Preparing for and Responding to Bioterrorism:
Information for the Public Health Workforce

Environmental Sampling and Decontamination

*Developed by*

Jennifer Brennan Braden, MD, MPH

Northwest Center for Public Health Practice
University of Washington
Seattle, Washington

*This manual and the accompanying MS Powerpoint® slides are current as of Dec 2002. Please refer to http://nwcphp.org/bttrain/ for updates to the material.*
Acknowledgements

This manual and the accompanying MS PowerPoint® slides were prepared for the purpose of educating the public health workforce in relevant aspects of bioterrorism preparedness and response. Instructors are encouraged to freely use portions or all of the material for its intended purpose.

Project Coordinator
Patrick O’Carroll, MD, MPH
Northwest Center for Public Health Practice, University of Washington, Seattle, WA
Centers for Disease Control and Prevention; Atlanta, GA

Lead Developer
Jennifer Brennan Braden, MD, MPH
Northwest Center for Public Health Practice, University of Washington, Seattle, WA

Design and Editing
Judith Yarrow
Health Policy Analysis Program, University of Washington, Seattle, WA

The following people provided technical assistance or review of the materials:
Jeffrey S. Duchin, MD: Communicable Disease Control, Epidemiology and Immunization Section, Public Health – Seattle & King County
Division of Allergy and Infectious Diseases, University of Washington, Seattle, WA
Jane Koehler, DVM, MPH Communicable Disease Control, Epidemiology and Immunization Section, Public Health – Seattle & King County; Seattle, WA
Dennis Anderson, MA: Office of Risk and Emergency Management, Washington State Department of Health; Olympia, WA
Nancy Barros, MA: State of Alaska, Division of Public Health; Juneau, AK
Janice Boase, RN, MS, CIC: Communicable Disease Control, Epidemiology and Immunization Section Public Health – Seattle & King County, Seattle, WA
Jeanne Conner, RN, BSN: Sweet Grass Community Health; Big Timber, MT
Marcia Goldoft, MD, MPH: Communicable Disease Epidemiology, Washington State Department of Health; Shoreline, WA
Nancy Goodloe: Kittitas County Health Department; Ellensburg, WA
Sandy Kuntz, RN: University of Montana School of Nursing; Missoula, MT
Mike McDowell, BSc, RM: Public Health Laboratories, Washington State Department of Health; Shoreline, WA
Patrick O’Carroll, MD, MPH: Centers for Disease Control and Prevention; Atlanta, GA
Maryann O’Garro: Grant County Health Department, Ephrata, WA
Carl Osaki, RS, MSPH: Department of Environmental Health, University of Washington; Seattle, WA
Sandy Paciotti, RN, BSN: Skagit County Health Department, Mount Vernon, WA
Eric Thompson: Public Health Laboratories, Washington State Department of Health; Shoreline, WA
Matias Valenzuela, Ph.D.: Public Health – Seattle & King County; Seattle, WA
Ed Walker, MD: Department of Psychiatry, University of Washington, Seattle, WA

Contact Information
Northwest Center for Public Health Practice
School of Public Health and Community Medicine
University of Washington
1107 NE 45th St., Suite 400
Seattle, WA 98105
Phone: (206) 685-2931, Fax: (206) 616-9415

Last Revised December 2002
# Table of Contents

About This Course ....................................................................................................................... 1

How to Use This Manual ............................................................................................................. 3

Environmental Sampling and Decontamination ......................................................................... 4

   Learning Objectives (Slide 4-5) ............................................................................................... 5

   Environmental Sampling (Slides 6-19) .................................................................................... 7

      Personal Protective Equipment (Slide 7) ............................................................................. 9

      Pre-sampling Considerations (Slides 8-11) ....................................................................... 11

      Rapid Assay Devices (Slide 12) ....................................................................................... 16

      Environmental Assessment Protocols (Slide 13). .............................................................. 18

      Packaging Critical Biological Agents (Slides 14-16) ...................................................... 19

      Sample Analysis (Slides 17-19) ....................................................................................... 21

