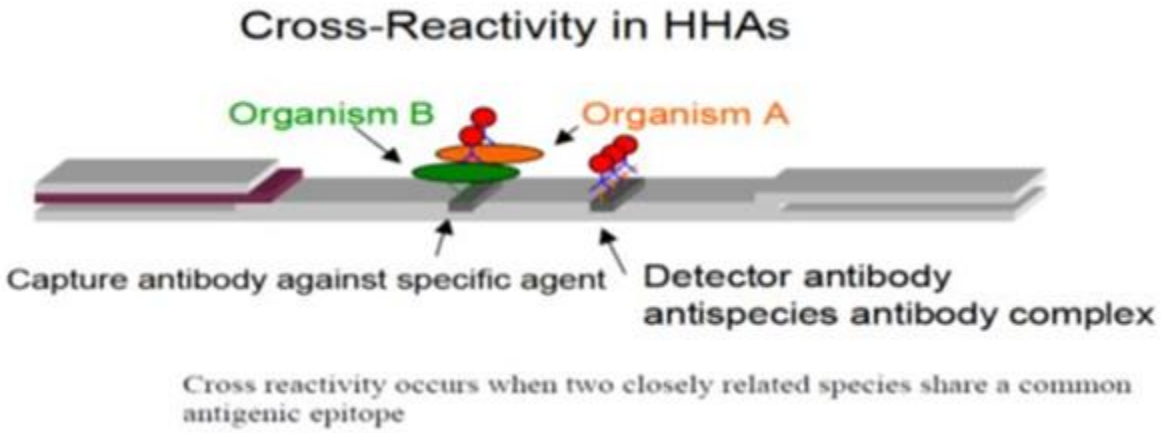
Figure 4.4. Lack of Sensitivity.



-HHAs have a sensitivity cutoff, which differs for each agent
--There is a threshold concentration that below this the assay will not be able to detect the presence of antigen
-If a sample is tested and results appear to be negative (false negative), there could potentially still be enough biological agent in the sample to cause illness

4.3.3.1.2. Cross-reactivity (See Figure 4.5). This occurs when an antibody binds to the species but also binds specifically to close relatives of that species. This can result in a false positive test result.

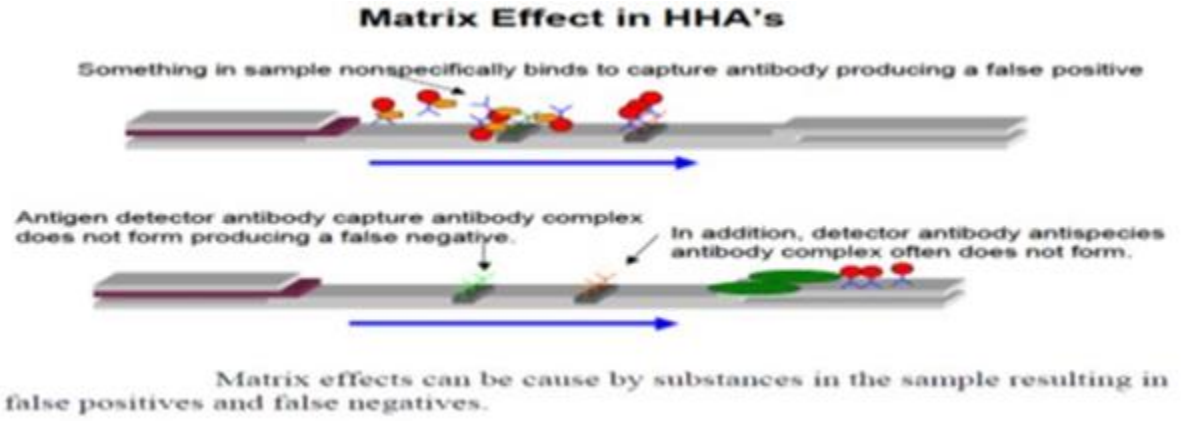
Figure 4.5. Cross Reactivity.



-Cross Reactivity occurs when antibodies bind to the species it was designed for but also binds specifically to close relatives of the species
--Occurs when two closely related species share a common antigen allowing the antibodies in the HHA to bind to both species
--Occurs with Bacillus Anthracis HHA in which the antibodies bind not only to Bacillus Anthracis but also to other Bacillus
--Bacillus Thuringinsis for example (common in soil)

4.3.3.1.3. Matrix effect (see Figure 4.6). Matrix effect is often encountered when assaying environmental samples and can be recognized by the control line not forming on the ticket during the test procedure. False negatives can occur when there is biological agent in the sample, but something else is in the sample or some property in the sample prevents the antibodies from binding to the antigen. False positives can occur if there is no bio agent in the sample, but something else in the sample or property of the sample causes capture antibodies to bind together nonspecifically.

Figure 4.6. Matrix Effect.

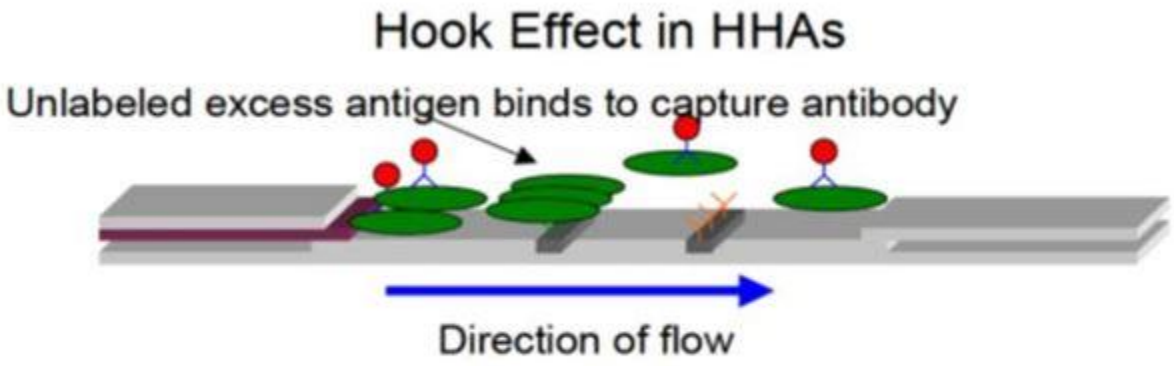


-Matrix Effect often encountered when assaying environmental samples and can be recognized by the control line not forming
--False negatives can occur when there is bio agent in the sample, but something else is in the sample or some property in the sample prevents the antibodies from binding to the antigen
--False positives can occur if there is no biological agent in the sample, but something else in the sample or property of the sample causes capture antibodies to bind together non specifically
-If matrix effect is suspected, it is recommended a 1:10 and 1:100 dilution of the sample in HHA buffer be run on a second HHA
--This remedy also applies if the sample pH is above neutral (pH 7.0)

4.3.3.1.4. Hook effect (see Figure 4.7). This occurs when the sample has a very high antigen concentration, resulting in a false-negative result.

4.3.3.1.5. Screening a second time with new HHAs following diluting sample 1:10 and 1:100 in Phosphate Buffered Saline is recommended to assist in resolution and increase the confidence in reducing both matrix and hook effect conditions as well as resolution for tests when no lines show up and Polymerase Chain Reaction is not available.

Figure 4.7. Hook Effect.



The hook effect will occur when too much antigen is added to the HHA resulting in a false negative.

-The Hook Effect occurs when too much antigen is added to the HHA which results in a false negative
--The amount of antigen exceeds the amount of antibodies
--The excess unbound antigen migrates across the Nitrocelluose membrane more quickly than the heavier labeled antigen where it saturates all the binding sites on the capture antibodies
--When the labeled antigen arrives there are no binding sites left on the capture line

4.3.4. Training.

4.3.4.1. Personnel using HHA's should receive training prior to collecting a sample for testing.

4.4. Resource Contamination.

4.4.1. Current Air Force biological detection capability is extremely limited in determining if individual are contaminated.

4.4.2. The probability a specific resource was contaminated by the initial hazard cloud largely depends on the item's distance from the agent release point, the size of the object, the type and geometry of surface involved, and whether or not the biological warfare particles can easily gain access to the interior of the item. Residual contamination that does exist is more likely to transfer to people through the hand-to-mouth entryway as opposed to being an inhalational hazard. See Attachments 7 and 8 for supplemental information regarding agent decay rates and resuspension hazard.

Chapter 5

ESTABLISHING AN AIR SCREENING BIOLOGICAL DETECTION NETWORK

5.1. General. The term detection network in this context is a bit of a misnomer. The "network" is not physically or electronically connected together nor to a Command and Control function. Additionally, the equipment in the field does not detect agents or provide immediate indication that a biological attack occurred. Consequently, the installation does not receive a warning of any kind from the dry filter unit. When used in conjunction with a biological agent identification system to screen air, it is possible to provide senior leadership with a window, typically 12-24 hour time period, of when the incident occurred. The installation is therefore able to establish an estimated timeline for required medical interventions and other response actions prior to the onset of symptoms in some cases.

5.2. Planning. The specific implementation of air collection and screening varies depending on a number of considerations to include commander's intent, total area(s) considered for screening, number of collectors available, as well as manpower and environmental laboratory throughput capabilities.

5.2.1. Commander's Intent. The Commander's intent is required to assign area designations and priorities for dry filter unit placement. Use of decision points in the biological surveillance mission in addition to biological threat and vulnerability information is recommended to ensure collector placement, screening sample collection intervals, and testing priorities remain consistent and properly support the mission. Decision points might include the initiation of post exposure prophylaxis treatment, increased surveillance of patients by medical personnel during routine medical encounters, initiation of public health warnings, etc. The Commander's priority of effort allows planners to prioritize collection locations in the event of planned and unplanned collection grid reductions and expansions.

5.2.2. Total Area(s) Considered for Screening. There is flexibility when using dry filter units for air sample collection. The collection grid(s) are easily tailored to meet mission requirements in scale from large areas, such as an entire military installation down to a subset of the installation, as well as within individual buildings.

5.2.2.1. The dice five (where 5 detectors are emplaced in a pattern like that of a number 5 side of a dice), small area critical asset, perimeter, and/or a combination/hybrid of the three are the only employment patterns recommended for the collection grid. See Figures 5.1-5.3 for notional examples of detector grid layouts.

Figure 5.1. Notional example of Dice-5 layout.

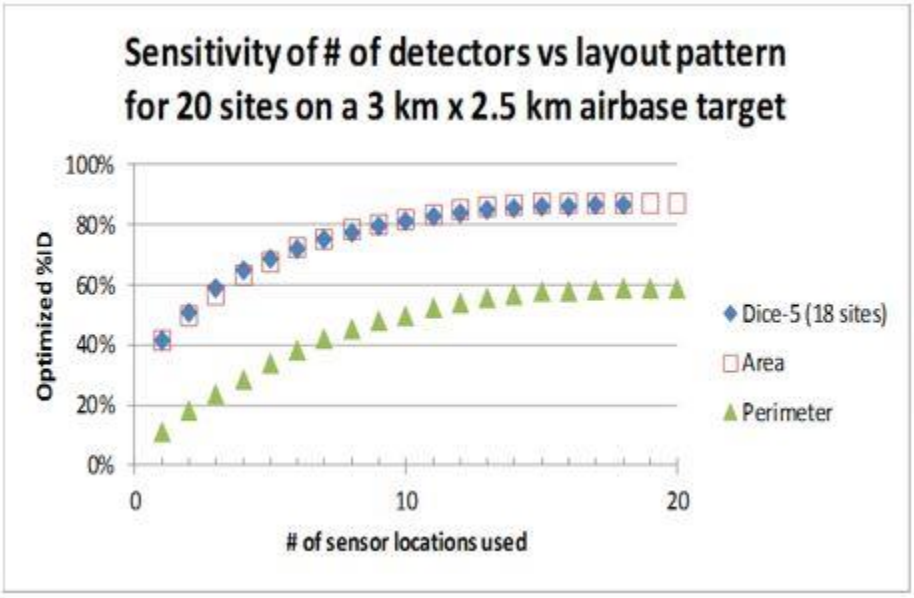
Figure 5.2. Notional example of Small Area Critical Asset layout.

Figure 5.3. Notional example of Perimeter layout.

5.2.3. Number of collectors available. In order to provide the best feasible probability of detection and reasonably sustain operations for ≥ 10 consecutive days, the objective is for each installation in a major combat operations environment to implement a strategy for 12-15 dry filter units, with four (4) additional units available as spares. For most limited peacetime screening purposes, four (4) dry filter units meet the air screening collection needs. A fifth dry filter unit should be available as a spare or can be used to create a true dice five pattern.

5.2.3.1. There is a point of diminishing returns when it comes to the number of dry filter units an installation uses. Air Force modeling analysis using a wide variety of agents, weather conditions, agent release points, etc., has shown that generally between 12 and 15 dry filter units will provide the best balance between resource allocation and probability of detection. It also shows that the dice-5 pattern clearly out performs the "perimeter" pattern (where dry filter units are only placed around the installation perimeter). See Figure 3.4 below.

Figure 5.4. Sensitivity of # of Detectors vs. Layout Pattern 1.



5.2.4. Manpower and Laboratory Throughput Capabilities. Availability of adequate manpower and equipment resources will directly determine the effectiveness of this biological monitoring operation. Additionally, there is an indirect correlation between the number of dry filter units actively collecting air and the number of sample filters the laboratory is capable of processing in a timely manner. **Note**: It is recommended to collect filters and perform analysis for toxins (using HHAs) every 12 hours and perform pathogen analysis (on two sets of filters) every 24 hours. This will reduce the need for multiple shifts within the environmental laboratory.

5.2.4.1. Under normal circumstances, the installation's chemical, biological, radiological, and nuclear reconnaissance teams will be chemical, biological, radiological, and nuclear Subject Matter Experts that collect the dry filter unit samples and deliver them to the designated point/environmental laboratory. However, installations retain flexibility in regards to managing the chemical, biological, radiological, and nuclear reconnaissance

personnel. An option to consider would be that units could choose to have one team collect and deliver all samples.

5.2.4.2. In major combat operations environments, it is highly unlikely all equipment and personnel required for the establishment and sustainment of installation biological detection and identification capabilities will arrive at the employment location on the same day. Consequently, the first-arriving personnel will likely have to establish a time phased implementation of the dry filter unit collection grid and laboratory support capacity.

5.2.4.2.1. Equipment might arrive in an inoperable condition or be damaged during attacks or accidents. The operational environment might exhaust consumable supplies earlier than anticipated. Personnel must be prepared to resupply rapidly and/or adjust the air screening protocol(s) to match resource availability.

5.2.4.2.2. It is possible the collection capability is in place prior to the screening/identification capability or vice versa. This limiting factor makes it extremely important that more than one functional community be capable of accomplishing tasks.

5.2.4.3. Utilizing too many dry filter units will result in untested filters within the desired time frame, and places unnecessary demands on manpower and equipment. Conversely, not using enough dry filter units greatly increases the probability of an undetected biological event and the eventual presentation of sentinel casualties.

5.2.4.3.1. The chemical, biological, radiological, and nuclear control center coordinates with the environmental laboratory to identify what the maximum daily filter throughput capacity is for conducting Polymerase Chain Reaction testing. This number, in combination with the desired sample collection frequency, is used to identify the maximum number of operating dry filter units. There is no single throughput template that is applicable to every laboratory and circumstance.

5.2.4.3.2. Knowledge of the laboratory sample throughput capacity is crucial when developing the biological detection strategy i.e., the number of collectors and frequency of sample collection.

5.2.4.3.2.1. It is important to know what resources are available to put against the threat. For example, the current technologies used in the environmental laboratory have an expected throughput based on manpower availability, sample prep time, equipment run time, supplies, etc. Manpower limitations are likely to affect biological detection activities, especially in the early stages of major combat operations conflicts.

5.2.4.3.2.2. A different Polymerase Chain Reaction equipment item will not have the exact same throughput. Reduction in throughput capability could affect the number of ambient air collectors (e.g. dry filter units) able to effectively be employed and/or possibly the frequency of sample pull times.

5.2.4.3.3. When in-house laboratory support is not available, planners must coordinate with the Laboratory Service Chief and the Military Treatment Facility Emergency Manager to determine the off-site laboratory’s availability and testing turnaround time.

5.2.5. Additional Planning Considerations. The time available for dry filter unit siting activities will vary; in some instances the Air Force has an abundance of information regarding the employment location while only limited knowledge exists in other circumstances. In some scenarios there will be adequate time for advance planning while other scenarios will dictate that just-in-time or hasty siting techniques be used.

5.2.5.1. Background Conditions and Interferences. When time and resources permit, consider running the dry filter units at intended siting locations, prior to mission requirement in order to exercise filter collection and laboratory support coordination activities as well as determine if there are residual background hazards or other possible ambient interferences. This step facilitates location characterization and is particularly important in areas where biological agents targeted by detection systems are endemic in the environment.

5.2.5.2. Coordination. A cooperative effort amongst multiple base functional areas is required as the dry filter unit siting process should not take place in a vacuum.

5.2.5.2.1. Early coordination between base functional areas to identify unique location requirements and expectations enhances the likelihood of a successful air monitoring mission occurring during critical times and in the most opportune places. **Note**: If possible, ensure dry filter unit sites and awareness of associated collection activities are integrated into the installation Common Operating Picture.

5.2.5.2.2. Investing time to develop, coordinate, and plan dry filter unit siting positions in advance of operational requirements is the best way to reduce the risk of poor dry filter unit placement and boost the confidence level of collection activities in support of biological surveillance.

5.2.5.2.3. Time permitting, the siting process is improved by consulting with experienced personnel from Civil Engineers, Bioenvironmental Engineering, Antiterrorism/Force Protection, Security, etc. to gain critical insights and facilitate collection optimization. When possible the Threat Working Group should be advised of the dry filter unit siting plan and inputs solicited to ensure the best use of limited resources. This can be invaluable during conversations regarding site security, use of available power, generator refueling plans, etc.

5.3. Siting Dry Filter Units. Collector siting optimization is influenced more by site selection than actual weather. The object is to ensure the dry filter unit is exposed to the best air flow; the temperature, wind speed, and air stability are not relevant factors. It is possible that recommended dry filter unit siting guidance appears counterintuitive at first to planners accustomed to only detector siting. Use of installation mapping products is only recommended for determining preliminary or possible dry filter unit sites. Follow-up reconnaissance or an eyes-on visit to prospective sites is critical to check “the lay of the land” and make a final determination in regards to overall appropriateness of the site.

5.3.1. The following basic descriptions of dry filter unit siting requirements are used for planning purposes across the full range of military operations. The guidance here will maximize the potential for Biological Warfare Agent material collection and screening. If the siting recommendations that follow differ from guidelines found in Air Force Tactics, Techniques, and Procedures 3-2.44, Multiservice Tactics, Techniques, and Procedures for

Nuclear, Biological, Chemical Reconnaissance, or other references, the guidance in this document applies.

5.3.1.1. Historical weather records from locations of interest around the world show that most sites have variable wind directions occurring frequently throughout each 24-hour period. The most effective siting technique emphasizes exposing dry filter units to the maximum, unimpeded air flow rather than predicted dominant wind direction(s).

5.3.1.2. Dry filter units should be located on open level terrain with no significant nearby obstructions that deflect the wind flow. Attachment 3 of this document provides specific guidance for spacing distances required for various obstacles.

5.3.1.3. Observe conditions around the collection site; note any activities that might impact filter particle loading. Change collection site if necessary based on ground truth.

5.3.1.4. Collection teams should have unimpeded and safe access to the dry filter units in order to collect filters and conduct routine maintenance on the dry filter units and associated generators. Dry filter unit operations involve transporting supplies and equipment to and from the collection sites routinely. When possible, place units near access points as opposed to off-road in hard-to-reach areas. The development of a response kit containing all required equipment and supplies is highly recommended.

5.3.1.5. Aircraft Hangers and Flight line: Siting collectors in and around aircraft hangers and flight lines require special precautions. See Attachment 3.

5.3.1.6. Environments change over time, e.g. new building construction or the growth of trees or high shrubs. Periodically (at least once every two years) re-evaluate previously selected air collector locations to determine if they meet the desired sample collection purpose and objectives. This includes collectors that are permanently installed on pads with electricity. **Note**: Additional discussion of factors to be considered for dry filter unit siting can be found in Attachment 12.

5.3.1.7. Consideration of the local and/or host nation capabilities should be included in site selection if there is a possibility of sharing responsibility, information or results. The degree of reliable support will be determined by Commander's intent, Status of Forces Agreement, Department of State recommendation, Mutual Aid Understandings/Agreements, etc.

5.3.2. Indoor Siting of Dry Filter Units

5.3.2.1. Dry filter units can be used to perform air screening inside facilities. The Dry Filter Unit 1000 is designed to operate inside a facility.

5.3.2.2. Usually dry filter units placed inside facilities are planned to be used only for a short period of time and for only a small number of facilities.

5.3.2.3. Although the dry filter unit is able to collect samples inside facilities, other equipment assets may be better suited to this task elsewhere on the installation.

5.3.2.4. If the decision is made to position dry filter units inside facilities it is highly recommended Emergency Management work with Bioenvironmental Engineering, Public Health, and other sections of Civil Engineering to ensure collection is optimized.

5.3.2.5. In most cases the best choice is to place samplers in air exchanges as appropriate when the hazard is expected to come into the facility through the air handling systems.

5.3.2.6. When siting dry filter units within facilities, the equipment is located appropriately in and around Heating, Ventilation, and air conditioning ducts, taking full advantage of any mixing chambers

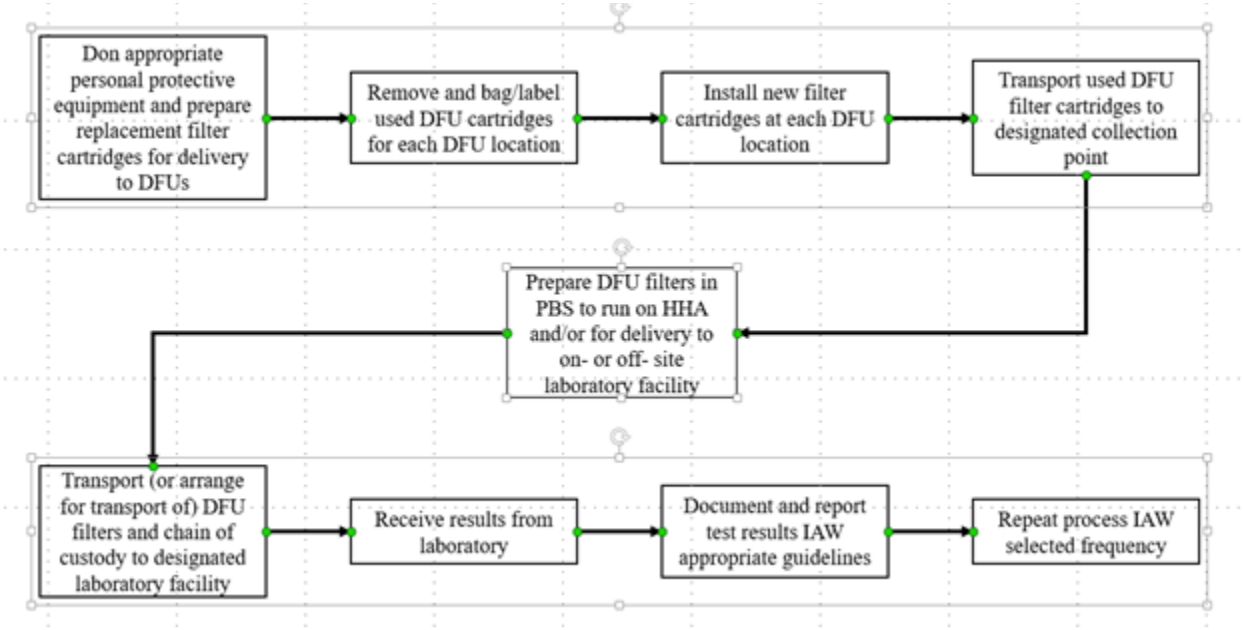
5.3.2.7. Another possible placement location for dry filter units inside facilities is at the entrances and common areas.

Chapter 6

DRY FILTER UNIT FILTER COLLECTION AND TRANSPORT PROCESS

6.1. Air Sample Screening. Collecting dry filter unit filters for screening is critical to the early identification of biological agent(s). Figure 6.1 below depicts the overview of the ideal dry filter unit filter collection process. All biological sampling activities (other than dry filter unit filter collection) will follow guidance on biological sample collection types, media, and safe techniques for collecting environmental samples in liquid, solid form, from Air Force Tactics, Techniques, and Procedures 3-2.44, Appendix H.

Figure 6.1. Overview of Ideal Dry Filter Unit Filter Collection Process.



6.1.1. Records of Air Screening Activities. Each installation will maintain a record of all biological screening activities, to ensure that the records are preserved for historical purposes such as post-conflict lessons learned, analysis associated with syndromic assessments like Gulf War Syndrome, etc. While the Air Force anticipates dry filter unit screening samples will comprise the vast majority of the effort, it is possible different scenarios could warrant sample collection from food, water sources, etc. Installations can combine dry filter unit screening sample documentation with records from other screening activities or maintain separate logs as desired.

6.1.2. Each installation requires a dry filter unit log book when dry filter units are actively collecting screening samples in order to serve as a record of operations for each dry filter unit. Emergency Management in conjunction with Bioenvironmental Engineering will select the method of maintaining records best suited for their circumstances e.g., one electronic logbook maintained in the CBRN Control Center, one logbook per CBRN reconnaissance team, one logbook per dry filter unit, etc.

6.1.2.1. The dry filter unit log book contains the official records associated with the collection and handling of air screening samples. The log book annotations provide

accountability of air filters from the time of placement to laboratory submission and capture descriptions of important observations. The records will inform post-attack actions such as determining what specific areas have been affected by hazards, or serve as a primary data-gathering source for historical inquiries should a biological event occur. Consequently, attention to detail and proper documentation of all filter collection and processing activities are top priorities during Biological Warfare Agent air screening operations.

6.1.2.2. Ensure dry filter unit logbooks contain:

6.1.2.2.1. Dry filter unit identification number(s), site coordinates, and area description e.g., in midst of three one-story facilities, in open field, 50 meters from edge of wooded area, etc.

6.1.2.2.2. Identification of time periods when dry filter unit is actively collecting screening samples and time periods when dry filter unit is not operating because of damage, maintenance issues, etc.

6.1.2.2.3. Listing of screening sample identification numbers (see Table 6.1 for additional detail) used throughout the collection process

6.1.2.2.4. Descriptions of unusual observations or events e.g., damage to dry filter unit, filter cartridge extracted out-of-cycle because of environmental conditions, discoloration existed on the filter cartridge when extracted from the dry filter unit, etc. **Note**: Users will determine the required extent/scope of these descriptions. Remember that seemingly unimportant information can be extremely important when combined with other information if further assessment and test result interpretation is required. For example, the excessive presence of sand in a filter might explain why a specific dry filter unit location came up with a negative test result while surrounding dry filter unit filters produced positive test results.

6.1.2.2.5. Annotations indicating the specific personnel who accomplished each major activity e.g., collection of filters from dry filter unit, replacement of filters in dry filter unit, processing of screening samples prior to delivery of samples to laboratory, etc.

6.1.2.3. During collection activities the logbook(s) should be maintained away from immediate dry filter unit filter collection site activities (e.g. left in vehicle) to minimize the time CBRN reconnaissance personnel spend without overhead cover and to reduce the possibility of damage, loss, and/or inadvertent cross contamination.

6.1.2.4. Use dry filter unit serial number or other assigned identification designator so that individual dry filter units are easily correlated with assigned location on threat detection grid for tracking purposes. Validate actual location of each dry filter unit after initial setup and all subsequent moves with GPS. Record all dry filter unit locations by Universal Transverse Mercator (UTM) or latitude-longitude coordinates in logbook.