Environmental Decontamination (Slides 20-34) ..................................................................... 23

   Anthrax (Slides 23-26) ........................................................................................................... 25

   Smallpox (Slides 27-29) ....................................................................................................... 30

   Plague (Slides 30-31) ......................................................................................................... 34

   Botulism (Slides 32-34) ..................................................................................................... 35

   Tularemia (Slides 35-36) .................................................................................................... 37

   Viral Hemorrhagic Fevers (Slides 37-38) .......................................................................... 38

   Summary of Key Points (Slides 39-42) ................................................................................. 39

Resources (Slide 43) .................................................................................................................. 40

References .................................................................................................................................... 41

Appendix A: Modules ................................................................................................................ 47

Appendix B: Glossary ................................................................................................................ 48
Preparing for and Responding to Bioterrorism: Information for the Public Health Workforce is intended to provide public health employees with a basic understanding of bioterrorism preparedness and response and how their work fits into the overall response. The course was designed by the Northwest Center for Public Health Practice in Seattle, Washington, and Public Health – Seattle & King County’s Communicable Disease, Epidemiology & Immunization section. The target audience for the course includes public health leaders and medical examiners, clinical, communicable disease, environmental health, public information, technical and support staff, and other public health professional staff. Health officers may also want to review the more detailed modules on diseases of bioterrorism in Preparing for and Responding to Bioterrorism: Information for Primary Care Clinicians: Northwest Center for Public Health Practice (available at http://nwcphp.org/bttrain). Public health workers are a very heterogeneous group, and the level of detailed knowledge needed in the different aspects of bioterrorism preparedness and response will vary by job description and community. Therefore, the curriculum is divided into modules, described in Appendix A.
The course incorporates information from a variety of sources, including the Centers for Disease Control and Prevention, the United States Army Medical Research Institute in Infectious Disease (USAMRIID), the Working Group on Civilian Biodefense, the Federal Emergency Management Agency, Public Health – Seattle & King County, and the Washington State Department of Health, among others (a complete list of references is given at the end of the manual). The curriculum reflects the core competencies and capacities outlined in the following documents:


Center for Health Policy, Columbia University School of Nursing. Core public health worker competencies for emergency preparedness and response, April 2001: http://cpmcnet.columbia.edu/dept/nursing/institute-centers/chphsr/


The course is not copyrighted and may be used freely for the education of public health employees and other biological emergency response partners.

Course materials will be updated on an as-needed basis with new information (e.g., guidelines and consensus statements, research study results) as it becomes available. For the most current version of the curriculum, please refer to: http://nwcphp.org/bttrain.
How to Use This Manual

This manual provides the instructor with additional useful information related to the accompanying MS PowerPoint® slides. The manual and slides are divided into six topic areas: Introduction to Bioterrorism, Emergency Response Planning, Diseases of Bioterrorist Potential, Health Surveillance and Epidemiologic Investigation, Consequence Management, and Communications. Links to Web sites of interest are included in the lower right-hand corner of some slides and can be accessed by clicking the link while in the “Slide Show” view. Blocks of material in the manual are periodically summarized in the “Key Point” sections, to assist the instructor in deciding what material to include in a particular presentation. A Summary of Key Points is indicated in bold, at the beginning of each module.

The level of detailed knowledge required may vary for some topics by job duties. Therefore, less detailed custom shows are included in the Emergency Response Planning and Diseases of Bioterrorist Potential: Overview modules for those workers without planning oversight or health care responsibilities, respectively. In addition, there are three Consequence Management modules: for public health leaders, for public health professionals, and for other public health staff (see Appendix A).
Environmental Sampling and Decontamination

Summary of Key Points (Slides 39-42)

1. Appropriate personal protective equipment for workers conducting environmental sampling includes a powered air purifying respirator with full facepiece and HEPA filter, disposable clothing, and gloves.
2. The decision to conduct environmental sampling is based on the nature of the contamination and the characteristics of the contaminated facility.
3. Environmental sampling, packaging, and transportation should follow appropriate state protocols and federal regulations.
4. Samples should be analyzed for agents of bioterrorist concern at a facility that is part of the Laboratory Response Network for Bioterrorism (LRN).
5. Persons having direct contact with agents of bioterrorist potential should wash with soap and water.
6. Antibiotic prophylaxis may be necessary if the biological agent exposure involved airborne particles.
7. Only vaccinated personnel should perform smallpox decontamination.
8. The decision to sample or decontaminate a facility is a multi-agency
decision and should include experts at the local, state, and federal
levels.

9. Environmental decontamination is probably not necessary for agents
with a short survival time (i.e., plague, botulinum toxin), if the area can
be avoided to allow natural degradation.

Slide 1: Curriculum Title

Slide 2: Acknowledgements

Slide 3: Module Title

Learning Objectives (Slides 4-5)
The learning objectives for this module are:

1. Describe:
   - The indications and purpose for collecting environmental samples for biological testing
   - The indications and procedures for decontamination following a spill or aerosol release of a critical biological agent
2. List the agencies involved in environmental sampling and decontamination
3. Identify the requirements for personal protective equipment when collecting environmental samples.
4. Be able to locate sampling and packaging protocols for critical biological agents
Environmental Sampling (Slides 6-19)

Key Points, Slides 6-11

1. Environmental sampling may be useful for describing the contamination, and in supporting decisions for subsequent interventions.
2. Agencies and personnel involved in environmental sampling following an act of bioterrorism include the FBI and local law enforcement, the EPA and local HAZMAT teams, and public health laboratories.
3. Workers should wear appropriate personal protective equipment when conducting environmental sampling.
4. The decision to collect samples should be made by experts in consultation with other local, state, and federal agencies.

The following information on environmental sampling includes information from “Comprehensive procedures for collecting environmental samples for culturing Bacillus anthracis” (CDC, April 2002). Some of the text is reproduced from the document. Environmental sampling may or may not be appropriate with critical biological agents other than anthrax, depending on the source and nature of contamination and survival characteristics of the particular agent (see slides 23-38).
Environmental sampling to determine the presence of *Bacillus anthracis* spores in indoor environments is an important tool for assessing risk for exposure. Environmental sampling can also be used to determine the extent and degree of contamination, to support decisions regarding the need for medical treatment or cleanup, and to provide guidance regarding when cleanup is adequate to permit re-entry into an area. A multidisciplinary team including field investigators, laboratory personnel, and medical professionals, as well as local, state, and federal agency officials should interpret analytical results. Inclusion of field investigators and laboratory personnel in the interpretation process will provide the best insight into sample collection and recovery.

The deliberate release of a biological agent is a criminal act, and therefore it is important that evidence be collected and preserved in a manner that will withstand legal challenges to obtaining a conviction. Sampling will therefore most likely be conducted by law enforcement and FBI officials, in consultation with experts knowledgeable in the appropriate sampling methodologies and health risks of the organism(s) of concern (e.g., public health laboratory personnel, Environmental Protection Agency (EPA), state environmental health agency personnel). Under the Federal Response to Acts of Chemical/Biological Terrorism, Emergency Support Function 10 (see the “Consequence Management” module), the EPA is the lead federal agency for hazardous materials management activities. The EPA provides technical support, in coordination with state and local agencies, in environmental threat assessment and cleanup activities (see www.epa.gov/epahome/whereyoulive.htm for a list of regional EPA offices and state environmental agencies). Public health laboratory personnel will monitor the progress and thoroughness of cleanup activities through laboratory assays.
Personal Protective Equipment (Slide 7)

The following text is taken from “Protecting Investigators Performing Environmental Sampling for *Bacillus anthracis*: Personal Protective Equipment” (CDC, 2002). The level of personal protective equipment (PPE) described is likely to also be appropriate for workers conducting environmental samples for critical agents other than *Bacillus anthracis*, particularly if there is uncertainty regarding the identity of the agent(s) used. In the event of a biological aerosol release or other contamination, workers should consult with current CDC recommendations for PPE.