6.1.2.5. Screening sample identification numbers provide the accountability trace required to match specific samples with events that might have taken place at specific locations and/or times. This transparency will facilitate the post-event reconstruction of events and provide the foundation for answering follow-on inquiries. Table 6.1 provides the explanatory break out of screening sample identification numbers. **Note**: The screening

sample identification number is not constrained to a precise number of characters. For instance, the number would be longer if the dry filter unit serial number was used instead of a separate dry filter unit identification number.

Table 6.1. Explanation of Example Screening Sample Identification Number.

Example Screening Sample Identification Number: ROK**16011502AOAB0101800**					
ROK	**160115**	**02A/B**	**OAB**	**010**	**1800**
Foreign Country Trigram Code In Accordance With North Atlantic Treaty Organization Standardization Agreement 1059 *Codes for Geographical Entities*	Sample Collection date (given as year, month, and day)	The first filter set collected each day starts with 01, and following sets are numbered in sequence. The selection of "A" or "B" corresponds to the first or second filter from the same dry filter unit	Air Base Abbreviation	Dry Filter Unit Number	(Local)Time sample was collected
Filters were collected in the Republic of Korea (South Korea).	Filters were collected in 2016 on 15 January	The filters are the second set of filters collected on 15 January.	The filters were collected at Osan Air Base	The filters were collected from dry filter unit number 10	The filters were collected at 1800 hours

6.1.2.6. All samples including background samples will have a unique sample identification number assigned.

6.1.2.7. Labels are required for primary containers (inner bag) for each dry filter unit filter cartridge, the secondary container (outer bag) for filter sets. Prepare two sets of tracking labels for collection bags/tubes and one set for replacement filter cartridge bags. This equates to four bags and labels per dry filter unit filter pull/exchange: one for each of the two extracted dry filter unit filters, one outer bag that contains both extracted filter cartridges, and one bag that contains both replacement cartridges. **Note:** Assumes two filter assemblies per sited dry filter unit.

6.1.2.8. Labels for extracted filters will contain the unique identification number (see Table 6.1) and the names of the collection personnel.

6.1.3. Dry Filter Unit Filter Collection Equipment Kits. Installations must ensure personnel collecting and replacing dry filter unit filter cartridges have the Air Force Dry Filter Unit Filter Collection Equipment Kit, National Stock Number 6665-01-532-2403, to serve as the foundation for required equipment items. Additionally, personnel must possess:

- Protective eyewear such as goggles (reference Technical Order 11H1-11-2)
- Respiratory Protection (**Note:** Surgical masks are referenced in Technical Order 11H1-11-2, however, personnel should contact the local Bioenvironmental Engineering office to determine the appropriate level of respiratory protection)
- Filter Collection Logbook, National Stock Number 7530-00-222-3525
- Permanent Marker (color black recommended)
- Plastic Bags, National Stock Number 8105-01-151-1097
- Decon wipes (Moistened 5% chlorine bleach wipes)
- Spray bottle for 5% chlorine bleach solution, 8125-00-488-7952
- Bucket, 7240-01-094-4305
- Sodium Hypochlorite Solution, National Stock Number 6810-00-598-7316
- Ground sheet (chux-type product with absorbent material recommended)
- Receipt of Property/Screening Sample Transfer form(s)
- Conical tubes, National Stock Number 6640-01-530-5868
- Phosphate Buffered Solution (if filter analysis will take place on the installation)
- Parafilm, National Stock Number 7510-00-159-4450
- Commercial Shipping Box, size determined by number of filters, other media, and packing materials required for shipment
- Clear Shipping Tape
- Shipment Labels
- Required documents specified by the gaining laboratory

6.1.4. Use of Protective Equipment while Collecting Dry Filter Unit Filter Cartridges. The amount and type of protective equipment personnel wear while collecting/replacing dry filter unit filter cartridges depends on the threat situation at the time of execution. Bioenvironmental Engineering is the installation point of contact for determining threat appropriate personal protective equipment.

6.1.4.1. Personnel will wear their individual protective equipment with latex/nitrile gloves over their rubber gloves during major combat operations scenarios when Mission-Oriented Protective Posture 4 is in effect. **Note**: The rationale for wearing the latex/nitrile gloves is rooted in the reduction of follow-on cross contamination and false negative results as opposed to the provision of extra protection for the wearer. Individuals may require a larger size of latex/nitrile glove than normally used since they will be worn over the rubber gloves.

6.2. Dry Filter Unit Filter Collection Procedures. The following procedures (Table 6.2) employ the "clean person-dirty person" concept, wherein the "dirty person" is the only person who touches anything possibly containing contamination. The concept calls for the "dirty person" to work in front of the dry filter unit for their tasks, and then step away, allowing the "clean person" to move in front of the dry filter unit for their respective tasks. **Note**: The procedures take into consideration the possibility that either person, "clean person" or "dirty person", might require assistance from their partner. The protective posture of the partner allows assistance to be provided without degradation of the task or risk to the individual or the screening sample. Caution needs to be taken to protect the nucleotides from extreme heat of exposure to UV rays which can lead to false negative results. **Note**: This procedure differs from that stated in Technical Order 11H1-11-2 as HHA testing at each dry filter unit site is not recommended.

6.2.1. The designated team member will record the stop time for the dry filter unit filter collection period and the start time of the new collection period in the logbook at soon as possible after the action has been taken.

Table 6.2. Dry Filter Unit Filter Collection Procedures.

Person		Activity
Dirty		Don protective equipment prior to initiation of tasks.
Dirty		Place ground sheet on surface next to the dry filter unit.
Dirty		Shut down power to the dry filter unit.
	Clean	Don protective equipment.
	Clean	Prepare the contaminated waste disposal receptacle (fold edge of bag over so "clean area" can be accessed at end of process).
Dirty		Gain access to the dry filter unit (open the Dry Filter Unit 2000 enclosure for example) and use the following procedure to remove each filter cartridge, one at a time:
Dirty		Place the open end of bag over the end of first filter cartridge and hold it tight to the filter manifold with both hands.
Dirty		Using both index fingers on outside of bag, place both fingers in the grooves on the filter cartridge and pull the filter cartridge into the bag while still holding the bag tightly up against the filter manifold.
Dirty		Remove the bag from the filter manifold, holding the open end closed.
Dirty		Seal bag and decontaminate the exterior of the container with decontamination wipes (5 percent chlorine solution). Place decontaminated bag containing extracted filter cartridge on ground sheet.
Dirty		Repeat process for second filter cartridge.
Dirty		Remove outer layer of latex/nitrile gloves in a manner that does not contaminate inner glove. Place latex/nitrile gloves in a waste receptacle (red contaminated waste bag obtained from medical forces for instance) and secure. Note: The "dirty person" can now provide assistance if needed to the "clean person", touching items with the inner layer of latex/nitrile gloves.
	Clean	Acquire the correct set of replacement cartridges for the dry filter unit being serviced while the "dirty person" is extracting the used filter cartridges. If the "dirty person" requires assistance, provide the assistance and then remove/dispose of the outer layer of latex/nitrile gloves. **Note**: The "clean person" is the only person that will touch the replacement cartridges.
	Clean	Install the new dry filter unit filter cartridges. Secure bag for reuse as the secondary container (outer bag) for next collection period.
	Clean	Use a permanent marker to complete the primary and secondary container labels.
	Clean	Attach primary container labels to both of the bags containing the extracted filter cartridges, and verify that each bag is properly sealed.
	Clean	Place both labeled/sealed bags into the secondary container and seal the bag.

Person		Activity
	Clean	Decontaminate the exterior of the secondary container with decontamination wipes (5 percent chlorine solution). Place decontaminated bag on the ground sheet.
	Clean	Attach the label to the secondary container, and verify that the bag is properly sealed.
	Clean	Place the secondary container in the front portion of the vehicle for transport.
Dirty		Fold the ground sheet to the inside, pick up, and place in the waste disposal container.
Dirty		Restore power to the dry filter unit.
Dirty		Ensure the dry filter unit is functioning properly (has air flow).
Dirty	Clean	Remove remaining latex/nitrile gloves, place them in the waste receptacle, and secure the receptacle. Place the waste receptacle in the rear portion of the vehicle for transport.
Dirty	Clean	Remove goggles/mask and place in vehicle.
Dirty	Clean	Fill out the Receipt of Property (screening sample transfer) form.
Dirty	Clean	Start process over at next collection site.

6.2.2. Once all filter cartridges have been collected, return to the processing area where filters are removed from their respective cartridges and prepared for lab processing (see Table 6.3 for step-by-step procedure). The processing area can be any location that provides overhead cover, flat surface(s), sufficient lighting and is free of contamination.

6.2.3. The procedure that will produce the highest probability of detection and in which the installation will have the highest level of confidence involves processing all dry filter unit filter cartridges at a single location under (to the extent possible) controlled conditions instead of processing each set at the respective dry filter unit sites. The procedure might not be feasible at all employment locations. **Note:** Filters must be immersed in Phosphate Buffered Solution prior to being taken to the lab. The lab will not accept dry filters.

Table 6.3. Dry Filter Unit Filter Processing.

Task	Comments
Don protective equipment prior to the initiation of tasks	
Place ground sheet on work surface	
Open one sample bag containing dry filter unit filter cartridges	
Extract filter from cartridge using tweezers	
Place filter into conical tube containing 10ml Phosphate Buffered Solution	If there is not 10ml Phosphate Buffered Solution already in the conical tube, add Phosphate Buffered Solution to tube to reach 10ml. Do not place fingers into conical tube.
Close conical tube and seal with parafilm	
Label conical tube with sample number	
Place conical tube into primary sample container	

Task	Comments
Place cartridge into decontamination solution reservoir	Prepared In Accordance With Technical Order 11H1-11-2
Repeat process with second filter cartridge from the dry filter unit	
Place both extracted filters back into secondary sample bag	
Replace latex/nitrile gloves and repeat above steps for the next dry filter unit filter cartridge set	

6.2.4. Once the filters have been placed into the conical tubes they are ready to be analyzed for the presence of toxins using two HHAs, preferably from separate lot numbers. Using two separate lots is the preferred method. Efforts should be made to obtain two separate lots, e.g. purchasing of separate lots or sharing between Emergency Management and Bioenvironmental Flights or geographically co-located installations. In the event two separate lots are unable to be obtained, the same lot HHAs may be used. Confirmatory testing would need to be conducted using the available PCR testing.

6.2.4.1. Toxin analysis of dry filter unit filter samples will be conducted at single location (e.g. the filter processing area or environmental laboratory) by a qualified individual.

6.2.4.2. Following analysis for toxins the filter samples will be transferred to the Home Station Medical Response laboratory for pathogen screening.

6.2.5. The following degradation factors might exist if this process is not utilized.

6.2.5.1. Adverse impact of weather (sand, temperature, rain, snow, etc.). For example, In Accordance With Technical Order 11H1-11-2 false positive or negative results can occur with HHAs if the assays are exposed to rain or snow, or if the assays are used while at cold temperatures.

6.2.5.2. Extra time taken to run HHAs for toxin assessments. For instance, one person can accomplish the HHA screening for the filters from four separate dry filter units at a single processing location in essentially the same time that it will take four people to accomplish the HHA screening activity at each dry filter unit site. In this comparison, it would take ~80 minutes for HHA screening actions at the four individual dry filter unit sites vice the ~20 minutes for the HHA activities accomplished at the single processing point.

6.2.5.3. Consistency of one person running toxin assessments. For instance, one person accomplishes the HHA screening for all filters at a single processing location using essentially the same procedure and eliminating most of the variation that is likely to occur when a variety of individuals conduct HHA screening activities at each dry filter unit site.

6.2.5.4. Potential presence of interferents such as diesel exhaust that will negatively affect filter capacities.

6.2.5.5. Requirement for HHA contaminated waste disposal process and materials at each dry filter unit location instead of one setup at a single site.

6.2.5.6. Difficulty refurbishing the extracted filter assemblies so they can be used with the next set of replacement filters. Following decontamination, the filter assemblies must be

completely dry before the filters are installed. In Accordance With Technical Order 11H1-11-2, if the chlorine solution enters the filter it can cause false negative results upon testing.

6.2.5.7. Lack of overhead cover can result in contamination of the filters by chemical warfare agent in the event of an enemy attack.

6.3. Dry Filter Unit Filter Tracking.

6.3.1. Personnel must maintain accountability records for dry filter unit filters from the time the filters are prepared for insertion into the dry filter unit through final disposition of the item(s). Attachment 4 depicts a template CBRN reconnaissance teams may be able to use for transfer of the screening samples to the installation environmental laboratory. Attachment 5 depicts a chain of custody template that installation laboratories can use if they send the samples to other organizations at some point in the process. Use these forms, or equivalent, each time different people take possession of the filter(s).

6.3.2. Individuals processing filter cartridges will ensure that both filters from each dry filter unit are placed in individual small bags that are properly sealed, decontaminated with decontamination wipes (5% chlorine solution), and labeled with the original screening sample identification numbers e.g., ROK16011502AOAB0101800 and ROK16011502BOAB0101800.

6.3.3. Place the labeled primary container for the filter sets from one dry filter unit inside a secondary container and label the container with the unique screening sample identification numbers it contains. Annotate the date, time, and personnel name(s) on the label.

6.3.4. Decontaminate the used filter cartridges In Accordance With the instructions contained in Technical Order 11H1-11-2, to include ensuring they are completely dry and prepared as replacement filter cartridges for the next exchange.

6.3.5. Replacement filter cartridges are stored in bags labeled for assigned dry filter unit with date and time group. This allows a tracking mechanism for control filters when used.

6.3.5.1. New dry filter unit filters are typically packaged two per bag. Annotate the date of manufacture, lot number, and the storage location of the control filter in dry filter unit logbook under with assigned dry filter unit.

6.3.5.2. Prepare a new Receipt of Property form to go with chain of custody document (Figure 6.4).

Figure 6.2. Air Force Laboratory Transfer Sheet Description Example.

Three (3) each dry filter unit filter sample sets in double clear plastic bags. Each set contains two (2) each felt filter disks. Primary and secondary containers/ clear plastic bags are individually labeled.

1. 1. ROK16011502AOAB0001800 2. ROK16011502AOAB0021810
2. 3. ROK16011502AOAB0031820

6.3.5.3. The original and new Receipt of Property and original chain of custody form is provided to the lab individual that accepts the filter sets for testing. Lab will provide a copy of signed chain of custody document to the individual relieved of custody.

6.3.6. Collectors maintain Receipt of Property and chain of custody documents once the first sample is taken. Detailed description of sample quantities and physical state i.e., liquid, soil etc. are required.

6.3.7. Sample description example. Sample bottle, less than 50 milliliters of suspect liquid, wrapped with lab film, sealed with tamper-resistant tape, with absorbent material, in double clear plastic bags. Sample bottle and clear plastic bags individually labeled.

6.3.8. Multiple samples can go in one sample transfer case (e.g. large plastic bag) as long as each sample is individually bagged and described on Air Force Laboratory Property Transfer forms (or equivalents).

6.3.9. One Chain of custody document will be provided with each sample transfer case.

6.3.10. Receipt of Property and original chain of custody forms are provided to the lab individual that accepts the filters for testing. Lab will provide a copy of signed chain of custody transfer document to the individual relieved of custody.

6.3.11. Dry Filter Unit filter sets. Lab personnel will separate filter sets. One filter will remain in primary container for archiving while the other is individually aliquoted for testing, unless local Standard Operating Procedure dictates otherwise. **Note**: Filters delivered to the lab for screening must be immersed in Phosphate Buffered Solution, the lab will not accept dry filters.

6.3.12. Offsite Laboratories

6.3.12.1. In the event that the Air Force installation does not have Polymerase Chain Reaction capability, an off-site laboratory (i.e. Defense Laboratory Network, Laboratory Response Network) should be used for screening the filters. Additionally, samples can be sent to off-site laboratories for follow-on testing.

6.3.12.2. Filters sent off site for screening are sent accompanied with the appropriate paperwork required by the accepting laboratory. Prior coordination is always necessary.

6.3.12.3. Filters sent offsite are sent via commercial carrier where available. Special arrangements for off-installation transport or mil air support may be required at locations not served by commercial carriers. **Note**: Filters are ambient air samples for screening and not considered as hazardous materials.

6.3.12.4. Filters will be shipped In Accordance With applicable federal, state, and local laws and regulations, including *42 Code of Federal Regulations 72, 49 Code of Federal Regulations 172 and 173, 9 Code of Federal Regulations 122*, the Department of Transportation and International Air Transport Association (IATA).

Chapter 7

LABORATORY ACTIVITIES IN SUPPORT OF BIOLOGICAL AGENT IDENTIFICATION

7.1. Planning Considerations.

7.1.1. A critical purpose of the laboratory will be to support air screening where air samples are collected solely to provide actionable response information for force health protection purposes as opposed to being used as evidence in an enforcement action. The laboratory will also analyze soil, water, and food samples, depending on the approved matrices for the test system. In the event personnel have been exposed to biological agents, the earlier threat agents are identified the more likely successful medical intervention is when medical countermeasures are available.

7.1.2. For many biological agents the time between exposure and effective intervention is measured in hours to days. The ability to identify specific agents is critical to determining the appropriate medical countermeasures and other disease prevention controls (e.g. social distancing) to implement.

7.2. Guidance Document. The Air Force lab community has developed a templated operating procedure for air sample in-processing, preparation, and batching Standard Operating Procedure for environmental labs that provides a sound foundation for Air Force laboratories supporting air screening operations.

7.3. Throughput. During day-to-day operations most laboratories test a limited number of environmental samples, such as one to three samples per year in many cases. When air screening is ongoing, the number of filter samples presented to the lab greatly increases. Preparation and analysis of the first individual sample or pool typically takes 3-4 hours (using a Polymerase Chain Reaction instrument). Screening all samples for every threat agent in the Area of Responsibility will take longer, but it is not as simple as multiplying the number of samples by the 3-4 hours to derive what the actual laboratory throughput answer is. The first test takes longer than subsequent testing in a cycle, because follow on sample preparation is accomplished while the initial analysis is occurring thereby significantly reducing the time to test and receive the next sample(s) results.

7.4. Analysis Time. The expected amount of time required to screen all filter samples for potential threat agents is variable based on manpower, training and proficiency. Consult with laboratory personnel during planning processes to determine representative processing times based upon current technology being utilized. In general processing to result times range from 1 hour to 4 hours.

7.5. Available Equipment. Most outside continental United States installations have an in-house Polymerase Chain Reaction capability. Installations within the United States will either have an in-house capability or have access to this capability through a State Public Health Lab or Department of Defense reference lab. Processing of clinical and environmental samples might occur in different laboratory facilities in order to prevent cross-contamination. The Installation commander and Medical Group commander will determine the prioritization for testing clinical specimens and environmental samples when the threat warrants air screening.

7.5.1. Should that equipment item fail and require maintenance beyond what the owner/user can accomplish, the installation will use alternate Polymerase Chain Reaction-capable laboratories, or HHAs until a replacement is available.

7.6. The establishment of laboratory capabilities on an Air Force installation.

7.6.1. At the beginning of major combat operations, it is likely that personnel and equipment requirements for employment of the ideal biological collection and detection capability will arrive over the span of several days to weeks. As a result, Emergency Management/Bioenvironmental Engineering/Laboratory site planners responsible for deliberate planning operations should analyze the Operation Plan Time-Phased Force Deployment List to determine the following:

7.6.1.1. Time Biological Assessment Team equipment Unit-Type Code arrival with initial laboratory manpower, Polymerase Chain Reaction, and consumable supply arrival.

7.6.1.2. Anticipated time ideal biological warfare identification capability (e.g., dry filter unit/HHA combination for toxins and dry filter unit/Polymerase Chain Reaction identification system combination for pathogens) will be operational for screening environmental air samples.

7.6.1.3. Time period that only minimum biological warfare collection and identification capability exists (e.g., dry filter unit/HHA combination for toxins and pathogens).

7.6.1.4. Time the additional manpower and consumable supplies arrive and laboratory is able to support sustained or expanded biological warfare screening operations.

7.6.2. Locations identified for biological agent testing are surveyed by laboratory staff for suitability of the tasks required; by Bioenvironmental Engineering for compliance with facility requirements; and by Civil Engineers to ensure power, water, heating, ventilation, and air-conditioning and other engineering requirements are capacity appropriate.

7.6.3. Air Force laboratories will only accept samples for processing from off-site locations when approved by the Installation Commander or specifically directed from the Air Component Command or higher authority. Air Force laboratory resources assigned to an installation are only intended to support Air Force requirements at that location. Accepting samples from other entities can result in serious loss of biological screening capability based on additional throughput, re-supply, and sample process timing issues.

7.7. Sample Handling and Testing by the Environmental Laboratory.

7.7.1. All environmental samples for screening are submitted at a designated time and location. Personnel responsible for delivering the air samples will notify the environmental laboratory prior to transferring samples to the environmental laboratory. This will ensure the environmental lab staff is aware of the estimated sample arrival time and ensure they are prepared to receive and provide receipt for the samples.

7.7.2. Filters must be delivered to the environmental lab immersed in Phosphate Buffered Solution. The environmental lab will not accept dry filters.

7.7.3. Unless operational constraints prohibit, all environmental samples accepted by the environmental laboratory are accounted for with documentation that includes acceptance, testing with HHAs, new unique identification when processed to an aliquot or split, and

consumed or destroyed. All environmental samples delivered to U.S. environmental laboratories will include a chain of custody approved by the receiving laboratory. Laboratories will not accept samples without a chain of custody form. Documentation should include any the tests performed, the results, and the availability of remaining sample material available for subsequent testing is maintained regardless of whether the test results are positive, negative, or inconclusive.

7.8. Sample Pooling Strategies and Rationale.

7.8.1. The technique of pooling dry filter unit samples (or water or soil samples, etc.) for the screening process is a viable and very beneficial option for increasing throughput capabilities. The resulting pooled solution is likely to retain sufficient agent for identification purposes but will not identify which specific dry filter unit(s) produced the positive result.

7.8.2. Benefits of Pooling Samples. The primary benefit of pooling samples is increased sample throughput with significant reduction in the overall number of tests that must be analyzed. Additional benefits include lower total analysis times and a substantial reduction in expenditures on consumable materials. Pooling samples could potentially result in decreased manpower requirements as requirements are met with fewer test runs.

7.8.3. Risk. The major risk associated with pooling dry filter unit samples together is the increased possibility of a false negative due to sample dilution. While it is unlikely that a covert aerosol release of a biological agent would only be captured by a single dry filter unit on the installation, the possibility exists. Laboratory personnel should attempt to balance the available resources (manpower and consumables) against the proposed sample load and commander's risk tolerance. Additionally, pooling of samples will prevent the immediate identification of the individual dry filter unit location(s) that captures the hazard cloud. Obtaining that information would require additional sample preparation and testing.

7.9. Confidence in Analysis Results to Initiate Actions.

7.9.1. Environmental laboratory personnel will analyze samples (or arrange for analysis of samples) and then provide the test results to the Medical Group commander. The primary circumstance when this will not occur is when/if Emergency Management personnel are on site, and air screening is initiated for threat reasons before the laboratory personnel and equipment have arrived via Time-Phased Force Deployment List actions.

7.9.2. Bioenvironmental Engineering and Emergency Management personnel are trained in all aspects of the associated tasks of performing HHA analyses and will follow step-by-step procedures. HHA testing will be conducted either in the environmental laboratory or another designated central location to rule out toxins as a possible threat agent.

7.9.3. The laboratory staff is trained on the requisite Polymerase Chain Reaction methodology. Standard Operating Procedures or a similar type tool will be available to reference the step-by-step procedures. This will increase the confidence level in the test results since the personnel will be accomplishing tasks they do regularly in their daily jobs and they will have guidance on how to accomplish each step.

7.9.4. Orthogonal Testing. The Air Force will retain the discretion to implement immediate force health protective actions when positive identification of pathogen(s) is made utilizing Polymerase Chain Reaction or similar advanced identification technologies. Filter samples

that have positive Polymerase Chain Reaction test results for a particular agent are sufficient to recommend and implement medical interventions when possible. When Polymerase Chain Reaction or similar advanced technology is used, testing with two different technologies is not required to initiate medical intervention.

7.9.5. HHA for Pathogen Identification. The risk of false positives when using HHAs for pathogen identification, as a standard procedure, is too great, and waiting for testing with resources other than on-site Polymerase Chain Reaction might be too time-consuming. In the instance where no Polymerase Chain Reaction technology is available within the time limits necessary to effectively implement medical countermeasures, HHAs will be used to identify pathogens. When HHAs are used, the personnel performing the tests will communicate the uncertainties associated with HHA testing to leadership when presenting any positive results. To minimize false positives from HHA analysis, especially when PCR testing is not available, two HHAs should be used (preferably with different lot numbers). Other response equipment that have the capability of detecting the presence of proteins could be used in conjunction with HHA testing to increase confidence in the test results.

7.9.6. Confidence. Capabilities and limitations of the test, to include the technology used to determine if there is or is not a biological threat, should be included when reporting laboratory results. Public health should be consulted to investigate positive Biological Warfare Agent identification in the context of other syndromic surveillance/outbreak information to make subsequent assessments and interpretation of findings.

7.10. Follow-on Testing. As directed by policy or higher headquarters, the installation laboratory will package and send positive air sample materials for follow-on testing. A portion of the total sample (approximately half) collected is maintained for follow-on testing either by a designated laboratory in the US or a host nation laboratory if agreements are in place to do so.

7.11. Communication of Testing Limitations. Recommendations to senior leadership will include any limitations in technology or abnormalities that the staff encountered that could affect the final results. The leadership should have some working knowledge of the biological detection system in place on installation prior to an event; this will decrease the decision making time. Senior leadership can direct dry filter unit sample collection be accomplished more often than every 12 hours if laboratory services possess the required processing capacity, and threat and response capabilities pose a greater risk than is tolerable.

7.12. Management of Dry Filter Unit Following a Positive Result. Following a positive identification result from laboratory analysis it might be beneficial to conduct additional testing to determine the specific dry filter unit(s) collected the sample (unless pooling strategies were not employed; thus the individual dry filter units would already be identified). Those dry filter units identified should be considered as contaminated and must be handled appropriately. However, the dry filter units should not be removed from the collection network until the cessation of hostilities in a major combat operations environment. This is an accepted risk in departure from procedures described in Technical Order 11H1-11-2.

Chapter 8

LEVELS OF AGENT IDENTIFICATION AND ACTIONABLE ITEMS

8.1. General. Multiservice Tactics, Techniques, and Procedures outline a four-tier system for determining the identity of biological hazards, specifying "presumptive", "field confirmatory", "theater validation", and "definitive" as the various levels of confirmation.

8.1.1. The Air Force, however, will use a slightly different approach to suit force health protection mission needs; the Air Force does not specifically distinguish between the presumptive and field confirmatory levels.

8.1.2. The rationale for this modification is based on limited biological agent detection and identification capabilities when it comes to analysis of toxin samples e.g., there are not two different technologies available for testing (part of the normal criteria for "field confirmatory"). HHA test outcomes for toxin assessments provide enough confidence that medical counter-measures and/or chemo-prophylaxis may be implemented, when available, based on test results.

8.1.3. Further, as opposed to automatically employing HHAs for identifying a pathogen-related hazard, Polymerase Chain Reaction, when available, will be the lone technology used for pathogen identification. Using this method, Air Force commanders, along with proper medical guidance will have enough information to give the order to start medical treatment for exposure.

8.1.3.1. When HHAs are the only detection and identification capability on site, the Commander will determine if medical counter-measures and/or chemo-prophylaxis will be implemented based on recommendations from the Public Health Emergency Officer or medical authority. Typically additional information will affect this decision e.g., intelligence assessment of the enemy, situation in the Area of Responsibility.

8.1.3.2. If HHAs are used to identify pathogens this information will be provided to senior leadership with associated caveats and reports will indicate this fact. **Note**: HHAs are not the preferred way to identify pathogens and should only be used when no other capability exists.

8.1.4. The CBRN control center can potentially provide Biological Warfare Agent hazard area predictions to inform decision processes.