Workers conducting environmental sampling that places them at risk for exposure to *Bacillus anthracis*, the organism causing anthrax, should wear protective personal equipment (PPE), including respiratory devices, protective clothing, and gloves. The items described below are similar to those used by emergency personnel responding to incidents involving letters or packages. Emergency responders need to use greater levels of protection in responding to incidents involving unknown conditions or those involving aerosol-generating devices.
Powered Air-Purifying Respirator with Full Facepiece and High-Efficiency Particulate Air (HEPA) Filters

• The constant flow of clean air into the facepieces is an important feature of this respirator because contaminated air cannot enter gaps in the face-to-facepiece seal. These respirators also give wearers needed mobility and field of vision.

• Respirators should be used in accordance with a respiratory-protection program that complies with the OSHA respiratory-protection standard (29 CFR 1910.134).

• Respiratory facepieces for investigators should be assigned on the basis of results of quantitative fit testing.

• Wearing a properly functioning and powered air-purifying respirator with a full facepiece that is assigned to the wearer on the basis of quantitative fit testing will reduce inhalation exposures by 98% of what they would be without wearing this type of respirator.

Disposable Protective Clothing with Integral Hood and Booties

• Wearing protective clothing not only protects the skin but also can eliminate the likelihood of transferring contaminated dust to places away from the work site.

• Wearing disposable rubber shoe coverings with ridged soles made of slip-resistant material over the booties of the disposable suit will reduce the likelihood of slipping on wet or dusty surfaces.

• All PPE should be decontaminated immediately after leaving a potentially contaminated area.

• Protective clothing should be removed and discarded before removing the respirator.

Disposable Gloves

• Disposable gloves made of lightweight nitrile or vinyl protect hands from contact with potentially contaminated dusts without compromising needed dexterity.

• A thin cotton glove can be worn inside a disposable glove to protect against dermatitis, which can occur from prolonged exposure of the skin to moisture in gloves caused by perspiration.
Pre-sampling Considerations (Slides 8-11)

Slides 8-11 list factors to consider before conducting environmental sampling. Much of the information in these slides is specific to *B. anthracis*, but the general concepts will be useful when dealing with other agents as well. The first consideration is whether environmental sampling is appropriate, given the source and nature of contamination, and survival characteristics of the particular agent (see slides 31-46). Some of the agents of concern do not survive long in the environment (e.g., *Y. pestis*, causative agent of plague), limiting the usefulness of environmental sampling. Other factors to consider include whether safe and unsafe levels of exposure to the particular agent have been defined (i.e., exposure standards), the most accurate means to measure contamination (i.e., validated sampling and analytical methods), and how equipment will be decontaminated after conducting the sampling.

The decision to collect environmental samples for culturing *B. anthracis* should be made by industrial hygienists and other experts familiar with the organism and the appropriate sampling methodologies. Representatives from laboratories, as well as local, state, and federal agencies, should be consulted during the decision-making process. The decision to sample should be based on the extent and location of any suspected contamination, the potential for the contaminant to migrate, and the activity for which the facility is used.
Currently, no occupational or environmental exposure standards exist for *B. anthracis* spores. In addition, there are presently no validated sampling and analytical methods specifically for *B. anthracis* in environmental samples.