8.2. Actionable items.

8.2.1. In the event of a potential biological incident, senior leadership will be required to make decisions based on limited information. The decisions could potentially include the following:

1. Additional sample collection and analysis, which takes time and consumes limited resources.
2. Initiation of chemoprophylaxis
3. Expansion of medical capability in preparation for casualties.
4. Assessment of the vaccination or other preventative medicine capabilities based on the threat agent(s).
5. Warning and notification both on and off site

6. Isolation and quarantine preparation to include shelter in place in the event of a contagious disease.
7. Modifications to aircraft and personnel movements to reduce the implications of the event.
8. Contamination avoidance and decontamination considerations (small scale)
9. Just-in-time training based on hazard, symptoms, and expected actions of the population.
10. Risk and vulnerability assessment to determine threat to installation.

8.2.2. Senior leadership will require information and recommendations from a variety of subject matter experts to determine the best possible courses of action based on the information that is available at the time. Expertise can be found in Public Health Emergency Officer, Bioenvironmental Engineering, Emergency Management, Public Health, Laboratory, Health Care Providers, Threat Working Group, etc. It is important recommendations are feasible based on available assets and resources and meet the goal(s) of senior leadership. See Attachment 10 for information regarding the comprehensive risk management approach to the decision(s).

Chapter 9

BIOLOGICAL AGENT WARNING, REPORTING AND NOTIFICATION

9.1. Warning and Reporting. Warning and reporting for biological events will be accomplished In Accordance With Air Force Instruction 10-206, *Operational Reporting*, and Allied Tactical Publication 45, *Reporting Nuclear Detonations, Biological and Chemical Attacks and Predicting and Warning of Associated Hazards and Hazard Areas*. **Note**: Air Force implementation of Allied Tactical Publication 45 reporting requirements is contained in Air Force Tactics, Techniques, and Procedures 3-2.56, *Multiservice Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Contamination Avoidance.*

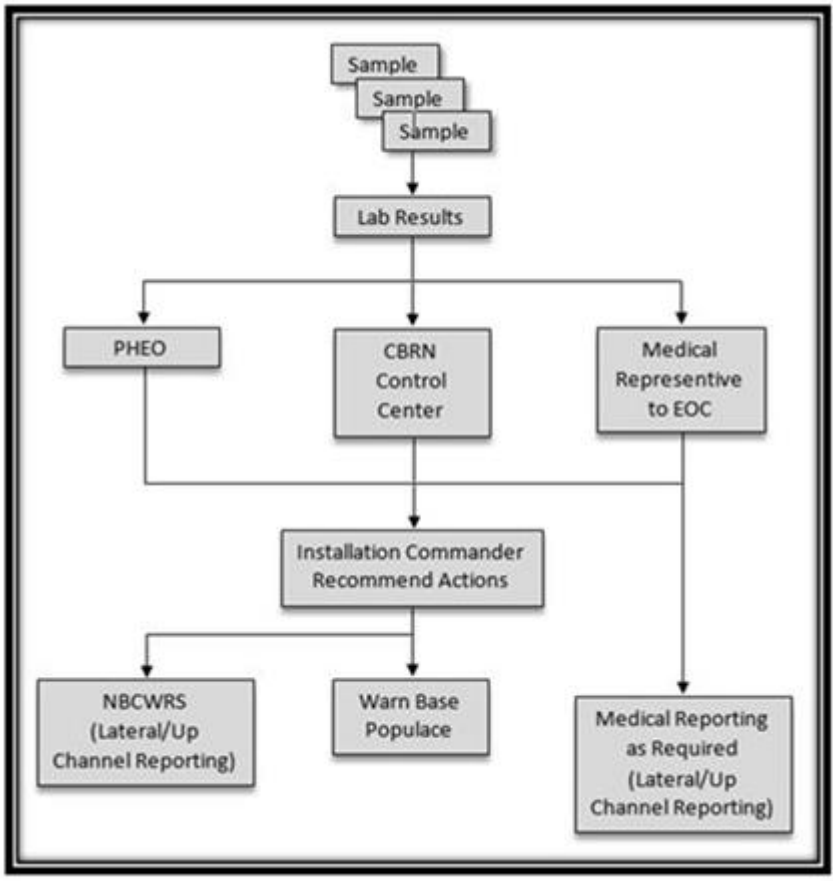
9.2. Operational Reporting-3 Reporting. Air Force Commanders use Operational Reporting-3 reports to immediately notify higher headquarters of any significant event or incident that rises to the level of Department of Defense, Chairman of the Joint Chiefs of Staff, Combatant Command, or Service Level interests. From the standpoint of official reporting, Air Force Instruction 10-206 does not specifically mandate Operational Reporting-3 reports be submitted when/if an installation decides to set up a dry filter unit network unless the Major Command directs otherwise as part of its Commander Critical Information Requirements. Major Command's or Combatant Command's may provide direction on specific reporting requirements to include initiation of screening.

9.3. Reporting Protocol for Air Screening Test Results. While individual circumstances might dictate alternative lines of communication, the preferred reporting protocol is as follows.

9.3.1. The decision to initiate screening will be made by Senior Installation Leadership and direction will be provided to the Emergency Management and Bioenvironmental Engineering personnel tasked to establish the capability. When establishing a sampling capability as a result of Force Protection Condition measures or States and Stages of Alert these activities will take place at the pre-determined time, and capability will be reported consistent with local guidance. Air sampling analysis results will be reported to environmental laboratory staff (prior to hand-off) as well as the CBRN and Medical Unit Control Center.

9.3.2. The Laboratory Officer will provide Polymerase Chain Reaction and HHA results for each air sample screening period. The typical process for providing results are in Figure 9.1.

Figure 9.1. Reporting Results.



9.3.3. The Laboratory Officer notifies the Medical Group Commander of positive biological warfare agent identification during screening.

9.3.4. The Medical Group Commander (or designee) investigates the context of the positive Biological Warfare Agent identification in relation to other pertinent information to make subsequent assessments and interpretation of the positive analytical findings for the air samples.

9.3.5. The Medical Group Commander (or designee) reports positive identification of a Biological Warfare Agent as well as subsequent assessments and interpretation efforts to the CBRN Control Center. The CBRN control center will create and submit CBRN reports as appropriate (reference Air Force Tactics, Techniques, and Procedures 3-2.56).

9.4. Operational Reporting. Operational Reporting is designed to be completed by Command Post Personnel after agent identification occurs and subsequent assessment and interpretation deems the threat is real and exposure is probable. Details can be found in Air Force Instruction 10-206, *Operational Reporting*.

9.5. Disease/Public Health Emergency. Send out initial operation reports describing findings if Operational Reporting was not sent out when air screening commenced.

9.6. Upgrading Operational Reporting. Upgrade Operational Reporting sent earlier when follow-up information meets the criteria of a higher-level report (e.g. BEELINE to PINNACLE).

9.7. Bioenvironmental Engineering Reporting. Bioenvironmental Engineering personnel will report all positive Biological Warfare Agent identified during air screening in the Periodic Occupational Environmental Monitoring Summary, or POEMS, for Department of Defense environmental data archiving in the Defense Occupational and Environmental Health Readiness System.

9.8. Emergency Management Reporting. Emergency Management personnel will send a report to AFCEC/CXR within 24 hours whenever the installation Emergency Operations Center is activated for a real-world incident or event. Information will be up channeled using ICS Form 213, General Message Form. This information will be used to determine what additional assets are required for preparation or deployment.

9.9. Flow of Information within the Installation Following a Biological Event.

9.9.1. Biological events are very different from chemical or nuclear events in that there is little ability to recognize and immediately respond to a biological event of any kind. Short of seeing a perpetrator in the act of delivering the agent and having near real time information on the particular agent used, it is going to take some time to figure out what has happened. In a chemical or nuclear event it is easy to recognize the event quickly because of tell-tale markers such as instrument readings, people displaying symptoms or the recognition that a weapon has been detonated.

9.9.2. Communications in the aftermath of a biological release are generally not intended to direct personnel to take immediate protective actions such as put on a mask or evacuate an area. Rather, the notifications provide direction about what health and hygiene measures are being enacted to counter the effects of the exposure individuals already received. The likelihood is that it will be after agent release before the Air Force identifies what has occurred.

9.9.3. Once a positive result has been identified, the senior laboratory representative would notify the Medical Group Commander, Public Health Emergency Officer, Bioenvironmental Engineering, Public Health, and Medical Intelligence Officer, who will develop possible courses of action to recommend to senior Installation Leaders.

9.9.4. Results and recommendations are brought to the CBRN Control Center and senior Installation leaders, who will make decisions regarding the best course(s) of action.

9.9.5. Notifications are developed or templates are adjusted to pass all pertinent information along to the potentially affected population. This is usually done in conjunction with the Public Affairs and Legal offices through the Emergency Operations Center.

9.9.6. The information is subsequently passed to the population through all appropriate communication systems.

9.10. Timely Reporting to Affected Populations. Should a biological event occur, information must be provided to the affected population in a timely manner. The information provided may include:

9.10.1. The situation, to include what agent has been detected.

9.10.2. Mitigation measures being implemented locally e.g., social distancing, quarantine, etc.

9.10.3. Medical counter measures being implemented locally.

9.10.4. Process for receiving medical treatment supplies, to include locations of distribution centers for medical counter measures if appropriate.

9.10.5. Side effects to medical counter measures, and instructions for what to do if these effects are experienced.

9.10.6. Reminders on sanitation and hygiene measures as appropriate to the situation.

9.10.7. Symptoms to be cognizant of as a result of agent exposure.

9.10.8. When to report for medical care i.e., what symptoms require immediate medical attention.

9.10.9. Indicators of subsequent attacks.

9.11. Notification to Local Populace. There is a significant amount of information to pass to the local population once biological warfare agent are identified and no matter what information is provided, concerned people will want more. An information void will be filled with facts or something less desirable.

9.11.1. Medical Group Commander should establish reporting procedures to ensure compliance with reporting to civil authorities In Accordance With International, Federal, State and local laws and agreements.

9.11.2. Consider providing an information line for people to request information when Public Health or other health care professionals are available to perform this service.

9.11.3. Provide concise and clear information on protective measures and how they will help potentially exposed personnel.

9.11.4. Provide periodic updates when new information is available.

Chapter 10

CONTAMINATION AVOIDANCE AND DECONTAMINATION ACTIVITIES ASSOCIATED WITH BIOLOGICAL AGENT COLLECTION AND TRANSPORTATION ACTIVITIES

10.1. Biological Clearance Guidelines.

10.1.1. The Undersecretary of Defense (Policy) released the for Platforms and Material on 27 Sep 2016, however, this package does not capture all circumstances that could be encountered in a biological warfare event at an Air Force Installation. There are areas where guidance exists for one portion of an integrated task, but amplification instructions do not exist for other segments of the task.

10.1.2. Leadership at all levels would likely have crucial decisions to make if the installation Emergency Operations Center/Crisis Action Team believed a Mobility Air Forces aircraft had been parked in the path of a biological hazard cloud during major combat operations activities but there was not a positive biological detection test result to verify the aircraft was contaminated. Taking limitations associated with biological detection into consideration, those operational policy determinations could include deciding what if any decontamination is required prior to placing the airframe back in service; and whether or not to use the aircraft for all missions or curtail its activities to "exchange zone" operations while remaining in the Area of Responsibility.

10.1.3. The amount of contamination that is considered acceptable will probably be different in major combat operations than it is in peacetime day-to-day operations. **Note**: The Environmental Protection Agency and the Centers for Disease Control and Prevention have established a cleanliness standard for *Bacillus anthracis* in the United States which requires no detectable viable spores prior to an asset or area being returned to full use. This standard was developed in response to *Bacillus anthracis* releases in the US. Where guidance is lacking decision makers will be required to determine what is acceptable at the time of execution.

10.2. Capability Concerns and Assumptions. Current Air Force biological detection capability is extremely limited in relation to being able to determine if individual resources are contaminated. The dry filter units do not possess this capability and the detection thresholds associated with HHAs are unlikely to yield positive results in the aftermath of an airborne release, even if small amounts of contamination exist.

10.2.1. Within major combat operations environments, installations will not be required to unilaterally make a decision about how clean previously contaminated items have to be in order to leave an installation; the Combatant Commander is responsible for the disposition of platforms and materiel within their command, including those formerly contaminated platforms and materiel. Higher headquarters guidance must consider detection limitations. For example, installations do not have the resources to conduct testing to verify that biological decontamination efforts have been effective. Current detection capability is targeted at obtaining knowledge of a biological attack and identifying the specific agent for the purpose of prescribing medical prophylaxes to reduce casualties. The Air Force does not have the detection or laboratory quantification testing capacity to determine the precise degree of residual hazard remaining.

10.2.2. During peacetime operations commanders, through appropriate channels, will enlist the aid of U.S. or host nation governmental agencies that have responsibilities in the specified area of concern.

10.2.3. Within the context of major combat operations environments, commanders should consider the availability of uncontaminated resources and areas from which to conduct operations. Installations should use uncontaminated resources and areas to the extent possible

10.2.4. If there is a compelling case that the resources might be contaminated, commanders should consider treating the assets as if they are "dirty" if such treatment will not significantly impact critical mission operations. This includes using uncontaminated resources to accomplish the mission(s) if the assets are available and protecting personnel to the degree practical. For instance, personal safety should be the key factor amongst maintenance personnel if the maintainers can accomplish the task(s) within the required timelines while wearing the appropriate protective equipment.

10.2.5. If the use of uncontaminated resources is not feasible and the use of protective equipment will degrade critical mission operations, senior leaders and technical advisors will consider six primary aspects to the question "what specific resources should we count as residually contaminated in the aftermath of a biological warfare attack." These considerations are: the purpose for the question, the operating environment, the likelihood of initial contamination, the probability of secondary contamination through resuspension and deposition of biological warfare materials, the prospect that the resource is still contaminated, and the number and location(s) of people that will be affected by the decision.

10.2.6. Purpose of the question. The context of the question is extremely important. Are people trying to determine if a resource can be used for mission critical activities or are they trying to determine if any contamination at all exists? For example, in the midst of a major combat operations conflict, senior leaders might equate "contamination" to "militarily significant contamination". Conversely, the commander and civil authorities at an installation during normal day-to-day activities might consider one biological warfare particle as "contamination".

10.3. Operating environment. The degree of risk senior leaders are willing to accept will differ between day-to-day activities at home station and situations occurring at employment locations in the midst of major combat operations conflicts. During day-to-day activities at home station, there is a possibility that senior leaders and civilian authorities will adopt a "prove the resource is uncontaminated" approach rather than the "prove the resource is contaminated" approach which may occur in major combat operations environments.

10.3.1. Likelihood of initial contamination. There is a very low probability that individual resources (aircraft, vehicles, etc.) will be contaminated by airborne releases occurring $\geq$ 1 km away to the point that people will get infected as a result of the residual contamination.

10.3.2. Probability of secondary contamination. There is only a very remote likelihood that Air Force resources will be contaminated through the mechanism wherein agent originally deposited on a surface is re-suspended and subsequently is deposited on the asset(s) in question.

10.3.3. Prospect that resource is still contaminated. The amount of agent that dissipates, and loses its hazard potential, increases as time passes. The likely hazard duration in the

environment of the agent(s) involved is the primary consideration with this factor. See Attachment 7 for biological warfare hazard duration estimates.

10.3.4. Number and location(s) of people that will be affected by the decision. During major combat operations activities, installation leadership will likely make the decision if only limited numbers of personnel are or will be affected, and these personnel will remain on site. Commanders cannot make the decision unilaterally if the resource, a cargo aircraft for instance, will transit several locations and come in contact with personnel from multiple Services and locations. Under these circumstances, the decision will likely be made by the Air Component Commander or the Combatant Commander. See Attachment 10 for an example decision aid for this area based on a comprehensive risk management approach.

10.3.5. If uncontaminated items or areas are not available, senior leaders should assess the installation's ability to decontaminate the item(s) in question within required timelines. Installations should accomplish decontamination activities to the extent possible if the process can be quickly completed and is likely to significantly reduce the residual hazard. Senior leaders should also assess the ability of personnel to accomplish the mission/task while wearing appropriate protective equipment (mask for instance) when working with or within actual or suspected biologically-contaminated resources and areas. Complete the project while wearing appropriate protective equipment whenever possible in order to minimize risk to personnel.

10.4. Filter Collection Process Contamination Concerns. In most cases, personnel accomplishing sample collection and transport duties will not know if a filter is positive or negative because the analysis is done after they deliver the sample. However, the Air Force will implement a variety of contamination avoidance and decontamination procedures regardless, in order to protect personnel and mitigate the impact of any inadvertent release of agent.

10.4.1. Benefits of Precautionary Activities. Sample collection personnel accomplish precautionary biological agent contamination avoidance and decontamination activities as part of the filter collection process. These practices are important for two primary reasons:

10.4.2. Enhanced sample quality. The procedures reduce the possibility of inadvertent cross-contamination, and are easily accomplished.

10.4.3. Containment/mitigation of potential biological hazard. The procedures minimize the probability of an accidental spill of a liquid sample through double bagging and other precautionary measures.

10.5. Step-by-step procedures. Step-by-step procedures for contamination avoidance and decontamination activities are included in Chapter 6 for filter collection and Attachment 11 for spill response.

10.6. Decontamination Cleanliness Standards. Neither the Air Force nor the Department of Defense currently has official decontamination cleanliness standards that are measurable, for biological agents. Consequently, even though there are no established decontamination verification protocols, it is incumbent upon Air Force personnel to accomplish contamination avoidance and decontamination activities as precisely as possible in order to minimize residual hazards.

10.7. Non-Expendable Resources. Non-expendable resources contaminated as a result of a spill and subsequently decontaminated should be identified, marked, and tracked In Accordance With Air Force Manual 10-2503, and other existing guidance.

Chapter 11

EDUCATION, TRAINING, AND EXERCISES

11.1. Education and Training. The Air Force's revised biological collection, detection, and identification activities as described in this document will recommend education and training for several functional areas. Table 11.2 provides a list of subjects where training is recommended either through Air Force Specialty awarding courses, supplemental training courses under the purview of the Air Education and Training Command and Air Force Material Command, included in Career Development Courses, added to contingency training location curricula, reinforced during internal training sessions, or completed as "just-in-time training". This publication provides an agreed upon methodology for collection, detection, and identification of environmental samples that might contain biological warfare agents. These samples can be collected anywhere and anytime a biological threat exists: during major combat operations, contingencies other than major combat operations, or during homeland defense operations.

11.1.1. Although the requirement for special training classes is not envisioned, Emergency Management and Bioenvironmental Engineering personnel should ensure that senior leaders are familiar with existing capabilities, limitations, and potential risk-benefit issues related to biological agent aerosol collection and identification in order to promote realistic expectations and an understanding of potential operational risk management factors and decisions. Table 11.1 lists several of the expected decisions senior leaders will make in regards to biological collection, detection, and identification issues.

Table 11.1. Representative Biological Warfare-related Senior Leader Decisions.

Prioritization of environmental air sampling locations if quantity of dry filter units or laboratory capacity is limited	Prioritization of clinical versus environmental sample testing if personnel or resource capacities are limited
Frequency of environmental air sample collection and testing	Determination of confidence level in test results from each detection / identification technique
Initiation/termination times for environmental air sampling	Delineation of base populace members to provide medical countermeasures for based on test results
Need to adjust Mission Oriented Protective Posture level based on test results	

11.1.2. Emergency Management and Bioenvironmental Engineering personnel will provide educational materials and/or training on the installation's biological collection, detection, and identification activities and the limitations, protection capability, decontamination procedures, expected result timelines, and anticipated support required from external installations/agencies to key advisors and appropriate installation working groups (e.g. Installation Threat Working Group) on an annual basis. These actions will enable affected personnel to understand their role in the decision making process and facilitate the development of recommendations for senior leadership consideration.

11.1.3. Public Health personnel will provide guidance on reporting diseases, In Accordance With International, Federal, State and local laws, regulations, and guidance.

11.2. Biological Agent Collection, Detection, and Identification Exercise Considerations.

11.2.1. Exercises should embody a "train the way we fight" philosophy and should employ actual command relationships as much as possible. Exercises should provide opportunities to assess real-world capabilities consistent with safety, security, and overall exercise objectives. When appropriate, exercises should also incorporate other requirements, such as logistics, support, force protection, and the ability to operate in a degraded/contaminated environment, including CBRN environments. Whenever possible, exercises should seek to employ and evaluate current or proposed plans, policies, procedures, processes, and doctrine.

11.2.2. Available exercise opportunities are limited and Installation Commanders are responsible for determining what specific areas will be included in the annual exercise plans. Consequently, Emergency Management and Bioenvironmental Engineering personnel must stress the importance of biological warfare defensive capabilities and facilitate the inclusion of critical items into installation and joint exercises.

11.2.3. There are a number of exercise items that are key to ensuring all biological screening activities are validated and fully understood by senior leadership, these include:

11.2.3.1. Emphasize the development of senior leadership decision points, as there are a substantial number of assessments that need to be made in a timely manner to ensure the force is adequately protected. The medical community, Threat Working Group and others will develop recommendations for the commander based on what is known about the situation; those recommendations must then be evaluated and decisions made on such things as initiating chemoprophylaxis, mandating isolation or quarantine, eliminating public gatherings etc.

11.2.3.2. Exercises should be allowed to run to their natural conclusion. Some past biological response exercises focused on the detection of the agent and a discussion about what might be done next, then the exercise is ended. This limited evaluation is not conducive to finding the real problems or concerns the installation could encounter if actually executing those measures. It might be possible for the laboratory to process a handful of samples collected after a single collection cycle, but not possible for that laboratory to continue testing samples from subsequent attacks due to throughput limitations. The decision could be made to provide prophylaxis to the population, but the plan to do so might not executable in the timeframe available to stave off the disease.

11.2.3.3. Include all required personnel in the exercise(s), to include key civilian partners. Doing partial-task evaluations provides a limited view of the impact to an installation a biological event presents. When the entire population is included in the exercise; issues such as care of a sick child, limitations within the health care system, impact to off base military population, facility, and support requirements to support isolation and quarantine, become more apparent. Recognizing the weaknesses in the plan and developing workarounds is important to successful response.

Table 11.2. Recommended Training Items.

Training Item	Target Audience
Background on Biological Agents	Laboratory Personnel Emergency Management/Bioenvironmental Engineering
Review of guidance in Air Force Instruction 10-2606 and Air Force Tactics, Techniques, and Procedures 3-10.26	All tasked functions
Risk management in biological agent detection	Senior Leadership/Emergency Management/Bioenvironmental Engineering
Biological agent collection, detection and identification assets and sustainment requirements	Emergency Management/Bioenvironmental Engineering/Public Health
Biological agent sampler collection plan(s) to include timing by agent	Emergency Management/Bioenvironmental Engineering
Medical Surveillance piece of biological detection	Emergency Management/Bioenvironmental Engineering/Public Health
Biological detection decision making	Senior Leadership/Emergency Management/Bioenvironmental Engineering
Dry Filter Unit sample collection process and procedures	Emergency Management/Bioenvironmental Engineering (encourage cross-training as mission permits)
Biological agent decon	Emergency Management/Bioenvironmental Engineering
Level of sample analysis and associated response measures	Emergency Management/Bioenvironmental Engineering/Lab
Biological agent detection/identification reporting criteria	Emergency Management/Bioenvironmental Engineering/Public Health/Lab
Medical intervention by agent with associated timelines	Public Health Emergency Officer/Emergency Management/Bioenvironmental Engineering/Public Health
Sample pooling strategies and throughput	Bioenvironmental Engineering/Lab
Risk communication	Senior Leadership/Public Health Emergency Officer/Emergency Management/Bioenvironmental Engineering
Notification and recommendations to Senior Leadership and civilian partners	Emergency Management/Bioenvironmental Engineering/Public Health
Indicators when the sample collection grid can be discontinued	Emergency Management/Bioenvironmental Engineering

11.2.3.4. Threat agents chosen for exercises should be applicable to exercise locations, but ideally should not be the agent the installation is most prepared for. For example, the base population may be vaccinated against *Bacillus anthracis*, which may lead to portions of

installation plans not being exercised. If requirements exist to accomplish actions such as sending suspect samples to follow-on laboratories for higher confidence testing, the activities associated with that activity should be exercised.

11.2.3.5. Consider the longer term effects of a biological attack to include items such as determining what had been contaminated and how that contamination will be documented/tracked. If a contagious disease is chosen address second and third order cycles of disease and the implications to the mission and the need for resources. Determine what specific activities or situations must be in place to reverse decisions that have been made e.g., if social distancing rules were implemented what must happen for that directive to be rescinded.

11.2.3.6. Use the exercise(s) to improve the installation plans. Lessons learned from the exercise(s) should be bumped up against existing plans in order to resolve areas that require improvement.

11.3. Training Matrix.

11.3.1. Table 11.2 contains recommended training items. Items identified are not necessarily included in current curricula, but should be considered in the future. Methods of training can include, but are not limited to, school houses, computer based training, just-in-time training, contingency training location, or in-house training.

11.3.2. Although a target audience is identified in the matrix there might be other personnel trained in some of the identified tasks to meet mission requirements.

11.3.3. Training hours are limited so their use must be maximized to the extent possible. The training objective is designed to provide the required training to the right people at the most opportune time. There will be situations where units fall back to "just-in-time" training, but that is not the desired readiness posture. Regardless of the circumstance, there must be qualified personnel available to provide just-in-time training; the likelihood of successful task accomplishment will be degraded if the entire team requires training at the time of execution.

11.3.4. Emergency Management and Bioenvironmental Engineering personnel will require training on dry filter unit siting strategies and options to maximize the probability of detection and force health protection without exceeding laboratory throughput capacities. These personnel will also require instruction and/or educational materials on sample-related documentation requirements and sample transfer procedures with the laboratory staff. Further, Emergency Management and Bioenvironmental Engineering personnel will require training on non-standard procedures and emergency response situations e.g., the process for collecting and testing samples when laboratory resources are not available, the guidelines and prioritization decisions for situations in which adversary attacks take place during the sample collection process, etc.

11.3.5. Laboratory staff might require training on sample pooling techniques and guidelines, sample identification number assignments, and sample transfer procedures from CBRN reconnaissance team members and to external agencies.

When laboratory capabilities are not available on installation, training in preparing samples for transport to a pre-designated laboratory might be necessary.

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Surgeon General

Attachment 1

GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION

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Prescribed Forms

None

Adopted Forms

AF Form 847, Recommendation *for Change of Publication*

Abbreviations and Acronyms

AFI—Air Force Instruction

AFMAN—Air Force Manual

AFTTP—Air Force Tactics, Techniques, and Procedures

CBRN—Chemical, Biological, Radiological, and Nuclear

DFU—Dry Filter Unit

EEE—Eastern Equine Encephalitis

GPS—Global Positioning System

HHA—Hand-Held Assay

IAW—In Accordance With

ICS—Incident Command System

J2—Joint Staff Intelligence Office

MDS—Mission Data Set

POEMS—Periodic Occupational Environmental Monitoring Summary

ROK—Republic of Korea

UTM—Universal Transverse Mercator

VEE—Venezuela Equine Encephalitis

WEE—Western Equine Encephalitis

Terms

Dice-Five—the arrangement of the devices in a pattern like that on a standard die 

Fomite-Delivery—the transmission of disease by an object (as a dish, toy, book, doorknob, or clothing) that may be contaminated with infectious organisms and serve in their transmission.

Vector-Delivery—the transmission of disease by a vector, which is an organism that does not cause disease itself but which spreads infection by conveying pathogens from one host to another.

Sentinel Casualty—the initial casualty in a disease outbreak.

Attachment 2

MAJOR COMBAT OPERATIONS BIOLOGICAL WARFARE DETECTION AND IDENTIFICATION RESOURCE ARRIVAL

A2.1. Planning Considerations. One of the most critical planning considerations for major combat operations environments involves the relationship between the threat and the point at which all required biological warfare detection and identification resources will be present on the installation. It would be highly unusual for all required resources to arrive on the same day, especially because personnel and equipment packages from different functional communities are involved. Historically speaking, it would also be somewhat unusual for the Emergency Management, Bioenvironmental Engineering, and laboratory Unit-Type Codes to all arrive at the very onset of airbase operations. As a result, the Air Force in general and the affected installation command and control personnel in particular must address the following considerations:

A2.2. Threat Profile. When is the adversary likely to employ biological warfare agents? Are initial biological warfare attacks likely to be overt or covert in nature? Are friendly forces vaccinated against the probable threat agents? The key is to determine the degree of risk friendly forces are incurring by potentially not having an established biological warfare detection network at the onset of operations, and then take steps to mitigate the risk – even if it means making a formal request to move at least a minimum capability (dry filter unit/HHA combination) up in the Time-Phased Force Deployment List process.

A2.3. Dry Filter Employment. The objective of dry filter unit employment is to allow for the collection and subsequent screening of ambient air samples to provide "detect-to-treat" notification of a biological attack in time for commanders to recognize the need for, and implement, effective medical treatment protocols. The main principles behind the employment of dry filter units are: to only use the systems when a credible airborne biological threat exists, to site the systems in a manner that protects the main population and maximizes the probability of detection, and to establish the filter collection frequency based on the threat agents involved and laboratory throughput capabilities (recommendation is collection every 12 hours and analysis every 24 hours. However, this might not apply if toxins are the primary threat agents).

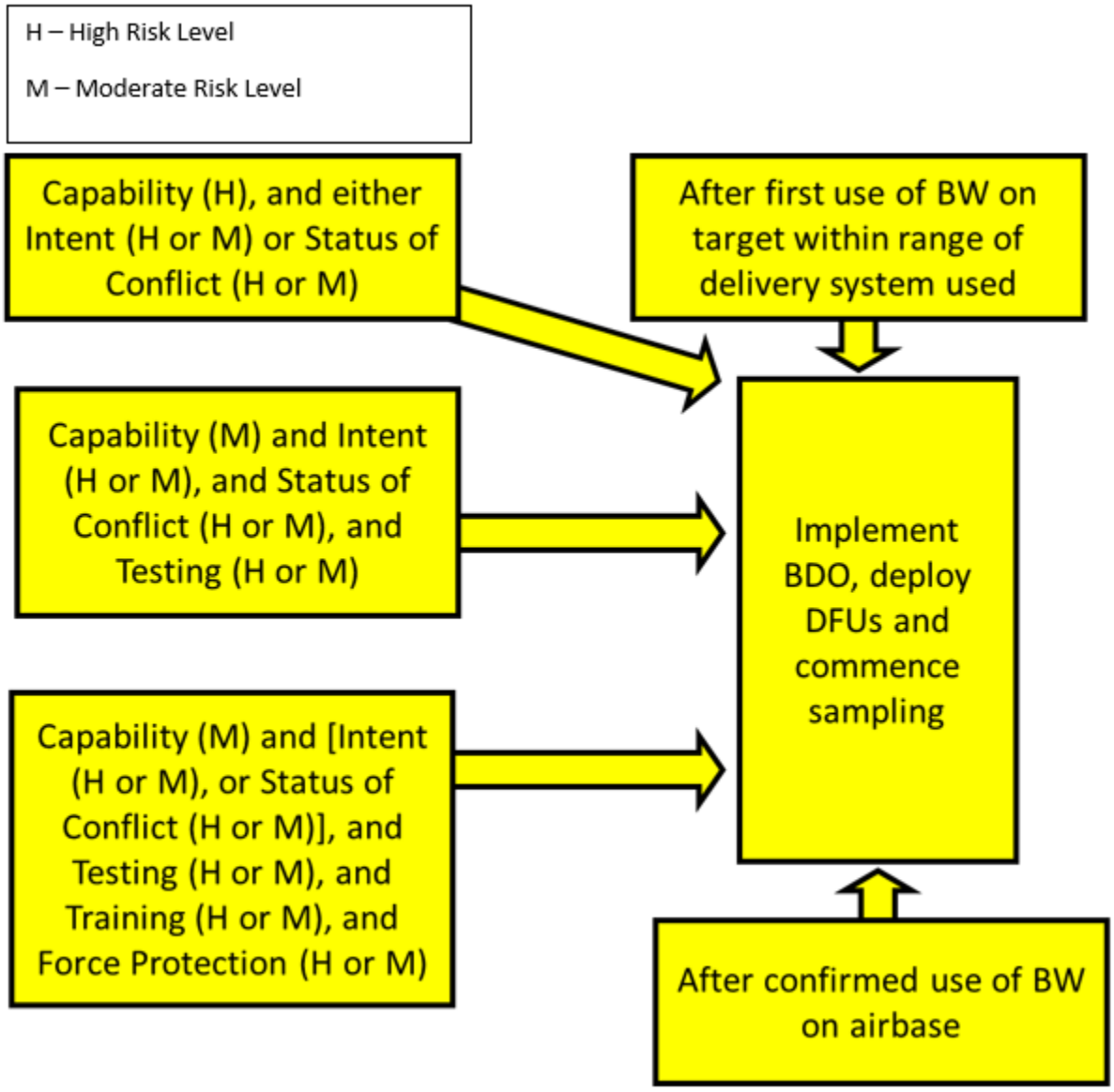
A2.4. Planning for Biological-Surveillance Operations. This task provides the opportunity for leaders to analyze the impact biological agents have on operations and involves a cooperative effort between Emergency Management, a laboratory that processes environmental samples, Public Health, Bioenvironmental Engineering, the installation's medical care providers, and the Threat Working Group. A viable planning effort includes local threat and intelligence estimates, commander's guidance and assessment of acceptable risk, size of area(s) requiring protection, resource availability to include manpower, and timelines for receipt of test results if the installation relies on external agencies for support in this area.

A2.4.1. Biological detection and identification efforts are part of the larger CBRN Reconnaissance and Surveillance mission. Commanders implement the Concept of Operations for CBRN Reconnaissance and Surveillance mission through planning and implementing risk-reduction measures. The commander and staff use their situational awareness (visualization of the operational environment) to identify the risk reduction measures that will be implemented in supporting Operation Plans and/or operation orders. Generic methods that can be used to examine, assess, and implement the risk reduction measures associated with some

portions of the planning process are depicted in Air Force Tactics, Techniques, and Procedures 3-2.44, *Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Reconnaissance and Surveillance*.

A2.4.2. While Air Force Tactics, Techniques, and Procedures 3-2.44 identifies several generic risk reduction measures that should be implemented, Figure A2.1 below breaks out the key risk factors, and the metrics that provide insight into a commander's decision to activate sample collection. The key risk factors from an adversary's biological warfare use include: technical biological warfare program capability, stage of conflict, adversary intent and planning for biological warfare use, testing programs, training programs, and force protection programs. The first four items are focused on the adversary's strategic level commitment to developing and using an offensive biological warfare capability, which when considered during high and moderate risk levels, strongly supports the start of sample collecting earlier rather than later. The last two items are focused on the adversary's ability to protect both military and civilian populations while employing biological weapons – which might create hazard to infection from pathogens many hundreds of kilometers downwind from the release point.

Figure A2.1. Decision Tree for Deployment of Dry Filter Units and Sample Commencement.



A2.4.3. The three boxes on the left of the figure represent the risk factors which, when combined, should result in strong advocacy for active sampling to be conducted before the first use of biological warfare is observed in theater. The top and bottom boxes on the right side of the figure represent key factors which provide additional impetus to begin sampling when not previously initiated. **Note** that this decision tree represents key risk factors, and does not address resource availability (personnel and materiel), nor the cost associated with the decisions to collect and test against particular agents in the list of threats. The strength or weakness of any particular risk factor can dominate the decision-making process.

Attachment 3

DRY FILTER UNIT PLANNING AND MANUAL SITING

Table A3.1. Biological Warfare Detection Planning Checklist.

Employment Planning		
Determine the type of operation the biological detection and identification network will support (Major Combat Operations, non-Major Combat Operations contingency, or peacetime) and finish initial associated tasks.		
a. Phased Biological Warfare Detection Network Development for Major Combat Operations. Effective air screening and medical intervention capabilities enable commanders to disrupt the potential effects of Biological Warfare attacks while continuing to provide combat power without interruption. The required personnel and equipment resources for employment of the full biological agent collection and identification Concept of Operations will likely arrive over the space of several days or even weeks. As a result, Emergency Management/ Bioenvironmental Engineering/Laboratory planners responsible for deliberate planning operations should analyze the operation plan Time Phased Force Deployment List and determine the phased approach timeline and steps that will be required to reach full capacity.		
Task	Comments and Examples:	Office of Primary Responsibility
Determine: - The number of dry filter units, HHAs, Polymerase Chain Reaction identification system, and associated consumable materials desired for the location's projected biological detection and identification plan - The potential Biological Warfare threat agents that might already exist in naturally occurring forms at the site - The earliest time a minimum Biological Warfare detection and identification capability (i.e., dry filter unit/HHA combination) will exist at the installation - When and how much the network can be expanded over time if required - When the laboratory's Polymerase Chain Reaction	The physical placement of dry filter units might have to be completed in stages while waiting for the Time-Phased Force Deployment Data to deliver all assigned resources and/or power availability. The siting plan may have to be adjusted if assets are lost due to mechanical failure, damage, etc. The frequency of sample analyses may also need to be adjusted, at least temporarily, based on the testing equipment, manpower, specific agent probes, and consumable materials.	Public Health Emergency Officer/Bioenvironmental Engineering/Emergency Management/Public Health/ Laboratory

capability is initially available (limited scale) - When the laboratory manpower and consumable material supplies enable the laboratory to conduct optimum sustained operations		
Maintain status of current capabilities, shortfalls, and any expedited requisition recommendations.	The Emergency Management element continues coordination efforts with the Laboratory Officer and Bioenvironmental Engineering personnel to determine the location's combined air collection and Biological Warfare Agent screening assets to include manpower.	Emergency Operations Center, Medical Unit Control Center
Inform the Crisis Action Team (through Emergency Operations Center and/or the Threat Working Group if formed) of current capabilities and shortfalls		Emergency Operations Center, Medical Unit Control Center
Determine if there is threat-based justification to formally request additional or expedited biological defense capability (including manpower) in the time-phased force deployment list process. If so, request installation commander support through established CBRN and logistics processes.		Emergency Operations Center, Medical Unit Control Center
b. Non-Major Combat Operations Contingency Operations. Non-Major Combat Operations contingency operations refer to situations in which forces are deploying to conduct operations such as humanitarian aid but the threat of a biological attack is feasible. This type of situation requires a flexible capability and specific resource requirements might not be identified until the time of execution.		
Identify air collection and screening requirements and sample analysis frequencies	Planners consult with each other to develop recommendations for	Emergency Management/Bioenvironmental Engineering/

based on the threat profile in conjunction with the acceptable level of risk for the situation.	contingency operation resource tasks.	Laboratory
Determine the potential Biological Warfare threat agents that might already exist in naturally occurring forms at the site		Public Health Emergency Officer/Public Health
Maintain status of current capabilities, shortfalls, and any expedited requisition recommendations.	The Emergency Management element continues coordination efforts with the Laboratory Officer and Bioenvironmental Engineering personnel to determine the location's combined air collection and Biological Warfare Agent screening assets to include manpower.	Emergency Operations Center, Medical Unit Control Center
Inform the Crisis Action Team or equivalent of current capabilities and shortfalls		Emergency Operations Center or equivalent
Determine if there is threat-based justification to formally request additional or expedited biological defense capability (including manpower). If so, request installation commander support through established logistics processes.		Emergency Operations Center or equivalent
c. Peacetime Network: The use of air screening strategies during peacetime will probably not occur except in the unlikely event a significant and targeted threat indicates the need for short duration (<96hrs) biological surveillance during high visibility functions such as Open Houses, air shows, and sporting events. The dry filter unit siting process for these events must take place with representatives from the Civil Engineer, antiterrorism/FP, Safety and Security Forces to foster awareness and ensure that the collection grid and associated requirements integrate safely and adeptly into the event's comprehensive plan. Siting dry filter units in a dice five pattern for a three (3) day open house and air show has significantly greater scale and scope than placing a dry filter unit inside of a building in preparation for a visit by a distinguished guest or group.		

Identify air collection and screening requirements and sample analysis frequencies based on the threat profile in conjunction with the acceptable level of risk for the situation.	Installations that have pre-set or permanent dry filter unit pads in place are still required to accomplish this task.	Emergency Management/Bioenvironmental Engineering/ Laboratory
Determine the potential Biological Warfare threat agents that might already exist in naturally occurring forms at the site		Public Health Emergency Officer/Public Health
Determine the air screening start and stop times	Consider starting the screening process in conjunction with preparation activities. Continue screening throughout the planned event and consider continuing screening activities throughout the event close out actions (tear down and removal of event displays for instance).	CBRN Control Center
Determine sample analysis times	Collect air screening samples while vast majority of people are in the area(s) and analyze the sample(s) during the "off" periods.	CBRN Control Center
2. Complete the following tasks for all collection networks.		
Task	Comments and Examples:	Office of Primary Responsibility
- Identify Commander's intent and overall objectives. Will air collection and screening operations provide results to meet the CC intent and objectives? Yes – continue planning No – Recommend alternative objectives attainable through air screening that contributes to the tactical and	Example of attainable objectives: Effective screening for presence and identification of biological agents of operational significance. Make timely risk and medical intervention decisions prior to presentation of sentinel casualties. Initiate force health protective measures when the presence of threat agent(s) is identified	Bioenvironmental Engineering/Emergency Management/ Laboratory

operational decision making process.	through the air screening process. Potentially deter biological attacks by demonstrating that the Air Force has the capability to effectively identify and respond to biological attacks. Example of an inappropriate objective: Monitor and alert to prevent biological agent exposure during the conduct of Air Force mission requirements.	
- Determine if resources required to meet commander's objectives are available. Yes – Continue planning No – Recommend modification of objective(s) based on available resources and/or request additional Biological Warfare detection and identification assets from higher headquarters	Example of resource match: Provide, with 12-18 collectors, specific protection for 1-2 critical mission facilities and protection for the heavily populated portion of the installation Example of resource mismatch: Provide, with 12-18 collectors, specific protection for 10 critical mission facilities and protection for the entire land area associated with the installation	Bioenvironmental Engineering/Emergency Management/ Planners
- Determine the size of the area of concern for air collection grid. For Major Combat Operations and Contingency Operation environments, it is assumed that no more 18 dry filter units are required per 3 km x 2.5 km area as more collectors do not provide added benefit. For Peacetime activities, 4 dry filter units meet the sample collection needs in most cases. A 5th Dry Filter Unit is used either to create a true dice or as a back-up in the event a dry filter unit becomes inoperable.		
Identify initial or rough collection grid location(s). Using the Commander intent, identify the population(s) of concern. Identify where populations of concern are primarily located on base map to determine	Example considerations: Major Combat Operations population examples: Aircrew, Sortie generation, munitions build, aircraft backshop maintenance, cargo handling, Command and Control centers Areas of concern might include	Bioenvironmental Engineering/Emergency Management/ Planners

how many areas of concern are present. Determine the size of each area of concern which is used with the number of available collectors to calculate spacing intervals. Indicate the Commander's prioritization of each area.	cantonment (billeting, dining area, etc.), and mission dense areas. Non-Major Combat Operations Contingency Operation examples: U.S. and allied work force, Command and Control center Areas of concern might include billeting, dining, shelter, logistics, and treatment areas. Peacetime population examples for special event such as an Air Show: Base support personnel and visitors. Areas of concern might include event area, staging area for support equipment, visitor parking area(s) and mass transit pick-up/drop-off points, etc. Use an electronic, or other scaled map of the base (focus on cantonment, mission dense areas, etc.) to identify possible dry filter unit locations for siting. Consider local or host nation capabilities in site selection if there is a possibility of sharing responsibility, information, or results.	
- Identify areas considered for exclusion for safety, security, accessibility, or other reasons	Cross check these locations at the appropriate (later) spot in the dry filter unit siting process to ensure they do not result in an unacceptable vulnerability from a potential attack location/direction	Bioenvironmental Engineering/Emergency Management/ Planners
- Select dry filter unit employment pattern for collection network.	Dice 5 Pattern Provides wide area collection with depth in order to minimize	Bioenvironmental Engineering/Emergency Management/ Planners

	undetected hazard cloud "pass throughs." When one or more of the Dice 5 dry filter unit sites is in the immediate vicinity of a critical mission facility, this pattern can simultaneously provide perimeter and critical location protection. Small Area Critical Asset Pattern. Provides limited area collection capability when dry filter units availability or the laboratory testing ability is severely limited. Normal procedure is to have single dry filter unit placed in vicinity of facility/area requiring protection. If sufficient dry filter units exist, collectors could be equally placed equally around the perimeter (or as a modified Dice-5) of the area/location of concern. Single Line Perimeter Pattern. Primary use is for situation in which entire area must be protected, Biological Warfare release point(s) will be well outside the perimeter, and line-spray devices (air or mobile ground unit) is likely delivery system. Manpower and equipment heavy for large areas. Combination/Hybrid of Above Patterns. Tailored pattern based on commander's intent that has both specific location and area coverage requirements.	

- Determine the ideal dry filter unit spacing interval (in meters) based on size(s) of area of concern and the number of available collector units for the area.	The ideal dry filter unit spacing interval (in meters) is based on size(s) of area of concern and the total number of available collector units. Use of the Dice 5 pattern with equal distance spacing between collector units is recommended to collect air that is representative for the entire area of concern for each collection period.	Bioenvironmental Engineering/Emergency Management/ Planners
- Refine the selection of precise dry filter unit siting locations by considering the following factors.	Some of the information will be available within Air Force Geobase mapping products. However, planners should use whatever other sources are available (overhead photography, site surveys, etc.) when assessing the following considerations – even if Geobase mapping products are not available.	Bioenvironmental Engineering/Emergency Management/ Planners
Geobase Mission Data Set (MDS) A-2, Management Areas Provides information pertaining to site surface features, vegetation, climate and weather.	Appropriate elevation for the air collection/screening ranges from 1.5 to 2 meters (breathing height). Dry filter units should be located over open, level terrain where there are no significant nearby obstructions that appreciably deflect the wind flow to the dry filter unit from any direction. An unobstructed field of view of at least 270 degrees for ≥ 100 meters is preferable, using the minimum distances to obstacles provided in this checklist. Paved, and unpaved locations with vegetative	Civil Engineer

	ground cover year round are preferred surfaces as they naturally assist in stabilizing the dry filter units. Dry filter units should not be placed in standing water and/or in areas prone to flooding. Avoid steep slopes and sheltered hollows. Trees Place dry filter units 10-20 meters from trees. Place dry filter units at least 10 meters away from single trees or a couple of trees that little impact on the wind flow. Place dry filter units at least 20 meters away from areas with several trees or thick, high foliage.	
Geobase MDS C-1, Installation Layout	Obstacles: The desire is to achieve unimpeded air and particle movement across the collector; obstacles such as buildings and built-up structures interfere with the air flow. A general rule for dry filter unit placement in the vicinity of obstacles is a minimum distance of at least two times the height of the obstruction (nearby buildings, tents, solid fencing, etc.). Example: A building 5 meters high should not have a dry filter unit placed closer than 10 meters away from the building. Aircraft hangars and flight line. Siting collectors in and around aircraft hangers and	Civil Engineer

	the flightline requires special consideration. Hangers often produce a channeling effect similar to an urban canyon. The runway side of hangers and flightline operations are constrained by aircraft safety regulations that likely reduce the potential for effective collector siting.	
Geobase MDS G-4, Electrical Distribution System (Street & Airfield)	Adequate power for the dry filter unit network is a top priority. Dry filter units do not have an operating capacity using batteries, hard wired power is required. If sufficient generators are not available, a tradeoff may exist between the availability of commercial power and the best location(s) for agent collection. Powering dry filter units with commercial power generally requires far-reaching extension cords. 5kW generators are often used when commercial power is beyond access and/or when frequent commercial power interruptions occur. Additional planning for generator availability, fuel, and refueling schedules is required when generators are used. **Note**: In order to prevent emission interferences, place small generators at least one meter away from buildings and other equipment during air collection operations.	Civil Engineer

O-2 Physical Security	Operators require safe and reasonable access to dry filter units. Dry Filter Unit placement should facilitate operator's efforts to perform visual inspections, exchange filter cartridges, generator refueling, etc. When selecting locations, consider: Dry Filter Unit operation involves transporting supplies and equipment to and from the collection site. Reasonable proximity to service roads. Locations that do not require special access. Locations and filter exchanges do not compromise or activate physical security systems. **Note**: Chain-link fencing has a very small impact on the wind field. Dry filter units placed inside a chain-link fenced area will accurately collect a composite sample from the ambient wind field.	Security Forces
B-2 Environmental Emissions. Provides known site air emission data.	If possible avoid areas that are extremely high in dust and other background particulate. This is particularly true if using a Dry Filter Unit-1000 outside. Research indicates extremely dusty or dirty environments can draw in enough 1-10 micron sized particles over time, which are not particles of interest, to cause the filter to reduce air flow. There are some reports indicating diesel and diesel-	Emergency Management

	like materials that are aerosolized can have a detrimental impact on Deoxyribonucleic Acid material collected in dry filter unit filters (thereby adversely affecting the Polymerase Chain Reaction Identification System's ability to identify the agent). Avoid placing dry filter units nearer than 20 meters from high concentrations of machinery and vehicles emitting diesel exhaust, furnace and incineration flues/exhaust, fumes from generators etc.	
Geobase MDS O-1, Surge Capability (Beddown and Support of Deployed Forces)	Provides predictive information for planner pertaining to possible collection grid expansion.	Civil Engineer
Existing and future land use plans	Provides situational awareness and option determination.	Civil Engineer
- Determine if the Laboratory can handle the quantity of samples that will be generated by the proposed dry filter unit siting strategy.		
Determine the maximum daily filter throughput capacity for the in-house or other designated laboratory conducting Polymerase Chain Reaction testing.	Examples: The installation has in house Polymerase Chain Reaction capability and is able to test a maximum of 40 filters for 8 agents daily. The installation does not have in-house Polymerase Chain Reaction capability and uses a contract or state laboratory that is able to test a maximum of 12 filters for 8 agents daily.	Laboratory Service Chief
Identify the maximum number of dry filter units that can operate based on laboratory daily throughput.	Example: The installation has in house Polymerase Chain Reaction capability and is able to test a maximum of 40 filters for 8 agents daily. With this	Bioenvironmental Engineering/Emergency Management/ Planners

	throughput number, the planner identifies options of: • 18 each dry filter units operating and 24-hour filter collection/testing • 18 each dry filter units operating and 12 hr filter collections/testing • 13 each dry filter units operating and 8 hr filter collections/testing • 10 each dry filter units operating and 6 hr filter collections/testing • 6 each dry filter units operating and 4 hr filter collections/testing **Note**: As long as the installation has a credible mass prophylaxis distribution system (e.g., it can complete task within ~6 hours), there is little to no operational benefit in having samples tested in less than 12-hour intervals.	
- Evaluate continuing need for air screening requirement.	Air sampling is conducted continuously as long as credible biological threat(s) persist within the Air Force's operating area(s).	CBRN Control Center
- Reassess grid suitability and make adjustments when and as often as necessary.		Bioenvironmental Engineering/Emergency Management/ Planners
- Dry Filter Unit Site Plan Maintenance.	Ensure all required changes to the dry filter unit siting plan are fully documented and published in appropriate Base Support Plans.	Bioenvironmental Engineering/Emergency Management Planners

Attachment 4

RECEIPT OF PROPERTY FORM

Table A4.1. Receipt of Property Form.

Name of Unit Address Tel # (xxx) xxx-xxxx Fax (xxx) xxx-xxxx	
Receipt of Property Form	
Submitting Activity	
Name (Print) and Organization of Person Requesting Testing:	
Address:	Contact Phone#:
Location from Where Sample/Specimen Obtained:	
Description of Item to Be Tested: **Dry Filter Unit Filters**	Date Collected
Name (Print) and Title of Person Collecting Article: *(if different from above)*	Time Collected
This article has been evaluated and/or tested for explosives and screened for radiological and chemical hazards (N/A for clinical specimens and ambient air samples for screening) _____ *Name (Print) and Title of Responsible person(s)*	
Laboratory Team Use Only	
Article Received from: *(name, title, organization, form of delivery, etc.)*	
Description of Article(s) – (system used, number/quantity, and type/description)	
Two (2) each dry filter unit filters in clear plastic bags, contained within secondary plastic bag. Primary and secondary containers/clear plastic bags are individually labeled. **1.** ROK16011502AOAB0101800 2. ROK16011502BOAB0101800 or Two (2) each dry filter unit filters in individual primary containers within one (1) each secondary plastic bag. One (1) each felt filter disk in a conical tube with 10 mL of Phosphate Buffered Solution. One (1) each dry felt filter disk in clear plastic bag. Containers are individually labeled. 1. ROK16011502AOAB0101800 2. ROK16011502BOAB0101800	
Received From: (sign / date / time)	

Attachment 5

AIR FORCE LABORATORY CHAIN OF CUSTODY FORM

Table A5.1. Chain of Custody Form.

Name of Unit
Address
Tel # (xxx) xxx-xxxx Fax (xxx) xxx-xxxx

Chain of Custody

Date & Time	Released By	Received By	Purpose of Change in Custody
	Signature	Signature	
	Name, Title	Name, Title	
	Signature	Signature	
	Name, Title	Name, Title	
	Signature	Signature	
	Name, Title	Name, Title	
	Signature	Signature	
	Name, Title	Name, Title	
	Signature	Signature	
	Name, Title	Name, Title	
	Signature	Signature	
	Name, Title	Name, Title	
	Signature	Signature	
	Name, Title	Name, Title	
	Signature	Signature	
	Name, Title	Name, Title	

Final Disposal Action

Released to:_____
Print Name, Title, Organization

Destroyed: _____ _____
Date Signature of Person Destroying Articles(s)

Witness to Destruction of Articles(s)
The articles(s) listed above was (were) destroyed by the custodian, in my presence, on the date indicated above.

_____ _____
Print Name, Title, Organization Signature

Attachment 6

BIOLOGICAL THREAT CONSIDERATIONS TO SUPPORT RECOMMENDATIONS TO SENIOR LEADERSHIP

A6.1. Information worksheet for the Threat Working Group.

A6.1.1. Worksheet Goals:

A6.1.2. Threat information aggregation platform enabling Working Group members to develop Biological Warfare-related recommendation to Senior Leadership.

A6.1.3. Highlight timely, relevant,, and unique cross functional information which serves to cue or direct environmental surveillance to identify agent presence and begin treatment prior to the presentation of sentinel casualties.

A6.2. Background.

A6.2.1. In Accordance With Department of Defense Instruction 2000.16 Vol. 1, a Threat Working Group shall be established at Department of Defense installations, self-supported separate facilities, and higher headquarters which meets as needed to analyze and counter emergent threats.

A6.2.2. The Threat Working Group membership includes the installation commander or an antiterrorism program manager; the antiterrorism officer; intelligence, investigative, LE, and security representatives; medical representatives; specialists in CBRN consequence management and CBRN incidence preparedness, if available; and appropriate representation from installation tenants; and local, State, federal, tribal, and host nation authorities, as required.

A6.3. Biological Related Threat Working Group Activities.

A6.3.1. Air Force Office of Special Investigations and Intelligence monitor the biological threat on a routine basis and notify the Threat Working Group if threat indicators are significant enough to require a Threat Working Group meeting to discuss the situation. In order to make the Threat Working Group as productive as possible Emergency Management and Bioenvironmental Engineering should gather information regarding the threat prior to the meeting and develop actionable recommendations regarding biological warfare sample collection and testing.

A6.3.2. The worksheet is a tool that can be used prior to attending the Threat Working Group or similar work group, by each agency having knowledge of the threat or responsible for providing recommendations to senior leadership. The tool will help develop a logistically feasible set of recommendations based on perceived threat; risk tolerance; and manpower, medical countermeasures, and equipment availability.

Table A6.1. Indicator/Trigger Chart.

Question/Issue	Yes	No	Possible Action	Recommendation
Are there indicators of an increase in biological threat in the Area of Responsibility	X	No action	Attain all available information on the change	Inform Leadership
Are there indicators the biological threat has increased in the local area	X	No Action	Attain all possible information on the change	Schedule Threat Working Group
Are potential threat agents clearly defined?	X	Request Information	Collect information from local Intel, OSI, Medical Review all information on specific threat agents.	Assess information to determine if changes in posture or response measures are required. If not upchannel situation update.
Are potential delivery systems identified to include the most likely delivery mechanisms against air bases?	X	Request information	Assess information to determine if counter Biological Warfare capability is sufficient to satisfactorily mitigate the threat	
Are effective medical counter-measures in place for the potential threat environment?	No Action	X	Determine the delta and develop possible Course of Action's	Provide Course of Action's and recommendations to Threat Working Group and other appropriate forums Request required medications through appropriate channels
Are sample collection assets available in sufficient quantities	No Action	X	Develop phased sample collection plan e.g., procedures and setup before and	Request required sample collection assets from Higher Headquarters based on Commanders

Question/Issue	Yes	No	Possible Action	Recommendation
			after arrival of supplemental resources	goals, siting criteria and Home Station Medical Response laboratory throughput capacity
Are sample identification assets available in sufficient quantities	No Action	X	Develop phased sample identification plan e.g., procedures and setup before and after Higher Headquarters response. Immunoassay technology might be the only detection and identification capability available until Home Station Medical Response assets are delivered.	Request Home Station Medical Response capability and expected arrival time, and sample transport instructions to off-site laboratory.
Has a communication plan for notifying the population of the threat and expected response actions been developed and coordinated with senior leadership and Public Affairs	No Action	X	Develop Course of Action's and recommendations	Provide Course of Action's and recommendations to the Threat Working Group and other appropriate forums

Attachment 7

BIOLOGICAL AGENT DECAY RATES (AEROSOL, SURFACES)

A7.1. Persistence of Agent. Some materials can be stable in the environment for years, but other agents can experience very rapid decreases in their ability to infect after release. Differences in types of testing, conditions tested, reliability of test methods, and severe limitations of the testing data create a situation where much uncertainty and more gaps in the knowledge base than absolute knowledge exist. The available information is contained in this attachment.

A7.1.1. Caution must be used when examining decay rates because some of the influential factors might never be known by Air Force personnel. For example, agents can be prepared and released in different manners, and these differences affect decay factors. Production and preparation factors result in differences in the strength of an agent. Storage before weaponization matters.

A7.1.2. Agent survival when filled into a weapon and during release can have a substantial impact. When released by the weapon system, losses occur before the environmental decay factors which cause both physical and biological decay of effective strength occur.

A7.2. Measuring Agent Decay. Agent decay can and has been measured in different ways. If the decay rate is a function of the ability to culture the agent on a particular media under certain conditions, this is normally described as viability. If the decay rate is a function of the ability to infect, this is normally described as infectivity. If the decay rate is a function of the ability to successfully infect and cause illness, this is normally described as virulence. In addition, to what degree can the specified measure be identified and quantified by Polymerase Chain Reaction or by immunoassay technologies such as Enzyme Linked Immunosorbent Assay. These differences in measuring the biological agent all are likely to provide different estimates of the quantity and quality of a biological agent required to accomplish a particular desired effect.

A7.2.1. While many of the processes involved in agent decay may be functions of time, the decay rates associated with agent release to the environment and the deposition of an aerosolized or liquid agent onto a surface tend to be instantaneous events. In some cases, the decay functions of instantaneous events are separately enumerated in test reports, but in other cases, the losses in effective agent amounts are included in the time-based decay rates calculated from test data without distinction.

A7.2.2. Historical testing found the classic decay rates for storage of agent, aerosol environmental decay, decay of the agent on a surface, or a fluid are time-based exponential decay rates. Unfortunately, different decay rates exist for the same agents based on wet/dry source conditions, agent strain, preparation of the agent before release, ultraviolet light (day/night), temperature, relative humidity, surfaces, presence of certain chemical presences, or combinations of two or more of these factors. Consequently, it is difficult to produce simple charts that generalize decay rates across agents because of the different sets of influential environmental factor combinations.

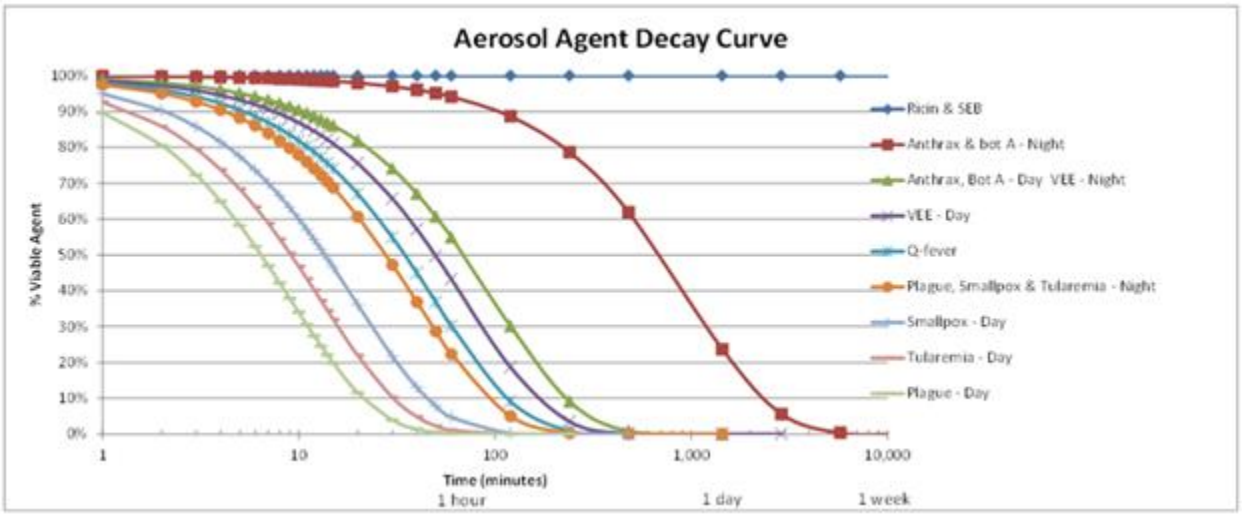
A7.2.3. Generating an aerosol which is an appropriate size (1 to 5 μm diameter) to deposit in the lung requires energy (explosive, pressure through a nozzle, nebulizer flow) which can result in damaging organisms and can even break down some toxins. The losses during dissemination are captured as the dissemination efficiency. Dissemination efficiencies vary

by agent, wet or dry release, and the design of the releasing systems. Some of the dissemination systems developed when the US had an offensive program had dissemination efficiencies as low as 1%, and others had efficiencies as high as 50%.

A7.2.4. Key environmental factors of sunlight (ultraviolet light exposure), temperature, and humidity all can affect the survival and infectivity of biological organisms or toxins. The susceptibility to these environmental factors can manifest itself by breaking nucleic acids (ultraviolet light), by desiccating vegetative organisms, or by causing particles to gain (or lose) liquid which changes the trajectory and ability to efficiently enter the desired route of entry. Some organisms have developed techniques which reduce the impact of environmental exposure (*Bacillus anthracis* forms spores which are very resistant to damage in the environment). Other organisms are very susceptible to damage in the environment (*Yersinia pestis*).

A7.2.5. The following figure, entitled "Aerosol Agent Decay Curve", illustrates the impact of different aerosol decay rates (using the values represented within Hazard Prediction Assessment Capability or Joint Effects Model models to represent the hazards from aerosol releases of biological agents). The aerosol decay rates represent the amount of agent that would remain (typically viable agent) that would be measured by culturing for pathogens and intoxication for toxins after a particular period of time. With zero decay rates, the ricin and Staphylococcal Enterotoxin B toxins remain at 100% of the original strength forever. The theoretical transport of *Bacillus anthracis* and botulinum toxin A (bot A) during continuous night time conditions (no Ultraviolet light exposure) is still at 87.8% initial strength at 2 hours after release, 61.9% of original strength at 4 hours after release, 23.7% initial strength at 24 hours after release, 5.6% after 2 days, 0.3% after 4 days, and achieves a 5 Logarithm reduction in just over a week. At the fast decay rate side of the spectrum, dry plague is expected to decay to 34% of original viable organisms by 10 minutes of aerosol transport, 0.2% by 1 hour, and by more than a 5 Logarithm kill rate by 2 hours after release.

Figure A7.1. Aerosol Agent Decay Curve.



A7.2.5.1. The figure above shows one set of aerosol decay rates, and the resulting impact on the stability of the aerosol. Some pathogens and toxins can be effectively transported for hundreds of kilometers, while others can be limited to a few kilometers with the same

starting payload in a device. For example, assuming between 1 and 5 meter/second wind speed (3.6 to 18 km/hr), a 5 to 10 micron diameter particle size which does not gravitationally settle out of the atmosphere would cover the area downwind of the release as shown in the table below.

Table A7.1. Cloud Extent after Release.

Cloud Extent after Instantaneous Release			
Time after release (hours)	Wind Speed (meters/second)	Trailing edge of cloud (kilometers)	Forward edge of cloud (kilometers)
0.25	1	0.45	1.8
0.5	1	0.9	3.6
1	1	1.8	7.2
12	1	22	86
24	1	43	173
0.25	3	1.4	5.4
0.5	3	2.7	11
1	3	5.4	22
12	3	65	260
24	3	130	518
0.25	5	2.3	9
0.5	5	4.5	18
1	5	9	36
12	5	108	432
24	5	216	864

A7.2.5.2. By contrasting the location of the leading and trailing edges of the aerosol cloud as a function of time with the atmospheric decay characteristics, one can understand a number of relationships. First item of note is that even the most rapidly decaying agents probably cover an airfield target area with effective agent (using a rule of thumb that releases generally put 2 to 6 orders of magnitude higher than necessary for intended median infective or intoxicating doses). Second item of note is that releases from 100s of kilometers away can effectively retain infective or intoxicating agent which has not decayed during atmospheric transport for those agents with the lower decay rates. It is the diffusion of the agent cloud that would determine the risk to the population exposed. Third item of note is that the cloud passes over an airbase sized target relatively quickly if the release is at or near the airbase, but could take considerable time if the release is more than a few 10s of kilometers upwind of the base. While the combinations of the aerosol decay rate and cloud travel distance table do not address this issue, it is also a point to be made that agent deposition levels on surfaces is highest close to the release point, and will diminish greatly the further that the aerosol travels downwind.

A7.2.5.3. A 99% decay is a 2 order of magnitude decrease in effective agent strength. A common target of biological warfare decontamination goals has often been to achieve a 6 Logarithm kill, or to achieve a 99.9999% destruction of agent. HEPA filters are designed to reduce agent levels by 99.97%. The following table shows the relationship between decay rate and the time to a particular Logarithm kill level. For high decay rates (like

10%/min), 6 Logarithm kills are achieved in 1 hour. If the decay rate is 0.1%min, then the 6 Logarithm kill takes days. Decay rates just below 0.001%/min take over a year to achieve a 6 Logarithm kill.

Table A7.2. Relationship between Decay Rate and Time to Reach a Level of Decay.

Relationship between Decay Rate and Time to Reach a Level of Decay			
Decay rate (%/min)	Time to reach 2 Logarithm kill (99% decay)	Time to reach 4 Logarithm kill (99.99% decay)	Time to reach 6 Logarithm kill (99.9999% decay)
10	20 minutes	40 minutes	1 hour
1	3.3 hours	6.7 hours	10 hours
0.1	1.4 days	2.8 days	4.2 days
0.01	14 days	28 days	1.4 months
0.001	4.6 months	9.3 months	14 months
0.0001	3.8 years	7.6 years	11 years
0.00001	38 years	76 years	111 years

A7.2.6. The aerosol decay rate tables below are partial collections of literature values of aerosol decay rates. The tables capture much of the available decay rate knowledge based on wet/dry release, day or night ultraviolet light conditions, temperature, and relative humidity.

A7.2.6.1. The decay rate itself is expressed in percent per minute. This means that a given percent decays in the first minute (5% for instance), then 5% of the remaining agent decays in the second minute, 5% of the remaining agent decays in the third minute, etc. You cannot simply take 100 and divide it by the decay rate to determine how many minutes the agent will remain. Consequently, the next three columns to the right reflect the time in hours to decay 50%, 95%, and 99% of the original material respectively. While the values in these three columns are by default in hours, the values, when appropriate, are annotated with a ^{d} for days, ^{m} for months, and ^{y} for years.

Table A7.3. Aerosol Decay Rates.

Agent	Decay Rate (%/min)	Time to 50% decay (hours)	Time to 95% decay (hours)	Time to 99% decay (hours)	Day/Night (ultraviolet factor)	Temperature (^{o}C)	Relative Humidity (%)	Reference
Bacteria								
Anthrax (wet or dry)	0	∞	∞	∞	Night			*; Miller & Artenstein, 1967
Anthrax (dry)	0.1	5.0	21.7	1.4^{d}	Night	25	30 50 85	(Van Meter, Krieger, & Cleveland, 1965)

Agent	Decay Rate (%/min)	Time to 50% decay (hours)	Time to 95% decay (hours)	Time to 99% decay (hours)	Day/Night (ultraviolet factor)	Temperature (^{o}C)	Relative Humidity (%)	Reference
Anthrax (wet or dry)	0.1	5.0	21.7	33.3	Night			Hazard Prediction and Assessment Capability
Anthrax (wet or dry)	1	0.5	2.2	3.3	Day			Hazard Prediction and Assessment Capability
Anthrax (wet or dry)	1	0.5	2.2	3.3	Day			(Stuart & Wilkening, 2005)
Brucellosis	1.43 0.91 0.18 0.87 0.59 0.05 0.28 0.16 0.04	0.35 0.55 2.8 0.58 0.85 10 1.8 3.1 12.5	1.5 2.4 12.0 2.5 3.7 1.8[d] 7.7 13.6 2.3[d]	2.3 3.7 18.5 3.8 5.6 2.8[d] 11.9 20.8 3.5[d]	Night	35 35 35 17 17 17 6 6 6	20 50 85 20 50 85 20 50 85	(Kaufman, 1983)
Brucellosis (wet) Bomblets and/or Sprayer	1.5 to 2	0.3	1.3	1.9	Night	25	Not significantly different	(Kaufman, 1983)
Plague	0.057	8.8	1.6[d]	2.4[d]	Night			(Durnford, et al., 1992)
Plague	0.75	0.67	2.9	4.5	Direct sunlight			(Durnford, et al., 1992)
Plague (wet or dry)	2.5	0.2	0.9	1.3	Night			Hazard Prediction and Assessment Capability
Plague	3.3	0.15	0.65	1.0	Day			(World Health Organization

Agent	Decay Rate (%/min)	Time to 50% decay (hours)	Time to 95% decay (hours)	Time to 99% decay (hours)	Day/Night (ultraviolet factor)	Temperature (^{o}C)	Relative Humidity (%)	Reference
								Group of Consultants, 1970)
Plague (wet)	5.8 3.5 4.4	0.1 0.1 0.1	0.4 0.6 0.5	0.6 1.0 0.8	Night	26 26 26	81 50 20	(Won & Ross, 1966)
Plague (wet)	4 to 10	0.079	0.34	0.53	Night			(McNally, et al., 1994a)
Plague (wet)	30 10 3	0.02 0.05 0.17	0.07 0.22 0.72	0.11 0.33 1.1	Night		30 50 85	Anon., 1970a
Plague (wet or dry)	10.8	0.05	0.20	0.31	Day			Hazard Prediction and Assessment Capability
Plague (wet)	10 to 30	0.029	0.13	0.19	Day			(McNally, et al., 1994a)
Q-fever (wet)	0.5	1.0	4.3	6.7	Night			(Roetzel, 1969)
Q-fever (wet)	0.9	0.56	2.4	3.7	Night			*
Q-fever (wet or dry)	2	0.3	1.1	1.7	Night			Hazard Prediction and Assessment Capability
Q-fever (wet or dry)	2	0.3	1.1	1.7	Day			Hazard Prediction and Assessment Capability
Tularemia (dry)	0 2.6	∞ 0.19	∞ 0.83	∞ 1.3	Night	-16 -> -39 4 -> 16		*
Tularemia (wet)	0.028	18	3.3[d]	5.0[d]			90	(Sinclair, Boone, Greeberg, Keim, &

Agent	Decay Rate (%/min)	Time to 50% decay (hours)	Time to 95% decay (hours)	Time to 99% decay (hours)	Day/Night (ultraviolet factor)	Temperature (^{o}C)	Relative Humidity (%)	Reference
								Gerba, 2008) (Cox, 1971) (Cox & Goldberg, 1972)
Tularemia (wet or dry)	0.8	0.63	2.7	4.2	Night			(Heden, 1967)
Tularemia (wet)	1.6 0.4 0.6 0.9 1.5 1.5 3.5	0.3 1.2 0.8 0.5 0.3 0.3 0.1	1.3 5.2 3.5 2.3 1.4 1.4 0.6	2.0 7.9 5.4 3.6 2.2 2.2 1.0		-40 -29 -7 24 29 29 35	Ambient Ambient Ambient 85 85 85 85	(Ehrlich & Miller, 1973)
Tularemia (dry)	4.5 6.7 5.8 4.9 4.5 3.0 2.9 1.0 0.9	0.1 0.1 0.1 0.1 0.1 0.2 0.2 0.5 0.6	0.5 0.3 0.4 0.4 0.5 0.7 0.7 2.3 2.5	0.7 0.5 0.6 0.7 0.7 1.1 1.1 3.5 3.8		90 80 70 60 50 40 30 20 0		(Cox, 1971) (Cox & Goldberg, 1972)
Tularemia (wet)	1.9 1.1	0.26 0.46	1.1 2.0	1.8 3.0	Night	-16 -> -39 4 -> 16		*
Tularemia (wet or dry)	2.5	0.2	0.9	1.3	Night			Hazard Prediction and Assessment Capability
Tularemia (wet)	2.8	0.18	0.77	1.2	Night	-39 -> 24 Not significantly different	16 -> 85 Not significantly different	*
Tularemia (wet)	0.03 0.9 1.5	19.7 0.6 0.3	3.6[d] 2.5 1.4	5.5[d] 3.8 2.2		90 80 70		(Cox, 1971) (Cox &

Agent	Decay Rate (%/min)	Time to 50% decay (hours)	Time to 95% decay (hours)	Time to 99% decay (hours)	Day/Night (ultraviolet factor)	Temperature (^{o}C)	Relative Humidity (%)	Reference
	5.9 6.9 6.9 6.7 2.9 2.9	0.1 0.1 0.1 0.1 0.2 0.2	0.4 0.3 0.3 0.3 0.8 0.8	0.6 0.5 0.5 0.5 1.2 1.2		60 50 40 30 20 0		Goldberg, 1972)
Tularemia (dry)	2.5 3.5 5.5	0.20 0.14 0.09	0.87 0.62 0.39	1.3 0.9 0.61	Night		30 50 85	*
Tularemia (dry) bomblet	5.0 5.0 5.0	0.10 0.10 0.10	0.43 0.43 0.43	0.67 0.67 0.67	Night	25	30 50 85	(Van Meter, Krieger, & Cleveland, 1965)
Tularemia (wet or dry)	7.6	0.1	0.3	0.4	Day			Hazard Prediction and Assessment Capability
Tularemia (wet) bomblet	8.0 8.0 1.0	0.06 0.06 0.50	0.27 0.27 2.2	0.42 0.42 3.3	Night	25	30 50 85	(Van Meter, Krieger, & Cleveland, 1965)
Tularemia (wet) sprayer	8.0 8.0 1.0	0.06 0.06 0.50	0.27 0.27 2.2	0.42 0.42 3.3	Night	25	30 50 85	(Van Meter, Krieger, & Cleveland, 1965)
Tularemia (wet) bomblet	8.0 8.0 1.0	0.06 0.06 0.50	0.27 0.27 2.2	0.42 0.42 3.3	Night	25	30 50 85	(Van Meter, Krieger, & Cleveland, 1965)
Virus								
Marburg (wet)	5	0.1	0.4	0.7	Night			(Belanov, et al., 1996)
Rift Valley Fever (wet)	4 6.5	0.1 0.08	0.5 0.3	0.8 0.5	Night		50 85	*

Agent	Decay Rate (%/min)	Time to 50% decay (hours)	Time to 95% decay (hours)	Time to 99% decay (hours)	Day/Night (ultraviolet factor)	Temperature (^{o}C)	Relative Humidity (%)	Reference
Smallpox (vaccinia) (wet)	0.01 0.01 0.04 0.05 0.06 0.22 0.5	3.5[d] 1.5[d] 0.6[d] 0.4[d] 0.3[d] 0.1[d] 0.4[d]	14.9[d] 6.7[d] 2.6[d] 1.7[d] 1.4[d] 0.4[d] 1.7[d]	22.9[d] 10.3[d] 3.9[d] 2.6[d] 2.2[d] 0.6[d] 2.6	Night	10.5 - 11.5 10.6 - 11.5 10.7 --11.7 21 – 23.1 21 – 23.2 21 – 23.2 31 – 33.5	20 50 80 26 50 80 20	(Wolff & Croon, 1968)
Smallpox	1.6	0.3	1.4	2.1	Night	-1, 21,and 32 Not significantly different	30, 50, and 85 Not significantly different	*
Smallpox (wet or dry	2.5	0.2	0.9	1.3	Night			Hazard Prediction and Assessment Capability
Smallpox (wet or dry)	5.1	0.1	0.4	0.7	Day			Hazard Prediction and Assessment Capability
Venezuelan Equine Encephalitis (wet)	0.01 0.05 0.09 0.08 0.17 0.21 0.15 0.38 1.4	1.8[d] 11.1 5.9 6.6 2.9 2.4 3.3 1.3 0.3	7.9[d] 2.0[d] 1.1[d] 1.2[d] 0.5 0.4 0.6 0.2 0.1	12.1[d] 3.1[d] 1.6[d] 1.8[d] 0.8 0.7 0.9 0.4 0.1	Night	9 – 9.5 9 – 9.5 9 – 9.5 21 – 23 21 – 23 21 – 23 20.5 – 23.5 20.5 – 23.5 20.5 – 23.5	19 48 86 19-23 50 81-86 19 48 81 - 85	(Harper, 1961)
Venezuelan Equine Encephalitis (wet)	0.5 0.4 < 1.0	1.0 1.3 0.5	4.3 5.4 2.3	6.7 8.3 3.5	Night		30 50-55 80	(Kaufman, 1983)
Venezuelan Equine	1	0.5	2.2	3.3	Night			Hazard Prediction and

Agent	Decay Rate (%/min)	Time to 50% decay (hours)	Time to 95% decay (hours)	Time to 99% decay (hours)	Day/Night (ultraviolet factor)	Temperature (°C)	Relative Humidity (%)	Reference
Encephalitis (wet or dry)								Assessment Capability
Venezuelan Equine Encephalitis (wet or dry)	1.4	0.4	1.5	2.4	Day			Hazard Prediction and Assessment Capability
Venezuelan Equine Encephalitis (dry)	1.2 3 3.6	0.4 0.17 0.14	1.8 0.7 0.6	2.8 1.1 0.9	Night		30 50-55 80	(Kaufman, 1983)
Venezuelan Equine Encephalitis (wet or dry)	(Survive 15 minutes in direct sunlight) 13.3	0.038	0.16	0.25	Day			(Day, 1981)
Viral encephalitis and hemorrhagic fever agents	0.0012	18.1d	2.6m	4.0m		21	23	(Sinclair, Boone, Greeberg, Keim, & Gerba, 2008)
Viral encephalitis and hemorrhagic fever agents	3.3	0.15	0.65	1.0		22	50	(Sinclair, Boone, Greeberg, Keim, & Gerba, 2008)
Toxin								
Botulinum A (wet or dry)	0.1	5.0	21.7	33.3	Night			Hazard Prediction and Assessment Capability

Agent	Decay Rate (%/min)	Time to 50% decay (hours)	Time to 95% decay (hours)	Time to 99% decay (hours)	Day/Night (ultraviolet factor)	Temperature (^{o}C)	Relative Humidity (%)	Reference
Botulinum A (wet or dry)	1	0.5	2.2	3.3	Day			Hazard Prediction and Assessment Capability
Botulinum A (wet or dry)	7.8	0.1	0.3	0.4	Day			(Dugway Proving Ground, 1977)
Ricin (wet or dry)	0	∞	∞	∞	Night			Hazard Prediction and Assessment Capability
Ricin (wet or dry)	0	∞	∞	∞	Day			Hazard Prediction and Assessment Capability
Staphylococcal Enterotoxin B (wet or dry)	0	∞	∞	∞	Night			Hazard Prediction and Assessment Capability
Staphylococcal Enterotoxin B (wet or dry)	0	∞	∞	∞	Day			Hazard Prediction and Assessment Capability

[d] Time in Days
[m] Time in Months
[y] Time in Years

Table A7.4. On Surface Decay Rates.

Agent	Decay Rate (%/min)	Time to 50% decay (hours)	Time to 95% decay (hours)	Time to 99% decay (hours)	Surface	Temperature (^{o}C)	Relative Humidity (%)	Reference
Anthrax	0.0000095	6^{y}	26^{y}	40^{y}	In soil			(Kaufman, 1983); (Day, 1981)
Anthrax	0.000011 0.0000093	5.2^{y} 6.2^{y}	23^{y} 27^{y}	35^{y} 41^{y}	Paper Filter			(Novel & Reh, 1947)
Anthrax	0.000230.000017	3.0^{m} 3.4^{y}	1.1^{y} 15^{y}	1.7^{y} 22^{y}	Dry Spores, canvas			(Graham-Smith, 1930)
Anthrax	0.0058 0.0019 0.0019 0.00025	3.6^{d} 11^{d} 11^{d} 2.8^{m}	16^{d} 1.6^{m} 1.6^{m} 1.0^{y}	24^{d} 2.5^{m} 2.5^{m} 1.5^{y}	Glass Wood Concrete Topsoil			*
Anthrax Vegetative cells	0.028	18.1	3.3^{d}	5.0^{d}	Topsoil no ultraviolet		46	(U.S. Environmental Protection Agency, 2014c)
Anthrax Vegetative cells	0.033	15.1	2.7^{d}	4.2^{d}	Topsoil simulated sunlight		60	(U.S. Environmental Protection Agency, 2014c)
Brucellosis	(Indefinitely) 0.00077 0.8	∞ 27.1 d 0.6	∞ 3.9^{m} 2.6	∞ 6.0^{m} 4.0	Frozen & protected Kept moist Kept moist	10 -> 15 45 -> 50		(Metcalf, Luchsinget, & Ray, 1994)
Brucellosis	0.0025	8.4 ^{d}	1.2^{m}	1.9^{m}	Aluminum and glass	22 5	40 30	(Calfee & Wending, 2012)

Agent	Decay Rate (%/min)	Time to 50% decay (hours)	Time to 95% decay (hours)	Time to 99% decay (hours)	Surface	Temperature (^{o}C)	Relative Humidity (%)	Reference
					Aluminum, glass, & wood			
Brucellosis (B. suis)	0.015 0.050 0.0050 0.083 0.060 0.42 0.042 0.42 .015 0.29 0.0050 0.21 0.015 0.030 0.0050 0.030 0.020 0.0050	1.4d 10.1 4.2d 6.0 8.4 1.2 11.9 1.2 1.4d 1.7 4.2d 2.4 1.4 16.8 4.2d 16.9 1.1d 4.2d	6.1d 1.8d 18d 1.1d 1.5d 5.2 2.1d 5.2 6.1d 7.4 18.2d 10.4 6.1d 3d 18.2d 3.0d 4.6d 18.2d	9.3d 2.8d 28d 1.7d 2.3d 8.0 3.3d 8.0 9.3d 11.3 28d 16.0 9.3d 4.7d 28d 4.7d 7.0d 28d	Aluminum Aluminum ultraviolet Aluminum Aluminum ultraviolet Concrete Concrete ultraviolet Concrete Concrete ultraviolet Glass Glass ultraviolet Glass Glass ultraviolet Soil Soil ultraviolet Soil Soil ultraviolet Wood Wood	22 22 6 6 22 22 6 6 22 22 6 6 22 22 6 6 22 6		*
Plague	0.00046	1.5[m]	6.5[m]	10[m]	Soil	4 -> 8		(Sinclair, Boone, Greeberg, Keim, & Gerba, 2008)
Plague A1122 (HIB with 1% peptone)	0.07 0.35 27.8 1.16	6.7 1.5 0.02 0.4	1.2[d] 6.3 0.08 1.9	1.9[d] 9.6 0.1 2.9	Metal	30 30 30 22	11 100 52 52	(Wilkinson, 1966)

Agent	Decay Rate (%/min)	Time to 50% decay (hours)	Time to 95% decay (hours)	Time to 99% decay (hours)	Surface	Temperature (^{o}C)	Relative Humidity (%)	Reference
Plague Harbin (PB)	2.06 1.52 1.42 0.43	0.2 0.3 0.4 1.2	1.1 1.4 1.5 5.0	1.6 2.2 2.3 7.7	Stainless steel Polyethylene Glass Paper	18 – 22 18 - 22 18 - 22 18 - 22	55 55 55 55	(Rose, Donlan, & Banerjee, 2003)
Plague	3.3	0.15	0.65	1.0	Sunlight			WHO, 1970
Q-fever (wet)	0.00077 % 0.0003	27.1 ^{d} 2.3^{m}	5.9^{m} 9.8^{m}	6.0^{m} 1.2^{y}	Sand & wood	15 -> 20 4 -> 6		(Day, 1981) *
Q-fever (dry)	0.00077 % 0.0003	27.1 ^{d} 2.3^{m}	5.9^{m} 9.8^{m}	6.0^{m} 1.2^{y}	Sand & wood	15 -> 20 4 -> 6		(Day, 1981) (Anon, 1970b)
Tularemia	0.0012	18.1 ^{d}	2.6^{m}	4.0^{m}	Moist soil and other media			(U.S. Army Medical Research Institute of Infectious Diseases, 2005) (Kortepeter, et al., 2001)
Tularemia	0.22 0.41 0.019 0.75 0.64 0.62 0.42	2.3 1.2 1.1^{d} 0.7 0.8 0.8 1.2	10.0 5.3 4.7^{d} 2.9 3.4 3.5 5.2	15.4 8.2 7.3^{d} 4.4 5.2 5.4 8.0	Metal	25 25 25 37 37 37 37	100 65 10 100 80 65 55	(Wilkinson, 1966)
Smallpox (Vaccinia)	< 0.0066 0.091 < 0.0050 0.024	> 3.2^{d} 5.5 > 4.2^{d} 20.6	> 14^{d} 23.8 > 18^{d} 3.7^{d} > 14^{d}	> 21^{d} 1.5^{d} > 28^{d} 5.7^{d} >21^{d}	Glass Glass Glass Glass Galvanized metal	22 22 6 6 22	10% 90% 10% 90% 10%	*

Agent	Decay Rate (%/min)	Time to 50% decay (hours)	Time to 95% decay (hours)	Time to 99% decay (hours)	Surface	Temperature (^{o}C)	Relative Humidity (%)	Reference
	< 0.0066	> 3.2[d]	9.0	14	Galvanized metal	22	90%	
			> 18[d]	> 28[d]	Galvanized metal	6	10%	
	0.24	2.1						
			2.1[d]	3.3[d]	Galvanized metal	6	90%	
	< 0.0050	> 4.2[d]	> 14[d]	> 21[d]	Painted cinder block	22	10%	
	0.042	11.9	3.7[d]	5.7[d]		22	90%	
					Painted			
	< 0.0066	> 3.2[d]	> 18[d]	> 28[d]	cinder block	6	10%	
			6.4[d]	9.9[d]	Painted	6	90%	
	0.24	20.6			cinder			
			3.7[d]	5.7[d]	block	22	10%	
	<	>	4.7	7.2	Painted	22	90%	
	0.0050	4.2[d]	13[d]	20[d]	cinder	6	10%	
			6.4[d]	9.9[d]	block	6	90%	
	0.014	1.5[d]			Carpet			
					Carpet			
	0.024	20.6			Carpet			
	0.46	1.1			Carpet			
	0.00068	3.1[d]						
	0.014	1.5[d]						
Viral encephalitis and hemorrhagic fever agents	0.0028	7.5[d]	1.1[m]	1.7[m]	Tissue culture medium on glass	4	55	(Piercy & al., 2010)
	0.48	1	4.5		Soil			
Staphylococcal Enterotoxin B	No significant decay	∞	∞	6.9	Dry metal (no sun)			*
	No significant decay	∞	∞	∞	Wood (no sun)			
				∞	With sun on			

Agent	Decay Rate (%/min)	Time to 50% decay (hours)	Time to 95% decay (hours)	Time to 99% decay (hours)	Surface	Temperature (^{o}C)	Relative Humidity (%)	Reference
	Significant decay				deposited material			
T-2 mycotoxins	0.00013	5.5^{m}	2.0^{y}	3.0^{y}		Room temperature		(U.S. Army Medical Research Institute of Infectious Diseases, 2005) (Kortepeter ,et al., 2001)

Attachment 8

BIOLOGICAL WARFARE AGENT RESUSPENSION HAZARDS

A8.1. Resuspension Hazards. Biological warfare agents, through the resuspension mechanism, present a residual danger to Air Force personnel in addition to the primary threat the agents pose as the hazard cloud passes over the installation. The length and magnitude of the residual hazard depends on several factors such as the agent involved, location of people in relation to the biological warfare release point(s), amount of time that has passed after the attack, weather conditions at and after the time of attack, physical location of the agent (inside, outside, type of surface), and the likely route of entry. **Note**: Although the threat presents risks that must be evaluated, the residual hazard from biological warfare agents is not nearly as robust as the residual hazard associated with Chemical Warfare Agent and radioactivity.

A8.1.1. It is important also to consider that turning on the dry filter unit network can provide benefit in more than providing just a detect-to-treat capability.

A8.1.2. Installations can employ dry filter unit sampling after an attack to establish that the primary aerosol cloud has passed, and if a residual aerosolized hazard remains on the airbase as time passes. While results from dry filter unit collection activities will enable installations to get a rough idea of the area that was in the hazard area, we will not know with full accuracy what resources were in the area at the time of cloud passage and what resources were subsequently affected or unaffected by resuspension of the biological material.

A8.1.3. Biological warfare detectors and identification systems do not have the sensitivity required to identify all potential resuspension hazards. Consequently, CBRN advisors must consider five primary items when evaluating the risk associated with biological warfare agent resuspension.

A8.1.3.1. Time after the attack. Some agents have short life spans once released into the environment, so even if the material presents a resuspension hazard it will only do so for a short time period. Conversely, other agents can present an extended hazard. See Attachment D for additional information regarding biological warfare agent decay rates. Despite the variability of results, most models assume the resuspension factor decays over time i.e., less hazard as time increases.

A8.1.3.2. Location of people in relation to the biological warfare release point. This factor will generally be unknown. However, in general only 1% to 10% of an aerosol deposits on surfaces, and of that, only 1% to 10% of the deposited material can be re-aerosolized. This means the largest re-aerosolization hazard comes from the high deposition areas, typically within 20 meters of a sub-munition or a few tens of meters from a sprayer.

A8.1.3.3. Location of people in relation to structures. The ability of an agent to enter a building depends on the type of building and whether or not the facility is open or closed. The following table comes from a Stanford University study entitled “Behavior of Aerosol Clouds within Cities”. **Note**: Attenuation from penetration has the effect of lowering the assumed deposition velocity by a factor of 10 i.e., it takes ten times the exterior dosage to produce an inside deposition capable of being re-suspended to produce a Median Effective Dose.

Table A8.1. Penetration of Buildings (Ratio of Inside to Outside Ground-Level Dosages).

Location	Season	Building Type	Median Value (%)
Minneapolis	Summer	Residence	58
Minneapolis	Summer	Office	31
Minneapolis	Winter	Office – Closed	15
Minneapolis	Winter	School – Closed	12
St. Louis	Summer	Various – All Windows Closed	34

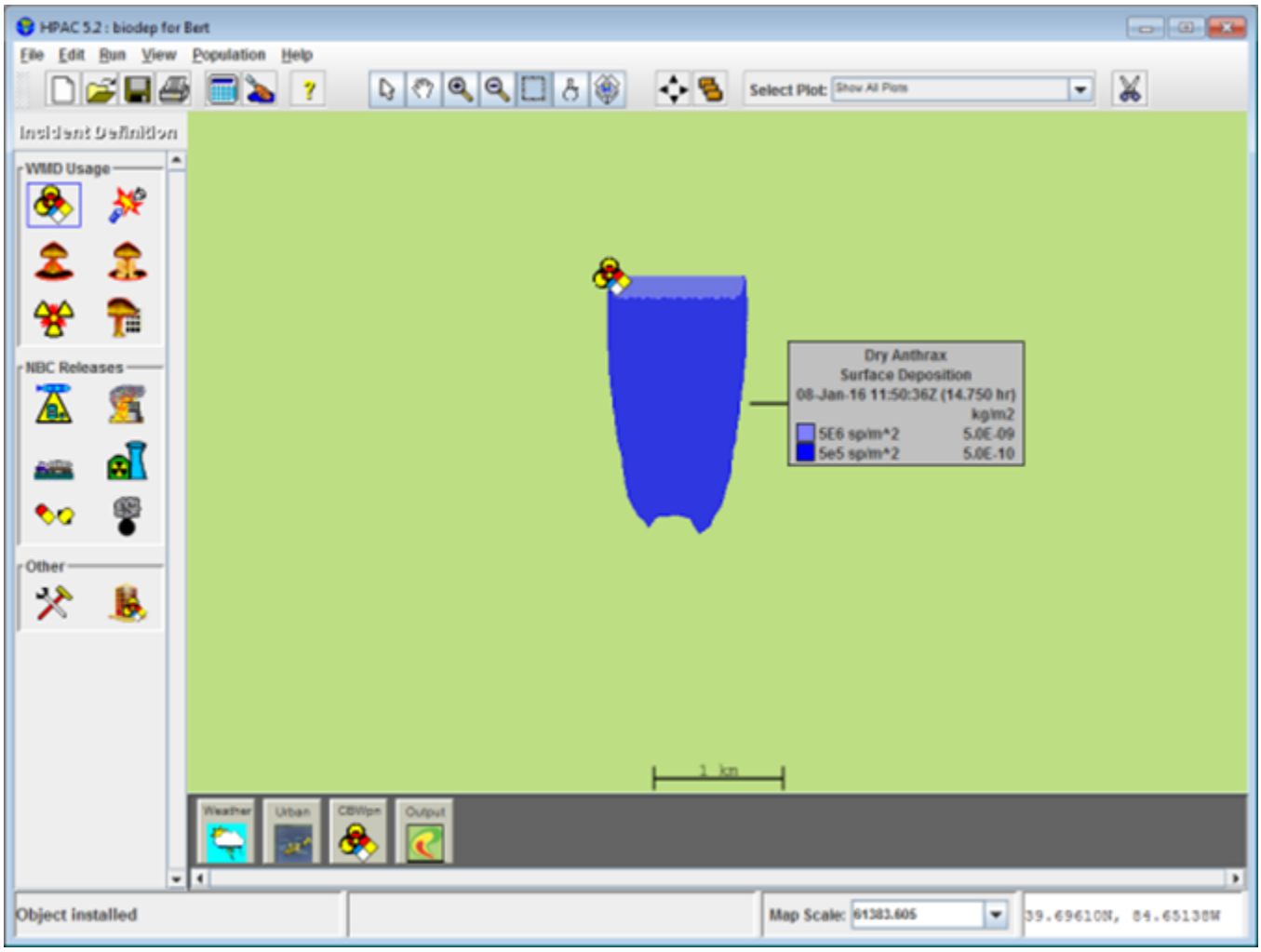
A8.1.3.4. Availability and effectiveness of medical countermeasures. The risk of developing symptoms associated with inhalation of re-suspended agent particles is greater if viable medical countermeasures are not available.

A8.1.3.5. Acceptable risk. Commanders are the final deciding authority for implementing procedures that affect the degree of acceptable risk (e.g. initiating screening activities, frequency of sample collection, etc.) once provided available information. The acceptable risk assessment will vary by scenario as well as by timing and circumstance within the scenario. It is likely the acceptable risk level will be higher during major combat operations scenarios when compared to non-major combat operations events. Also, the acceptable risk level in the midst of major combat operations activities will vary based on how the conflict is progressing and what critical mission operations are likely to be affected by the decision(s).

A8.2. Interpretation of Results. As is the case with biological warfare agent decay rates, there is a wide range of test results associated with quantifying the amount of agent likely to be re-suspended in the aftermath of biological warfare attacks. For this reason it is best to think in terms of ranges when considering resuspension hazards instead of using a single figure. For example, it takes between spore/m^2 and spore/m^2 in an indoor environment to produce an ED_{50} after 8 hours of exposure to re-aerosolized agent amongst unprotected and unvaccinated personnel. It takes spore/m^2 outside in a desert environment to produce the same effect.

A8.2.1. Figure A8.2 below is an Hazard Prediction and Assessment Capability plot depicting the dry *Bacillus anthracis* surface deposition profile of spore/m^2 from a 1 km spray line using 1 kg of agent (1 g/m^2 source strength), with 100% dissemination efficiency assumed. Using this attack profile, even though it represents the inside (versus outside) deposition required to generate an ED_{50} resuspension hazard, the coverage area is only approximately 1 km wide by 1.5 km long. This relatively small plume, where much of a typically sized installation will not be affected by a significant resuspension threat regardless of where the release point was, is in stark contrast to the corresponding aerosol dosage plot for the same attack (not pictured). The length of the ED_{50} hazard area for the aerosol dosage plot is about 50 km in length. **Note**: The Hazard Prediction and Assessment Capability program did not generate area coverage with a concentration of spore/m^2 at all for this attack profile.

Figure A8.1. Representative Dry *Bacillus anthracis* Deposition Plot.



Attachment 9

BIOLOGICAL RESPONSE TIMELINE CHARTS

A9.1. Assumptions and Planning Factors. Air Force biological defense operations are based on a set of assumptions. One of the major assumptions and planning factors is that there will be enough time after a biological event occurs to initiate medical countermeasures, when available.

A9.1.1. The progression charts that follow are a visual representation of the timeline by agent from attack to initiate of counter measures.

A9.1.2. In each case it shows the worst possible case in terms of time. The filters are not collected until about 12 hours after the event. The Polymerase Chain Reaction test results are known at about the 30 hour point

Figure A9.1. Biological Defense Operations Manual Progression Chart.

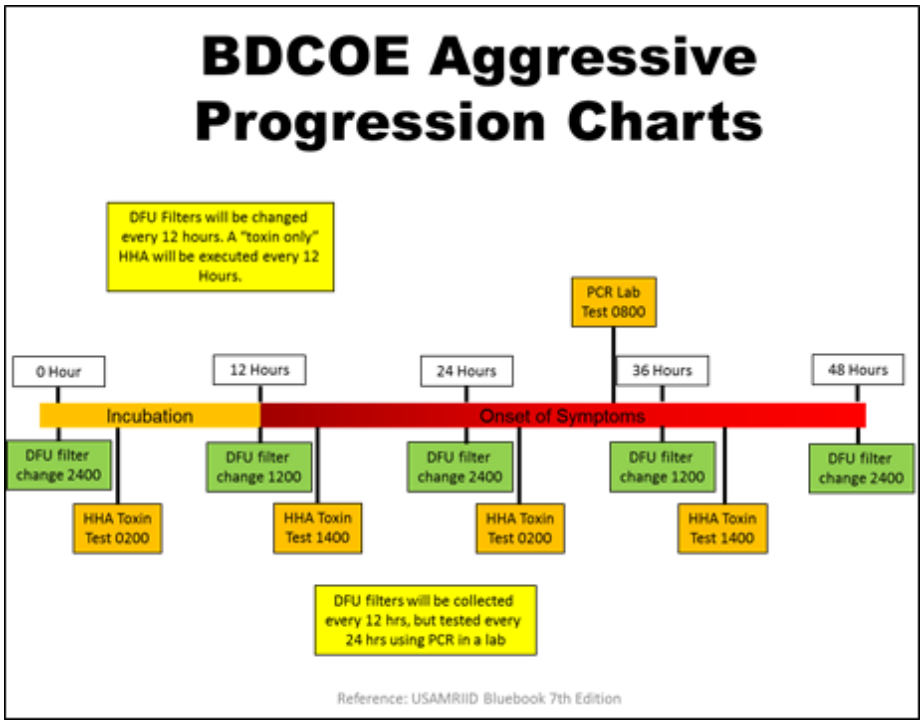


Figure A9.2. Botulism Progression.

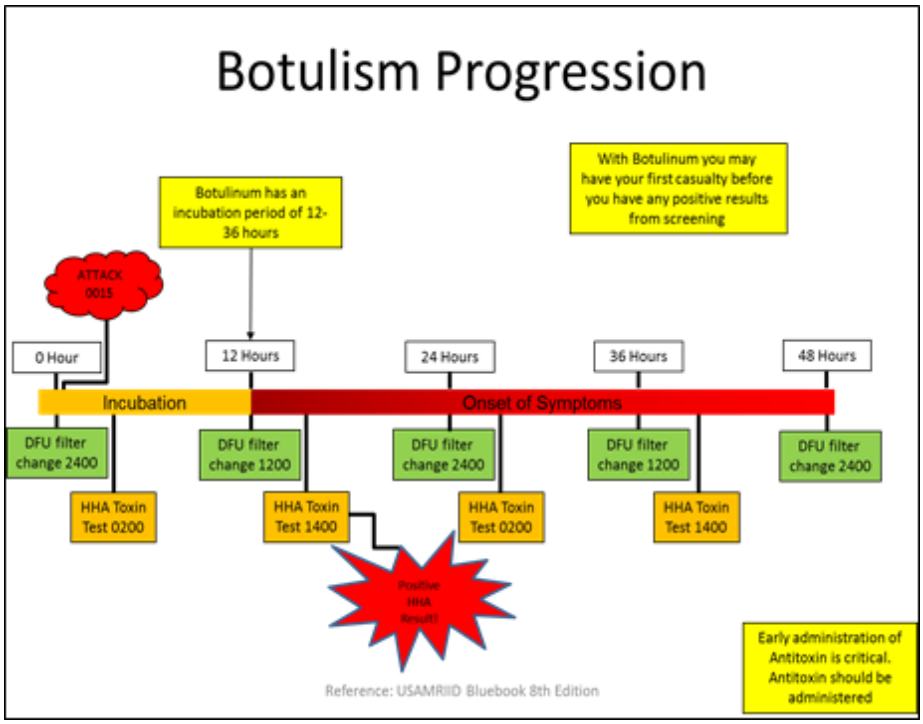


Figure A9.3. Tularemia Progression.

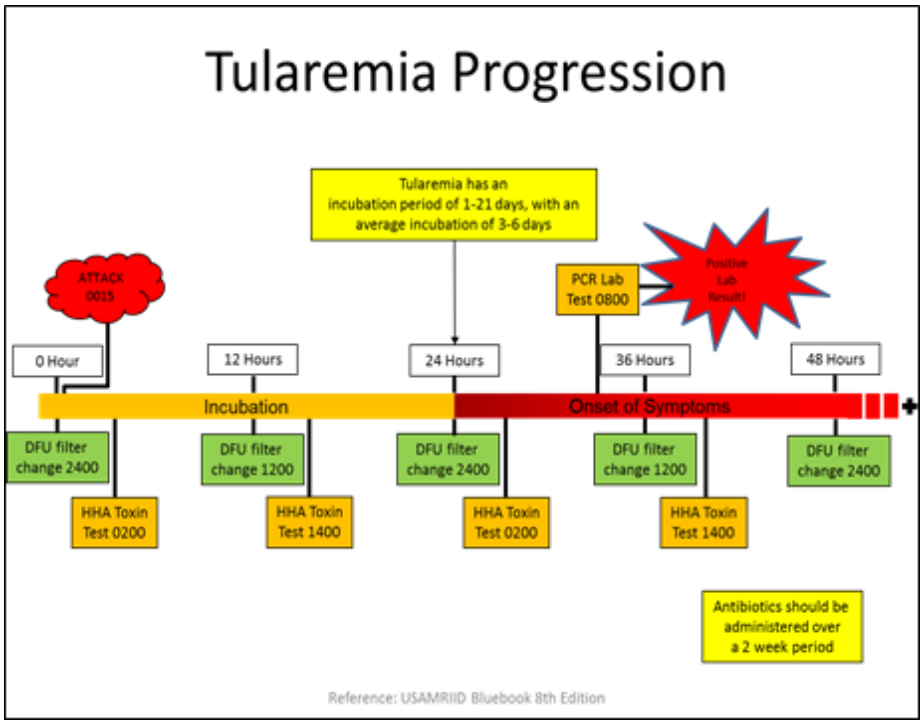


Figure A9.4. Smallpox Progression.

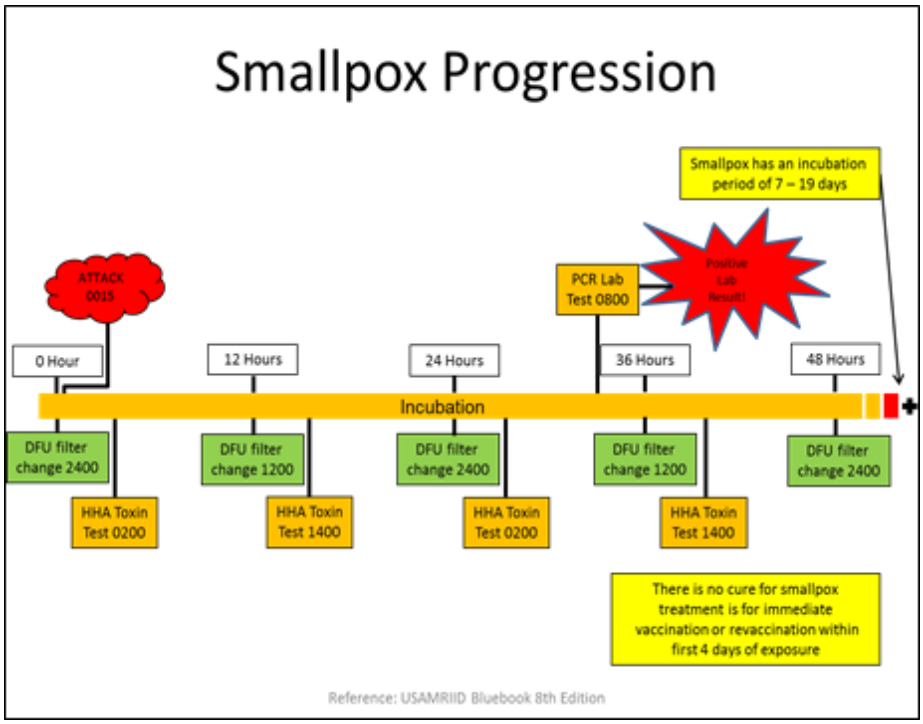


Figure A9.5. Brucellosis Progression.

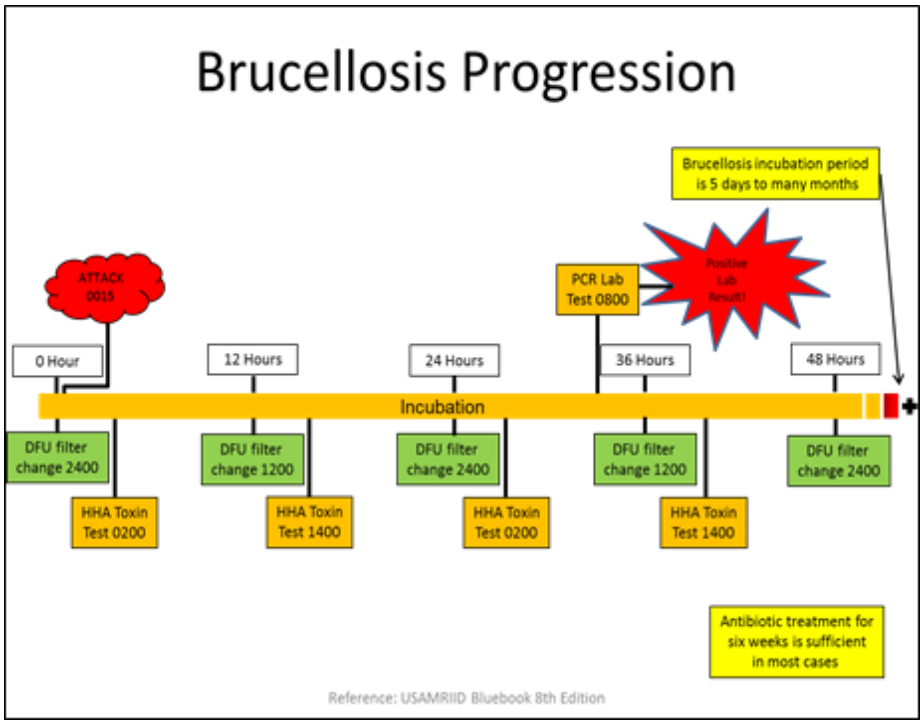


Figure A9.6. Q Fever Progression.

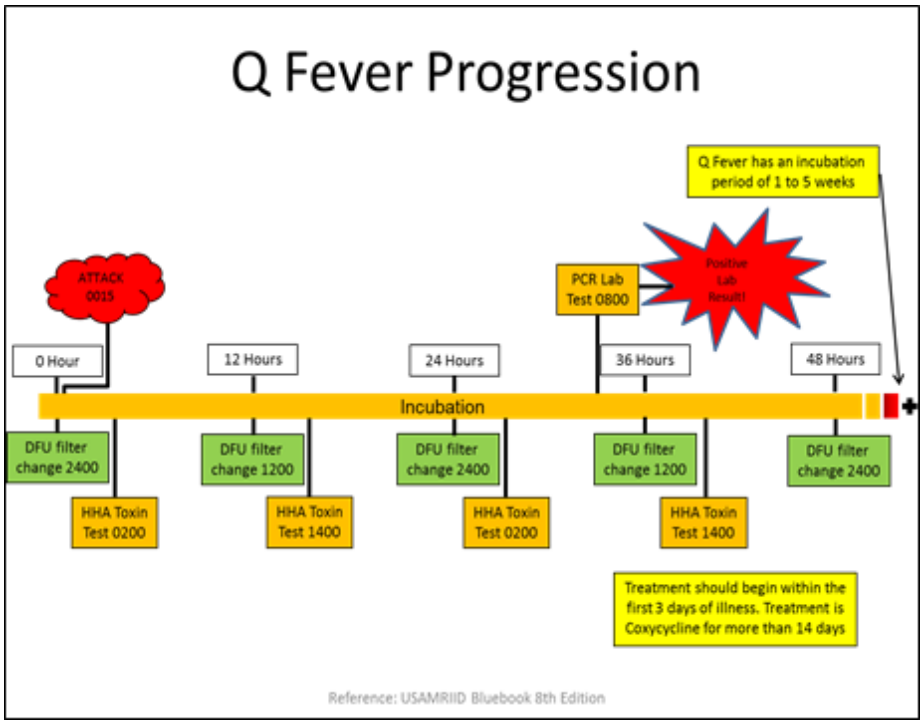


Figure A9.7. Inhalation Anthrax Progression.

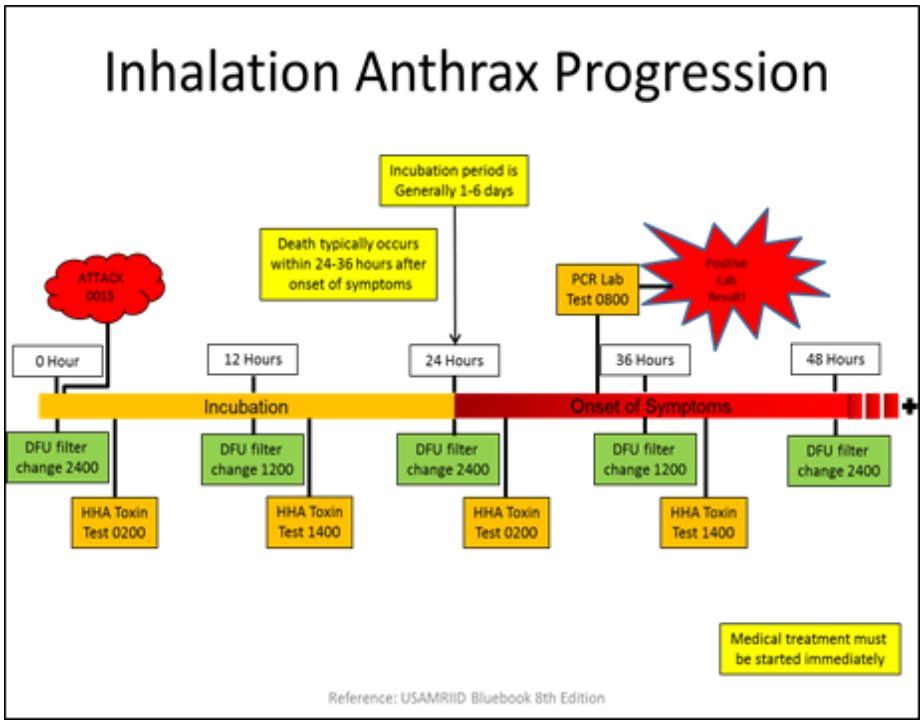
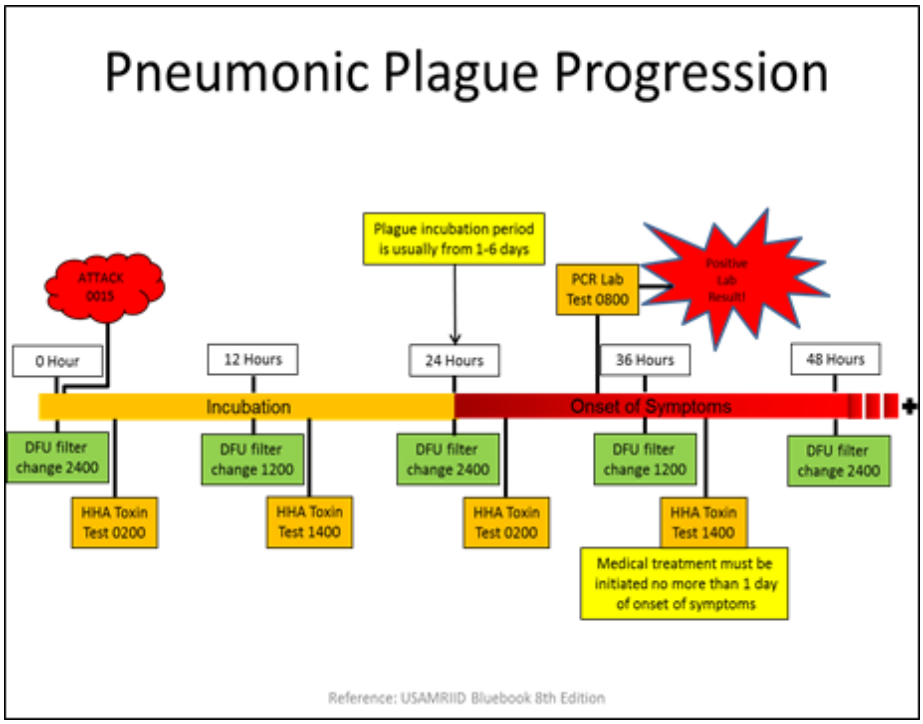


Figure A9.8. Inhalation Plague Progression.



Attachment 10

SAMPLE COMPREHENSIVE RISK MANAGEMENT TOOL

A10.1. Risk Assessment and Management. Commanders will make several crucial decisions in the aftermath of biological warfare attacks, with imperfect information. In some cases the decisions will be in areas for which there are not comprehensive guidelines or established policy in place, and detector limitations will prevent the use of empirical data as the sole determining factor. In other cases, the appropriateness of the answer will depend upon myriads of factors that exist at the time of a release of a potential hazard. Consequently, the Air Force uses a flexible risk management approach to facilitate senior leader assessments and decision making post attack.

A10.1.1. The purpose of this attachment is to provide a framework for evaluating and integrating risk factors, and subsequently making the best operational decisions given the situation at the time in the aftermath of biological warfare attacks. The attachment provides a process for methodically working through the problem In Accordance With the principles outlined in Air Force Instruction 90-802, *Risk Management*, and Air Force Pamphlet 90-803, *Risk Management Guidelines and Tools*. Use the embedded charts to assess biological warfare risk from various perspectives. The charts provide a system for integrating risk factors so that a preliminary holistic biological warfare agent risk is determined for the situation and provide recommended follow-on actions.

A10.1.2. It is essential that medical and mission-related stakeholders ensure that those responsible for managing risk understand the context of the threat as it relates to mission(s) at hand. This includes knowing why the decision(s) must be made, and when it is appropriate to modify risk tolerance in order to meet mission requirements. The charts contained in this attachment are risk assessment matrices. If key advisors and commanders require additional information or the embedded charts are not sufficient for assessing the problem at hand, the use of existing databases, alternative risk assessment matrices, or a panel of personnel experienced with the mission and hazards is encouraged to help complete the risk assessment. The acquisition of perfect information is unlikely and a range of factors associated with assigning risk might necessitate the need for subject matter experts across a number of communities to make a set of recommendations for senior leadership. **Note**: These risk assessment matrices are tools, which can be changed to fit the organization and/or situation as warranted. At no time should the numerical score alone take the place of reasoned judgment.

A10.1.3. An important feature of this process is to consider the full range of biological agent contamination risks across the entire scope of specific mission objectives. Each issue or question requires evaluation of key elements of specific importance (e.g. threat, mission criticality, time, redundancy, etc.) and integration as part of the ultimate solution. At no time should a single category or factor analyzed in isolation.

A10.1.4. As a caution, one potential pitfall is the common desire to assign a disproportionate amount of risk to the potential of biological exposure(s) rather than consider the actual hazard risk within the context of and combined with the inherent risk of combat operations in general. Upon assessing the final risk for a biological warfare hazard ensure the risk assessment encapsulates all active and passive measures (i.e. vaccines) taken for that hazard.

A10.1.5. Key advisors and commanders will examine risk in the context of biological contamination consequences from both an internal (base/Wing level) and external perspective (multiple bases or joint asset).

A10.1.6. This assessment uses three tasks to provide a holistic understanding of the hazard and to provide an accurate foundation to make a recommendation to senior leaders. The first task is to find a baseline of the hazard. The second task uses two tables as a resource to find the hazard risk at the time of contamination, prior to use of any active controls. The third task is to assess the hazard after active controls, which allows the user to gain an understanding of the risk after all available measures and provides a recommended course of action. It is recommended that the task be followed in the order as presented in this attachment, doing so will provide a thorough understanding of the hazard

A10.1.7. When completing the risk assessment, select the most hazardous option applicable from each category. For instance if the communicability of the hazard is low in the near term but possibly higher after incubation select the higher threat category.

A10.2. Task 1: Assess the Preliminary Hazard from Exposure:

A10.2.1. Specific characterization of agent hazards (communicability, persistence, incubation and onset) in relation to the Air Force mission sets is crucial. For a thorough assessment, identify the spectrum of hazards ranging from immediate through long term, and the less recognizable second and third order effects.

A10.2.2. The Threat Hazard Baseline Worksheet (see Table A10.1.) is used to establish the baseline hazard profile. Once completed, the worksheet provides the preliminary biological warfare exposure risk level. Additionally, the worksheet is a good background tool to use when finalizing and justifying information used in the risk assessment. To complete the table, fill in both columns under the "Score" heading with the number (1-4) appropriate for what is known at the time. The column on the left will help establish a baseline for the outdoor risk, and the right column will establish the baseline for indoors. Fill in all the rows and add the totals at the bottom, getting separate baseline numbers for both outdoor and indoor risk at the bottom of the sheet.

A10.2.3. Not all the columns must be used, if the factor does not apply to the hazard omit it. **Note**: The activities associated with Task 1 and this worksheet establish the baseline threat data that all affected organizations will use as the agreed-upon planning factors. The risk assessment in this step will be done prior to active controls.

Table A10.1. Threat Hazard Baseline for Inhalation Exposure.

Threat Hazard Baseline for Inhalational Exposure to Pathogens and Toxins					
Threat and Point Selection					
Factor	Low	Medium	High	Catastrophic	Score*
	1	2	3	4	

Communicability of the agent(s) involved	Disease or toxin is not passed person-to-person	Disease is passed person-to-person through extended close (within 6 feet) contact Or Poorly to moderate transmissible pathogen (Person-to-person transmission is possible but highly unlikely except when close contact with an infected individual takes place including the transfer of bodily fluids	Incapacitating disease is passed person-to-person through casual contact Or Highly transmissible pathogen, pathogenic, with a low case fatality ratio* (<15%) Or Disease also affects known and established vector species	Lethal Disease is passed person-to-person through casual contact Or Highly transmissible pathogen with a high case fatality ratio*(≥15%)		
Resuspension **Outdoors**	Unlikely re-suspension of hazard	Low chance of agent re-suspension (~ 25%)	Moderate to high chance of agent re-suspension (<50%)	High chance of agent re-suspension (>50%)		
Indoors	Unlikely re-suspension of hazard	Low chance of agent re-suspension (~ 25%)	Moderate to high chance of agent re-suspension (<50%)	High chance of agent re-suspension (>50%)		
Field dose Incubation time for pathogens (inhalational)** **or** **Symptom onset time for toxins (inhalational)**	Incubation time is >7 days	Incubation time between 4-7 days	Incubation time between 24-72 hours	Rapid incubation time <24 hours		
	Symptom onset time is >3 days	Symptom onset time is between 24 - 72 hours	Symptom onset time of 4-24 hours	Rapid symptom onset time <4 hours		
Environmental Persistency of agent(s) involved in relation to current and projected weather conditions **Indoors /dark or covered areas**	Agent not persistent, hazard should dissipate within ~ 4 hours	Agent moderately persistent, will probably remain a hazard for >4 hours and up to 1 day.	Agent is highly persistent, likely to remain a hazard for 1 – 3 days	Agent extremely persistent, hazard will likely remain for >3 days		
	Agent not persistent, hazard should dissipate within ~ 4 hours	Agent moderately persistent, will probably remain a hazard for >4 hours and up to 1 day	Agent is highly persistent, likely to remain a hazard for 1 – 3 days	Agent extremely persistent, hazard will likely remain for >3 days		
Availability and effectiveness of vaccinations or other pre-exposure preventative measure	Personnel vaccinated; vaccine is effective. High estimates of immunity expected (≥85%)	Even mixture of vaccinated to unvaccinated personnel or vaccination has lower (<85%) effectiveness rate	Vaccination does not exist (or personnel not vaccinated), agent is Incapacitating	Vaccination does not exist (or personnel not vaccinated), agent is Lethal		
***Left side of score column is for outdoor exposure scores Right side of score column Indoor/confined area/dark covered area exposure scores **Dose and exposure level dependent. Variances in reference documents and modeling expected.**					**Totals**	
1-5 Low	6-10 Medium	11-15 High	16-20 Catastophic			
Preliminary Outdoor Biological Warfare Exposure threat hazard: select one (Low, Medium, High, Extremely High)						
Preliminary Indoor/confined Biological Warfare threat hazard: select one (Low, Medium, High, Extremely High)						

A10.3. Task 2: Pathogen and Toxin Exposure Risk Assessment Matrix 1.

A10.3.1. Sub-task 1: Assess impacts on personnel and assign category designations:

A10.3.1.1. Determine the severity of the exposure in terms of the potential impact on personnel. When required by current attack, extend this portion of the assessment to include the potential impact on additional personnel (e.g. personnel at a different location or under

a different span of control). In this assessment include the availability of pre-exposure medical countermeasures (MCM) for the hazard.

A10.3.1.2. Table A10.2. provides the reference information used in the Matrix 1 (below) on the y-axes. Personnel will assess the risk based upon the Worksheet and use that assessment in the first step of completing the matrix. Once the determination of Severity of Hazard on Personnel is made, mark the corresponding category on Matrix 1.

Table A10.2. Severity of Hazard on Personnel Worksheet.

Severity of Hazard on Personnel Categories				
On Personnel	**Low**	**Medium**	**High**	**Catastrophic**
Virulence (severity of effects) of agent(s) involved after exposure incubation/onset of symptoms	Two or more effective and available MCM exists AND People might become ill for short period of time (less than 24 hours) requiring only quarters or limited duty. Majority of affected personnel are able to continue working. No hospitalizations or fatalities expected.	At least one or more effective and available MCM exists AND High incidence of people unable to continue work for moderate period of time (1 to 3 days), inpatient or supportive care required. Moderate incidence of fatalities (~5%)	Risk of incapacitating disease or illness, for which there is no available MCM AND >5% deaths likely to occur and/or majority of people will become ill to the point they cannot accomplish the mission for lengthy periods of time (>3 to 7 days). Hospitalization, extended convalescence, or evacuation required.	Communicable life-threatening disease, for which there is no available MCM AND >15% deaths likely to occur and/or majority of people will become ill to the point they cannot accomplish the mission for extended periods of time (> 7 days). Intensive or tertiary care required
Note: Table A10.2. provides the definitions based upon the scenario to help in selecting the personnel risk in Risk Matrix 1 (below).				

A10.3.1.3. For example, if assessing an anthrax hazard and it is determined to be a medium hazard, select medium on Table A10.3., as shown:

Table A10.3. Y-Axis of Risk Matrix 1.

Pathogen and Toxin Exposure Risk Assessment				PROBABILITY				
				Pathogen or Toxin Contamination of Area or Item				
				Certain	Probable	Likely	Uncertain	Unlikely
SEVERITY	EFFECT OF HAZARD	**Catastrophic** Communicable life-threatening disease, for which there is no available MCM (e.g. vaccine, other pretreatment, post exposure prophylactic or Therepy, etc.)	I	EH	EH	H	H	L
		High Risk of incapacitating disease or illness, for which there is no available MCM	II	EH	H	H	L	L
		Medium At least one of more effective and available MCM exists	III	H	M	M	L	L
		Low Two of more effective and available MCM exists	IV	M	L	L	L	L
				Risk Assessment Levels				
				EH	High	Medium	Low	

Pathogen and Toxin Exposure Risk Assessment		
SEVERITY	EFFECT OF HAZARD	**Catastrophic** Communicable life-threatening disease, for which there is no available MCM (e.g. vaccine, other pretreatment, post exposure prophylactic or Therepy, etc.)
		High Risk of incapacitating disease or illness, for which there is no available MCM
		Medium At least one of more effective and available MCM exists
		Low Two of more effective and available MCM exists

A10.3.2. Sub-Task 2: Establish the probability of contamination**.** The next step is to establish the probability of contamination based on information acquired from the hazard baseline process. The probability of contamination is defined by the categories in Table A10.4. The categories from Table A10.4. will be used on the top axis of Matrix.

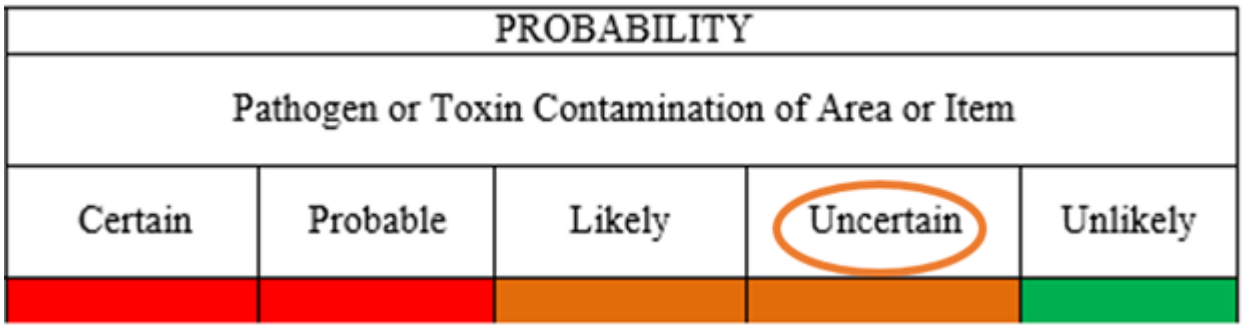
A10.3.2.1. Personnel accomplishing risk assessments will document for future reference the supporting rationale for assigning the probability of contamination value(s). Probability levels are designated A through E, with Category A representing the highest probability of contamination and Category E the least. Select only one level to describe the likelihood of contamination for each risk assessment and issue/asset considered.

Table A10.4. Probability of Contamination.

Probability of Contamination				
Certain	**Probable**	**Likely**	**Uncertain**	**Unlikely**
A	**B**	**C**	**D**	**E**
Certain, sample from resource tested positive Presence of Contamination is expected in most circumstances	Probable, sample taken from resource/area tested positive Strong possibility that contamination is present Sample screened from dry filter unit in immediate area (within 50 yards) tested positive with Polymerase Chain Reaction or equivalent	Possible, Biological Warfare hazard picked up by dry filter units located in the vicinity (>50 yards but ≤ 100 yards) of resource/area Reasonable chance that contamination is present Pooled sample from multiple dry filter units tested positive with Polymerase Chain Reaction or equivalent Uncertain status of individual dry filter unit results	Uncertain, Biological Warfare hazard picked up by dry filter units on base but dry filter unit near resource/area did not test positive Presence of contamination not expected but definite potential exists Biological Warfare pathogen screening identified hazard picked up by dry filter units on base, but not with Polymerase Chain Reaction or equivalent Unlikely/Improbable	Unlikely/Improbable: Biological Warfare screening identified pathogen hazard picked up by a single dry filter unit on base, but not with Polymerase Chain Reaction or equivalent and duplicate tests are negative Presence of contamination not expected but definite potential exists Biological warfare pathogen screening identified hazard picked up by dry filter units on base, but not with Polymerase Chain Reaction or equivalent and duplicate tests are negative

A10.3.2.2. After selection of a probability of contamination, select the applicable category on the top axis, labeled probability, of Risk Assessment Matrix 1. For example, if assessing the probability of contamination of an anthrax hazard and it is assessed to be uncertain (D) select the applicable category on the top axis of Risk Assessment Matrix 1, as shown in Table A10.5.

Table A10.5. Top Axis of Risk Assessment Matrix 1.



A10.3.2.3. Complete Pathogen and Toxin Exposure Risk Assessment Matrix 1: Cross-tabulate the selection from Table A10.2 and the selection from Table A10.4 to receive an initial risk exposure rating before active controls have been implemented/assessed. This determines whether a risk is categorized as red (extremely high), amber (high), yellow (medium) or green (low). Use of color coding facilitates rapid communication and understanding of initial risk levels.

Table A10.6. Pathogen and Toxin Exposure Risk Assessment Matrix 1.

Pathogen and Toxin Exposure Risk Assessment				PROBABILITY				
				Pathogen or Toxin Contamination of Area or Item				
				Certain	Probable	Likely	Uncertain	Unlikely
SEVERITY	EFFECT OF HAZARD	**Catastrophic** Communicable life-threatening disease, for which there is no available MCM (e.g. vaccine, other pretreatment, post exposure prophylactic or Therepy, etc.)	I	EH	EH	H	H	L
		High Risk of incapacitating disease or illness, for which there is no available MCM	II	EH	H	H	L	L
		Medium At least one of more effective and available MCM exists	III	H	M	M	L	L
		Low Two of more effective and available MCM exists	IV	M	L	L	L	L
				Risk Assessment Levels				
				EH	High	Medium	Low	

A10.3.2.4. After selecting the applicable categories on the axis's follow the row and columns until they meet to give the applicable risk category. For example, in the anthrax example select the uncertain category under probability and medium under the Severity Effect of Hazard column. Cross-tabulate in order to get a low risk assessment level, see Table A10.6.

Table A10.7. Completed Example Exposure Assessment.

Pathogen and Toxin Exposure Risk Assessment				PROBABILITY				
				Pathogen or Toxin Contamination of Area or Item				
				Certain	Probable	Likely	Uncertain	Unlikely
SEVERITY	EFFECT OF HAZARD	**Catastrophic** Communicable life-threatening disease, for which there is no available MCM (e.g. vaccine, other pretreatment, post exposure prophylactic or Therepy, etc.)	I	EH	EH	H	H	L
		High Risk of incapacitating disease or illness, for which there is no available MCM	II	EH	H	H	L	L
		Medium At least one of more effective and available MCM exists	III	H	M	M	L	L
		Low Two of more effective and available MCM exists	IV	M	L	L	L	L
				Risk Assessment Levels				
				EH	High	Medium	Low	

A10.4. Task 3: Matrix 2, Overall Risk and Recommended Actions.

A10.4.1. Sub-task 1 Residual Risk after Primary Active Controls:

A10.4.2. Identify the risk after implementation of primary active controls. Identify all controls previously implemented (e.g. vaccinations, pretreatments, etc.), and Controls that are readily available (e.g. prophylaxis, treatments, etc.) to abate or reduce risk relevant to the identified contamination hazard. Complete Table A10.8 by assigning a risk category to each of the rows. After assigning a risk number, score, to each row total the risk at the bottom to get the residual risk category. The total number will be used to assign a risk category, and the designated risk category will be used in Matrix 2.

Table A10.8. Residual Risk after Primary Active Controls have been Implemented.

Residual Risk after Primary Active Controls have been Implemented					
Factor	Low 1	Medium 2	High 3	Extreme 4	Score
Availability and effectiveness of vaccinations	Personnel vaccinated; vaccine is effective	Even mixture of vaccinated to unvaccinated personnel and/or vaccination has lower (<85%) effectiveness rate	Vaccination does not exist, agent is Incapacitating	Vaccination does not exist, agent is Lethal	
Availability and effectiveness of post-exposure prophylaxis	Post-exposure prophylaxis readily available and effective	Prophylaxis available but effectiveness is limited (between 70% and 80% ability to significantly mitigate symptoms to point personnel can continue working)	Prophylaxis available but effectiveness is limited (≤ 70% ability to significantly mitigate symptoms to point personnel can continue working)	Prophylaxis does not exist or not available in time	
Availability and effectiveness of post-exposure medical treatments for the agent(s) involved	Treatments readily available and effective	Treatment available but effectiveness is limited (between 70% and 80% ability to significantly mitigate symptoms to point personnel can continue working)	Treatment available but effectiveness is limited (≤ 70% ability to significantly mitigate symptoms to point personnel can continue working)	Treatment does not exist or is not available in time	
				Residual Risk Total	
1-4 Low	5-8 Medium	9-12 High	13-16 Extremely High		

A10.4.3. The residual risk category determined here is used as the value in "Residual Risk Value" column in the Overall Risk and Recommended Actions Matrix 2.

A10.4.4. For Example, if the hazard is anthrax the total residual risk after primary controls would be low as displayed in Table A10.9.

Table A10.9. Example Completed Residual Risk Assessment.

Residual Risk after Primary Active Controls have been Implemented					
Factor	Low 1	Medium 2	High 3	Extreme 4	Score
Availability and effectiveness of vaccinations	Personnel vaccinated; vaccine is effective	Even mixture of vaccinated to unvaccinated personnel and/or vaccination has lower (<85%) effectiveness rate	Vaccination does not exist, agent is Incapacitating	Vaccination does not exist, agent is Lethal	1
Availability and effectiveness of post-exposure prophylaxis	Post-exposure prophylaxis readily available and effective	Prophylaxis available but effectiveness is limited (between 70% and 80% ability to significantly mitigate symptoms to point personnel can continue working)	Prophylaxis available but effectiveness is limited (≤ 70% ability to significantly mitigate symptoms to point personnel can continue working)	Prophylaxis does not exist or not available in time	1
Availability and effectiveness of post-exposure medical treatments for the agent(s) involved	Treatments readily available and effective	Treatment available but effectiveness is limited (between 70% and 80% ability to significantly mitigate symptoms to point personnel can continue working)	Treatment available but effectiveness is limited (≤ 70% ability to significantly mitigate symptoms to point personnel can continue working)	Treatment does not exist or is not available in time	1
				Residual Risk Total	3
1-4 Low	5-8 Medium	9-12 High	13-16 Extremely High		

A10.4.5. Sub Task 2: Severity of Hazard on Mission.

A10.4.5.1. Table 10.10 has two categories covering the criticality to the mission and the time sensitive aspects of the mission. Similar to Table A10.9., select the most hazardous

category from the table. Do not select two values from the table, instead select the most hazardous value from the two categories.

A10.4.5.2. The selected category will be used in under the Severity of Hazard column on the left side.

Table A10.10. Severity of Hazard on Missions.

Severity of Hazard on Missions				
On mission/task	Low	Medium	High	Catastrophic
	IV	III	II	I
Criticality of the mission/task	Not important – impact limited to on-base activities and can be worked around	Moderately important – ties to mission involving other friendly forces but is of a routine nature	Very important – supports critical mission that involves life-saving of friendly forces, or may have significant impact on overall war effort. Current circumstances do not allow for more than a very brief (<2 hour) mission/task transfer or delay.	Critical - Immediate action supports critical wartime objective or involves life-saving of friendly forces, and circumstances do not allow for mission/task transfer or delay.
Time sensitive aspects of the mission/task	Not time sensitive – mission/task can be delayed for ≥ 24 hours or cancelled	Moderately time sensitive – mission/task can be delayed for ~4 hours	Time sensitive – mission/task can be delayed for ~2 hours	Critical time sensitive – mission/task must be accomplished ≤ 2 hours

Note: Table A10.10 provides the definitions based upon the scenario to help in selecting the mission risk for the Overall Risk and Recommended Actions Matrix 2

A10.4.5.3. For example, in an anthrax scenario if the hazard is more hazardous to the criticality of the mission/task than the time sensitive aspects, the assessment is a medium hazard when completing the assessment.

Table A10.11. Completed Severity of Hazard on Missions Table.

Severity of Hazard Impact on Missions				
On mission/task	Low	Medium	High	Catastrophic
	IV	III	II	I
Criticality of the mission/task	Not important – impact limited to on-base activities and can be worked around	Moderately important – ties to mission involving other friendly forces but is of a routine nature	Very important – supports critical mission that involves life-saving of friendly forces, or may have significant impact on overall war effort. Current circumstances do not allow for more than a very brief (<2 hour) mission/task transfer or delay.	Critical - Immediate action supports critical wartime objective or involves life-saving of friendly forces, and circumstances do not allow for mission/task transfer or delay.
Time sensitive aspects of the mission/task	Not time sensitive – mission/task can be delayed for ≥ 24 hours or cancelled	Moderately time sensitive – mission/task can be delayed for ~4 hours	Time sensitive – mission/task can be delayed for ~2 hours	Critical time sensitive – mission/task must be accomplished ≤ 2 hours

Note: Table A10.11 provides the definitions based upon the scenario to help in selecting the mission risk for the Overall Risk and Recommended Actions Matrix 2.

A10.4.5.4. When required by current mission, extend the severity assessment to include the potential impact on additional assets or missions (e.g. assets or missions at a different location or under a different span of control.) Annotate the category of hazard severity for each individual mission/task assessed using the Table A10.11.

A10.4.5.5. The final action under task 3 is to cross tabulate and interpret values from the Overall Risk and Recommended Actions Matrix 2. Locate the proper combination of values and annotate the overall risk and recommended action. Severity of Hazard Impact

on Mission values come from Table A10.10 and Residual Risk Values come from Table A10.9.

Table A10.12. Overall Risk and Recommended Actions Matrix 2.

Overall Risk and Recommended Actions Matrix 2			
Severity of Hazard Impact on Missions*	**Residual Risk Value****	**Overall Risk**	**Recommended Action**
Low	Low	Negligible risk to critical mission operations; minor risk to personnel exposed.	Cancel mission if feasible. If not, delay mission to the extent possible until all post exposure prophylaxis and treatments can be administered.
Low	Medium	Negligible risk to critical mission operations; impactful risk to reasonable percentage (15% - 20%) of personnel exposed	Cancel mission (benefit of mission accomplishment is likely not worth the adverse effects reasonable percentage of personnel will experience).
Low	High	Negligible risk to critical mission operations; probable risk that >30% of personnel exposed will be unable to continue working	Cancel mission (benefit of mission accomplishment is not worth the adverse effects reasonable percentage of personnel will experience).
Low	Extreme	Negligible risk to critical mission operations; plausible risk that significant number of personnel (>15%) exposed could die	Cancel mission (benefit of mission accomplishment is not worth the adverse effects reasonable percentage of personnel will experience).
Medium	Low	Modest risk to critical mission operations; minor risk to personnel exposed	Delay mission to the extent possible until all post exposure prophylaxis and treatments can be administered. Accept isolated cases of illness to base personnel.
Medium	Medium	Modest risk to critical mission operations; impactful risk to reasonable percentage (15% - 20%) of personnel exposed	Cancel mission if feasible. If not, delay mission to the extent possible until all post exposure prophylaxis and treatments can be administered.
Medium	High	Modest risk to critical mission operations; probable risk that >30% of personnel exposed will be unable to continue working	Cancel mission (benefit of mission accomplishment is not worth the adverse effects reasonable percentage of personnel will experience).
Medium	Extreme	Modest risk to critical mission operations; plausible risk that significant number of personnel (>15%) exposed could die	Cancel mission (benefit of mission accomplishment is not worth the adverse effects reasonable percentage of personnel will experience).
High	Low	Significant impact to critical mission operations; minor risk to personnel exposed	Accomplish mission. Accept isolated cases of illness in personnel.
High	Medium	Significant impact to critical mission operations; impactful risk to reasonable percentage (15% - 20%) of personnel exposed	Request Higher Headquarters transfer mission if feasible. If not, delay mission to the extent possible until post exposure prophylaxis and treatments can be administered. Accept 15% - 20% illness rate amongst exposed personnel. Accept "restriction of use" limitations on aircraft/equipment that will likely be levied upon completion of mission objective.
High	High	Significant impact to critical mission operations; probable risk that >30% of personnel exposed will be unable to continue working	Request Higher Headquarters transfer mission if feasible. If not, delay mission to the extent possible until post exposure prophylaxis and treatments can be administered. Accept operationally-crippling illness rate (>30%) amongst exposed personnel. Accept "loss of" or "restriction of use" limitations on aircraft/equipment that will likely be levied upon completion of mission objective.
High	Extreme	Significant impact to critical mission operations; plausible risk that significant number of personnel (>15%) exposed could die	Request Higher Headquarters transfer mission if feasible. If not, delay mission to the extent possible until post exposure prophylaxis and treatments can be administered. Accept operationally-crippling illness rate (>30%), with significant fatalities (>15%) amongst exposed personnel. Accept "loss of" or "restriction of use" limitations on aircraft/equipment that will likely be levied upon completion of mission objective.
Catastrophic	Low	Very serious impact on critical mission operations; minor risk to personnel exposed	Accomplish mission. Accept isolated cases of illness in personnel.

Overall Risk and Recommended Actions Matrix 2			
Severity of Hazard Impact on Missions*	**Residual Risk Value****	**Overall Risk**	**Recommended Action**
Catastrophic	Medium	Very serious impact on critical mission operations; impactful risk to reasonable percentage (15% - 20%) of personnel exposed	Accept 15% - 20% illness rate amongst exposed personnel. Accept "restriction of use" limitations on aircraft/equipment that will likely be levied upon completion of mission objective.
Catastrophic	High	Very serious impact on critical mission operations; probable risk that >30% of personnel exposed will be unable to continue working	Accept operationally-crippling illness rate (>30%) amongst exposed personnel. Accept "loss of" or "restriction of use" limitations on aircraft/equipment that will likely be levied upon completion of mission objective.
Catastrophic	Extreme	Very serious impact on critical mission operations; plausible risk that significant number of personnel (>15%) exposed could die	Accept operationally-crippling illness rate (>30%), with significant fatalities (>15%) amongst exposed personnel. Accept "loss of" or "restriction of use" limitations on aircraft/equipment that will likely be levied upon completion of mission objective.

Note: *From Table A10.10. **From Table A10.9.

A10.4.5.6. If using the example of anthrax from Table 10.3 and Table 10.9 the residual risk would be low, right column, and the severity of hazard would be medium, left column. After locating the proper combination in Table 10.11 the overall risk and recommended action is displayed in figure A10.12.

Table A10.13. Overall Risk and Recommended Actions Matrix 2.

		number of personnel (>15%) exposed could die	personnel will experience).
Medium	Low	Modest risk to critical mission operations; minor risk to personnel exposed	Delay mission to the extent possible until all post exposure prophylaxis and treatments can be administered. Accept isolated cases of illness to base personnel.
Medium	Medium	Modest risk to critical mission operations; impactful risk to reasonable percentage	Cancel mission if feasible. If not, delay mission to the extent possible until all post exposure prophylaxis and

A10.4.5.7. Final Actions: Assess the results from the three tasks and ensure all three assessments complement each other during cross checks.

A10.4.5.8. Refine/validate initial cross tabulation results based on the specific decision being considered. To some degree, the final risk assessment is influenced by the scope and type of residual risk in relation to the decision being pondered (see factors in Table A.10.9.). For example, there is little subsequent risk in a scenario wherein personnel have been vaccinated, effective countermeasures exist, the environment is such that a re-suspension hazard does not exist, and the question is "What level of residual risk remains if personnel use resources that might have been exposed to a Biological Warfare hazard cloud that passed through the area approximately 12 hours earlier?" Conversely, more risk to personnel safety remains if re-suspension of the hazard is likely and there is neither an effective vaccine nor medical treatment protocol available for the Biological Warfare agent in question.

A10.4.5.9. Refine/validate initial cross tabulation results from a legal and/or political perspective. For example, who has the burden of proof when test results are incomplete or unavailable, 'is an asset presumed to be uncontaminated and has to be proven to be contaminated,' or 'is an asset presumed to be contaminated and has to be proven to be uncontaminated.'

A10.5. Apply professional judgment before selecting any final answer or recommendation.

A10.5.1. Consult with the right people to make the assessment; do not automatically accept the initial answer because nuances could exist that force another solution.

A10.5.2. Be sure to identify the correct decision making authority for acceptance of the level of perceived risk for the assessment being made. If leaders are not authorized to accept the level of risk or potential consequences the mission requires, elevate the final decision to the appropriate level.

A10.5.3. Allowable risk is contingent on the situation i.e., the risk that is tolerable during combat operations might be considerably higher than the acceptable risk criteria for a post conflict scenario when the focus is on redeployment of assets.

Attachment 11

BIOLOGICAL DECON SPILL RESPONSE CHECKLIST

Table A11.1. Spill Response Checklist.

The purpose of this checklist is to provide guidance for mishaps involving samples collected from the dry filter units. When collecting and transporting filters that might include biological material it is extremely important to follow all procedures and exercise extreme caution. Other than during the conduct of an exercise it should be assumed any sample could contain Biological Warfare Agents that can injure or kill personnel.	
In the event a spill occurs or some other unusual event occurs where biological agents might have been released from the filter or container it is extremely important to document the details of the event to ensure the safety of personnel who may come in contact with the material and to document any difference in the sample condition from the initiation of the paperwork	
Spill Response Kit Composition	
Written spill response procedures to include emergency phone numbers and radio contact information	
Spray bottle of at least 5% chlorine solution that has been changed every 48 hours or bleach pack wipes. Do not use chlorine wipes like the ones available in the grocery store. These wipes tend to be less than 5% chlorine solution and quality control for consistency is limited.	
Shoe covers and safety goggles	
Absorbent materials which can include paper towels, rags, etc.	
Forceps or similar tool to pick up sharp items such as broken glass and contaminated waste materials	
Bio hazard bags for disposal of all materials used in the clean-up process	
Spare gloves in sufficient quantity for double gloving for personnel cleaning up the spill	
Stop watch to ensure a minimum 30 minute contact time for the chlorine solution with the spill/release materials	

Spill Response Procedures
1. If a spill/release occurs, first ensure the personnel tasked with managing the spill are protected to the appropriate level based on the threat (minimum level includes respiratory protection, gloves, and protective boot covers). In most cases a spill will be the result of the conical tube not being closed properly and the package failing.
2. Notify the appropriate Command and Control center e.g., CBRN control center, Emergency Operations Center, etc.
3. If appropriate for the circumstance, take actions to limit the area affected by the spill e.g., absorb the liquid before it expands to a larger area.
4. Notify other personnel in the immediate area of the spill and expected actions. **Note**: The primary decontamination techniques used for potential biological agent spills/releases will be the use of 5% chlorine solutions, removal of three inches of soil (sand, grass, etc.) or a combination of both.
5. Determine the extent of spill and best resources available to decontaminate the affected area and extend decon efforts beyond the identified area by 25% to ensure all affected areas are included.
6. Identify all objects affected by the spill e.g., plastic bags, vehicle upholstery, etc., to determine if a single decontamination method is appropriate for all affected objects.
7. Decontaminate the area and assets or objects affected by the spill to the maximum extent possible. Some items might not be able to be decontaminated and other measures may be required i.e., disposed as contaminated waste if the sample set tests positive.
8. Allow a minimum 30 minute contact time between the chlorine solution and the contaminated surface. This could require frequent reapplication of the chlorine solution if the affected area is not a flat surface.
9. Document on the chain of custody form and in the log book all information associated with the spill. Include beginning sample quantity and ending sample quantity as accurately as possible.
10. Notify the CBRN cell of the measures taken to mitigate the spill. Include collector location sample(s) affected, time of event, short description of the situation and request additional guidance as necessary.
11. Make verbal contact with the lab and provide situation update and request any additional guidance.

12. Remove potentially contaminated clothing and dispose of it as contaminated waste in biohazard bags. These bags will be removed from the spill location and taken to a designated site for disposal In Accordance With applicable guidance.
13. Transport sample(s) to the laboratory (unless directed otherwise) and transfer sample with associated documentation. Provide contact information in the event the laboratory staff needs additional information.

Attachment 12

ADDITIONAL DRY FILTER UNIT SITING INFORMATION

A12.1. Siting Considerations. Optimum dry filter unit siting plans are based on the integration of multiple variables, randomly selected and mixed over a large number of hazard projections in order to identify probable results. Simply looking at the projected width and length of a given hazard plume and then positioning collectors based on those dimensions is not totally accurate and provides a false sense of security. This occurs because the approach does not account for the way the plume width and direction changes multiple times as it winds itself downwind from the release point.

A12.1.1. Perhaps the most important factor for CBRN specialists to understand is that there is no such thing as static weather or predominant wind directions within the context of siting collectors such as dry filter units. This explains why installation Command and Control systems that depict results from weather sensors across the site routinely show disparate wind directions at each sensor location. As a result, the ability to know precisely the wind direction for planning a biological warfare release is not currently possible, nor is it likely to ever be possible. Further, the ability to accurately predict the precise path of a biological warfare hazard cloud is also not currently possible.

A12.1.2. While different weather conditions, release mechanism efficiencies, and other variables produce a wide range of hazard plot dimensions, the following table provides representative averages of plume widths for different agent/dissemination combinations. Use the chart to assist in determining the desired dry filter unit spacing distance.

Table A12.1. Agent and Delivery System Average Cloud Width.

REPRESENTATIVE BIOLOGICAL WARFARE HAZARD PLUME WIDTHS*◊			
Agent	**Delivery System**	**# Cases modeled**	**Plume Width (meters)****
Bacillus anthracis°	Stationary Backpack Sprayer[1]	260	166
	Theater Ballistic Missile Submunitions[2]	260	7012
	Aerial Sprayer[3]	260	8920
Botulinum Toxin°	Stationary Backpack Sprayer[1]	753	168
	Theater Ballistic Missile Submunitions[2]	753	272
	Aerial Sprayer[3]	753	9354
Yersinia pestis°	Stationary Backpack Sprayer[1]	260	192
	Theater Ballistic Missile Submunitions[2]	260	8452
	Aerial Sprayer[3]	260	9673

REPRESENTATIVE BIOLOGICAL WARFARE HAZARD PLUME WIDTHS*◊			
Agent	**Delivery System**	**# Cases modeled**	**Plume Width (meters)****
Smallpox°	Stationary Backpack Sprayer[1]	260	158
	Theater Ballistic Missile Submunitions[2]	260	6843
	Aerial Sprayer[3]	260	10583
Tularemia°	Stationary Backpack Sprayer[1]	253	169
	Theater Ballistic Missile Submunitions[2]	253	8705
Ebola°	Stationary Backpack Sprayer[1]	219	217
	Theater Ballistic Missile Submunitions[2]	219	9075

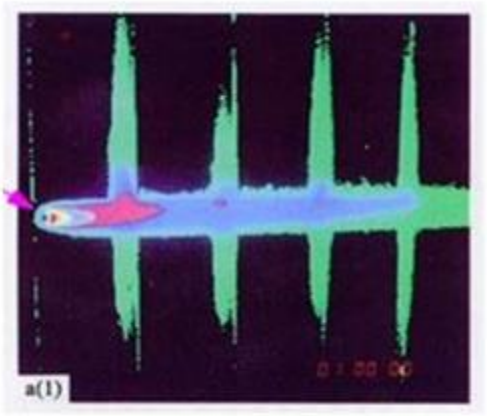
*Results incorporated from VLSTRACK runs depicting a number of different weather conditions for each agent/delivery system combination
**Plume widths are the average of the median distances for daytime, nighttime, and dusk/dawn releases (widths approximate the detectable limit for Polymerase Chain Reaction {pathogens} and HHA {toxins} results)
◊ Plume widths are measured at 1000 meters from the release point. The plume widths continue to grow as the cloud travels downwind in most cases.
° Whenever an agent can be released in "dry" or "wet" forms, the narrowest plume values were used.
[1] 10 kg used for agent in dry form and 20 kg used for agent in wet form
[2] 50 kg used for agent in dry form and 100 kg used for agent in wet form; 500 sub munitions in package with spread radius of 2 km
[3] 100 kg used for agent in dry form and 200 kg used for agent in wet form; line spray length 5 km

A12.1.3. Agent and delivery systems. Dissemination techniques vary for biological weapons. Unlike the primary chemical threat for Air Force operations, backpack sprayers or other spray devices are a greater potential threat for an Air Base than Tactical Ballistic Missiles.

A12.1.4. A good rule of thumb in determining dry filter unit spacing is to employ the dry filter units in a manner that captures the biological material from the narrowest of the most likely biological warfare threat profiles, thus also capturing the agent from the wider hazard plumes. Collection grids sited considering attacks with only large plume footprints can result in attack non-detects and higher potential for relying on sentinel casualties to indicate a biological event has taken place.

A12.2. Terrain Considerations. The introduction of terrain features such as trees and buildings complicate the siting process and "no agent remains" declarations even further. The following graphics provide representative examples of some of the idiosyncrasies that will likely occur.

Figure A12.1. Wind Channels.



Even if the wind is blowing straight down a street, the existence of buildings will create channels between structures that agent particles will flow into, even if those channels are directly perpendicular to the current wind direction.

Figure A12.2. Wind Channels Examples.

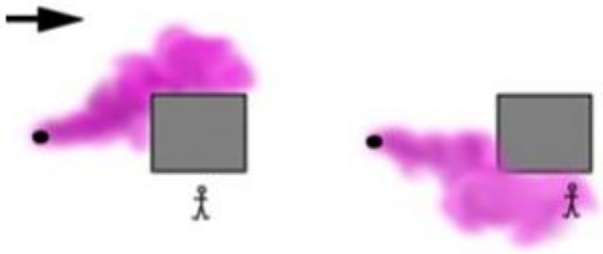
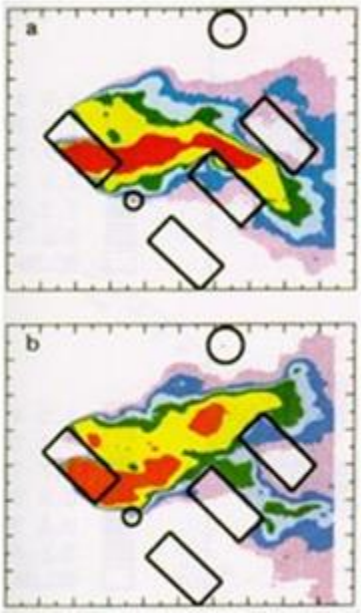


Figure A12.3. Prevailing Winds.

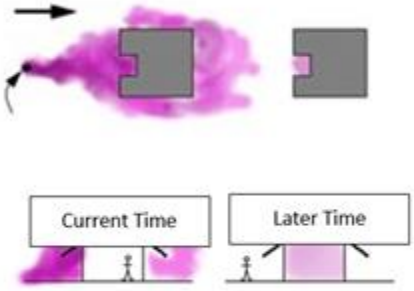


The prevailing wind is hardly ever completely steady, but instead shifts its direction and speed rapidly on the order of seconds. On average the wind might blow in a particular direction, but instantaneously the wind could be pointing in a somewhat different direction.

Figure A12.4. Low Prevailing Winds.

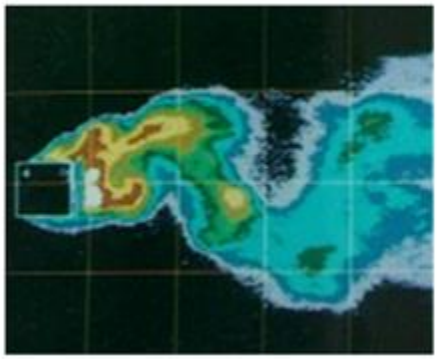
For low prevailing wind speeds, the wind might completely reverse direction in a matter of seconds.

Figure A12.5. Cloud Passage.



When a plume passes over, the agent will predominantly be outdoors; however, as time passes a "clean" outside reading does not necessarily mean the hazard is completely gone. Recessed entranceways and facilities can entrap and hold air contaminants for a period of time after the hazard cloud has passed.

Figure A12.6. Cloud Shape.



Biological warfare hazard plumes will change shape and take "dips and turns" as time passes and the cloud moves downwind. It is probable that a clear cut, cylindrical plume pattern (such as those depicted on hazard plotting programs such as the Joint Effects

Attachment 13

AVAILABLE HHA TICKETS

Table A13.1. HHA Available Tickets.

Brucella spp.
Bacillus anthracis
Yersinia pestis
Francisella tularensis
Coxiella burnetii
Bacillus globigii
Erwinia herbicola
MS2 Virus
Ovalbumin
Ricin Toxin
Botulinum Toxin A/B/E
Staphylococcus Enterotoxin B
Orthopox virus
Venezuelan equine encephalitis virus

Attachment 14

FILMARRAY KIT INFORMATION

Table A14.1. Specimen Types Validated for the FilmArray Panels.

Assay	Disease	Pathogen	Clinical Sample Matrices					
			Naso-pharyngeal Swab	Positive Blood Culture	Stool in Cary Blair	CSF	Whole Blood	Sputum
FilmArray Respiratory Panel			X					
FilmArray BCID Panel				X				
FilmArray GI Panel					X			
FilmArray ME Panel						X		
Film Array Warrior Panel	Anthrax	*Bacillus anthracis*		X			X	
	Plague	*Yersinia pestis*		X			X	X
	Tularemia	*Fancisella tularensis*					X	X
	Q Fever	*Coxiella burnetii*					X	
	Viral Hemorrhagic Fever	*Ebola virus*					X	
		Marburg virus					X	

Table A14.2. Sentinel Panel Bacterial and Sample Types.

	Liquid			**Powder**	**Swab**	**Soil/Sand**		**Vector**	**Mammalian Blood**
Microorganism	Culture Medium	Aerosol Collection Buffer (PBS)	Surface Water	Powder	Sample Swab	Soil	Sand	Flea, tick, louse, mosquito	Mammalian Blood
Bacillus anthracis	X	X	X	X	X	X	X	N/A	X
Yersinia pestis	X	X	X	N/A	X	X	X	X(Flea)	X
Francisella tularensis	X	X	X	N/A	X	X	X	X(Tick)	X
Coxiella burnetii	N/A	X	X	N/A	X	X	X	X(Tick)	N/A

Brucella spp. (melitensis, suis, avis, and abortus)	X	X	X	N/A	X	X	X	N/A	X
Brucella abortus (or melitensis) specific	X	X	X	N/A	X	X	X	N/A	X
Burkholderia mallei	X	X	N/A	N/A	X	X	X	N/A	N/A
Burkholderia pseudomallei	N/A	X	N/A	N/A	X	X	X	N/A	N/A
Rickettsia prowazakii	N/A	X	N/A	N/A	X	N/A	N/A	X(Louse)	N/A

Table A14.3. Sentinel Panel Toxin Parent Genes and Sample Types.

	Liquid			**Powder**	**Swab**	**Soil/Sand**		**Vector**	**Mammalian Blood**
Microorganism	Culture Medium	Aerosol Collection Buffer (PBS)	Surface Water	Powder	Sample Swab	Soil	Sand	Flea, tick, louse, mosquito	Mammalian Blood
Clostridium botulinum (Parent gene)	N/A	X	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ricinus communis (Parent gene)	N/A	X	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table A14.4. Sentinel Panel Viruses and Sample Types.

	Liquid			**Powder**	**Swab**	**Soil/Sand**		**Vector**	**Mammalian Blood**
Microorganism	Culture Medium	Aerosol Collection Buffer (PBS)	Surface Water	Powder	Sample Swab	Soil	Sand	Flea, tick, louse, mosquito	Mammalian Blood
EEE Virus	X	X	N/A	N/A	X	N/A	N/A	X (Mosquito)	N/A
VEE Virus (1AB and 1C)	X	X	N/A	N/A	X	N/A	N/A	X (Mosquito)	N/A
Wee Virus	X	X	N/A	N/A	X	N/A	N/A	X (Mosquito)	N/A
Smallpox (Orthopox virus and Variola major)	X	X	X	X	X	X	X	N/A	N/A
Ebola Virus (Sudan, Bundibugyo. Ivory Coast, Reston, Zaire)	X	X	N/A	N/A	X	N/A	N/A	N/A	N/A
Marburg Virus (Ci67, RAVN,	X	X	N/A	N/A	X	N/A	N/A	N/A	N/A

Musoke, Angola)									

Table A14.5. Commercial Panels.

Respiratory Panel	**Gastrointestinal Panel**	**Blood Culture Identification Panel**	**Meningitis/Encephalitis Panel**
Bacterial Targets	**Bacterial Targets**	**Gram Positive Bacterial Targets**	**Bacterial Targets**
Bordetella pertussis	*Camplylobacter (jejuni, coli, and upsaliensis)*	*Enterococcus*	*Escherichia coli K1*
Chlamydophila pneumoniae	*Clostridium difficilie (toxin A/B)*	*Listeria monocytogenes*	*Haemophilus influenzae*
Mycoplasma pneumonia	*Plesiomona shigelliodes*	*Staphylyococcus aureus*	*Listeria monocytogenes*
Viral Targets	*Salmonella*	*Streptococcus agalactiae*	*Neisseria meningitidis*
	Yersinia enterocolitica	*Streptococcus pneumonia*	*Stretococcus agalactiae*
Adenenovirus	*Vibrio (parahaemolyticus, vulnificus and cholera, Vibrio cholera)*	Streptococcus pyogenes	*Streptococcus pneumoniae*
Bocavirus	*Diarrheagenic E. coli/Shigella*	**Gram Negative Bacteria Targets**	*Bordetella pertussis*
Coronavirus HKU1	*Enteroaggregative E. coli (EAEC)*	Acinetobacer baumannii	*Chlamydophila pneumoniae*
Coronavirus NL63	*Enteropathogenic E. coli (EPEC)*	Haemophilus influenza	*Mycoplasma pneumoniae*
Coronavirus 229E	*Enterotoxigenic E. coli (ETEC) it/st*	Neisseria meningitides	**Fungal Targets**
Coronavirus OC43	*Shiga-like toxin-producing E. coli (STEC) stx1/stx2*	Pseudomonas aeruginosa	*Crytococcus gatti*
Human metapneumovirus	*E. coli O157*	Enterobacter cloacae complex	*Cryptococcus neoformans*
Human Rhinovirus/Enterovirus	*Shigella/Enteroinvasive E. coli (EIEC)*	Escherichia coli	**Viral Targets**
Influenza A	**Viral Targets**	Klebsiella oxytoca	Cytomegalovirus (CMV)
Influenza A/H1	Adenovirus F40/41	Proteus	Enterovirus
Influenza A/H1-2009	Astrovirus	Serratia marcescens	Epstein-Barr virus (EBV)
Influenza A/H3	Norovirus GI/GII		Herpes simplex virus 1 (HSV-1)
Influenza B	Rotavirus A	**Yeast Targets**	Herpes simplex virus 2 (HSV-2)
Parainfluenza Virus 1	Sapovirus (I, II, IV, and V)	*Candida albicans*	Human herpesvirus 6 (HHV-6)
Parainfluenza Virus 2	**Parasitic Targets**	*Candida glabrata*	Human parechovirus
Parainfluenza Virus 3	*Crytosporidium*	*Candida krusei*	Varicella zoster virus (VZV)
Parainfluenza Virus 4	*Cyclospora cayetanensis*	*Candida parapsilosis*	
Respiratory Syncytial Virus	*Entamoeba histolytica*	*Candida tropicalis*	
	Giardia lamblia	**Antimicrobial Resistance Targets**	
		mecA – methicillin resistence	
		van A/B – vancomycin resistance	
		KPC – carbapenem resistance	

Table A14.6. All Panels.

Warrior Panel	Sentinel Panel	Global Fever Panel
Bacterial Targets	Bacterial Targets	Bacterial Targets
Bacillus anthracis	*Bacillus anthracis*	*Bacillus anthracis*
Coxiella burnetii	*Brucella melitensis*	*Yersinia pestis*
Francisella tularensis	*Brucella species*	*Francisella tularenis*
Yesinia pestis	*Burkholderia mallei*	*Plasmodium spp., falciparum, vivax*
	Burkholderia pseudomallei	*Leptospira spp.*
Viral Targets	*Clostridium botulinum*	*Salmonella typhi*
Ebola virus (Bundibugyo, Ivory Coast, Reston, Sudan, Zaire)	*Coxiella burnetii*	
Marburg virus (Angola, CI67, Musoke, & RAV)	*Francisella tularensis*	**Viral Targets**
	Yesinia pestis	Dengue virus
		Chikungunya virus
	Viral Targets	Lassa virus
	Ebola virus (Bundibugyo, Ivory Coast, Reston, Sudan, Zaire)	Crimean Congo Hemorrhagic Fever virus
	Marburg virus	West Nile virus
	EEE virus	Ebola virus
	Orthopox genus virus	Marburg virus
		Zika virus
	Ricinus communis	**Parasitic Targets**
Assays for the other biothreat agents (e.g. Burkholderia, EEE, VEE, WEE, & Variola) are in development.		*Leishmania donovani, infantum*