Data are lacking on collection efficiency of the sample collection media (swabs, wipes, filters, etc.) for typical porous and nonporous surfaces encountered in indoor environments (e.g., furniture, carpet, letters, clothing, ventilation system filters). The effect of varying concentrations of *B. anthracis*-containing particles and dust loading on sampling efficiency has not been studied. Further, the recovery efficiency of the analytical methods (efficiency of removal of *B. anthracis* spores from the sample collection media) has not been adequately evaluated and limits of detection have not been established.
Before sampling is begun, the building’s engineer/HVAC facility manager should be consulted on the design and operation of the HVAC system(s) to assess airflow patterns and determine which components (fans, filters, ductwork, etc.) serve a given area. Since most buildings re-circulate air through ducted returns or ceiling plenums to other locations in the building, shutting down the ventilation system serving the contaminated area may be necessary to avoid dispersing *B. anthracis* spores. This issue should be discussed with the HVAC engineer with specific attention to some areas, such as computer network areas, which require constant ventilation (cooling) to prevent heat damage to critical systems. Safety considerations are imperative not only for investigators but for the general public. Depending on the size of the area involved, the types of surfaces potentially contaminated, and the extent of contamination, it may be necessary to isolate and control access to the contaminated area to prevent the spread of contamination through the movement of people or equipment.
Several components are essential for the implementation of a successful sampling strategy during an environmental investigation. Key components include properly trained personnel, suitable sample media and supplies, appropriate safety policies, and thorough record keeping and documentation procedures. Potentially contaminated areas should be secured to prevent cross-contamination and re-aerosolization of *B. anthracis* spores. To design a credible sampling strategy, the investigator must decide what questions the data are intended to answer. Defining the goal of a sampling survey is essential for capturing data that are scientifically meaningful and therefore useful in the decision-making process of an investigation. Once the goal of the sampling is adequately defined, an appropriate sampling strategy can be developed and implemented. The sampling method and number of samples collected will be influenced by the circumstances of the potential contamination. A sufficient number of samples must be taken to increase the probability that the sampling is representative of the extent of contamination. Obtaining samples from additional locations at varying heights within the area of interest may provide more specific information on the source and dispersion of the contamination. In an initial investigation where there has been a known or suspected release of potentially contaminated material, the first priority should be to collect samples in locations that are near the suspected release source(s).
If the aerosol containing *B. anthracis* spores has an aerodynamic size of less than 10 micrometers (µm), the particles will remain suspended in the air for extended periods of time (hours to days). In such cases, the spores can spread throughout an air space and into adjacent areas by following both localized (people walking by) and generalized (airflow from HVAC systems) airflow currents. In determining the extent of contamination, investigators should include coverage of areas along an anticipated contaminant pathway, i.e., those associated with air movement or dust collection, as well as activities that result in re-aerosolization or cross-contamination. In this case, the decision logic typically used in indoor environmental quality investigations of bioaerosols can be applied in identifying other important sampling locations. Spores can also be carried if they attach to clothing, shoes, or other objects; thus, more distant sampling may be needed.

The types of sampling methods utilized in a sampling strategy may include the collection of bulk, surface, and air samples. Each sampling method has specific advantages in particular applications. Consultation with laboratory personnel is essential to determine the capabilities and analytical process of the laboratories involved. It may be necessary to use a combination of sampling methods to adequately characterize an environment. Those performing the sampling need to be cognizant of how their own activities or the sampling method itself could disturb the existing environment and, therefore, alter the results. Additionally, field and media blank samples should be sent to the laboratory to determine if cross-contamination has occurred during sample collection. Field blanks should comprise at least ten percent of the total number of samples. Chain-of-custody procedures should be followed and documented as designated by local or state health laboratory reporting requirements. A written report of sample results should be obtained from the laboratory and should include a detailed description of the analytical procedures and any deviations from these procedures that may have occurred.
Rapid-Assay Devices (Slide 12)

The following text is taken from “Notice to Readers: Use of Onsite Technologies for Rapidly Assessing Environmental Bacillus anthracis Contamination on Surfaces in Buildings.” MMWR 2001 Dec 7;50(48):1087. Environmental sampling to ascertain the presence of Bacillus anthracis spores in buildings is an important tool for assessing risk for exposure. Similar to diagnostic testing, culture with positive identification of B. anthracis (CDC culture method) is the confirmatory test. Laboratory-based polymerase chain reaction (PCR) methods for detecting genetic material of B. anthracis can be used in preliminary assessments and as adjuncts to microbiologic methods.

Although these tests are consistent with culture results, PCR methods are not approved by the Food and Drug Administration, and results should not be the basis for clinical decisions. Rapid-assay devices that can provide results within minutes are used for onsite detection of environmental contamination. Some of these devices are PCR-based assays, and others are immune-based assays for B. anthracis. CDC has not obtained validation data for rapid-assay devices. A recent CDC evaluation of B. anthracis contamination at the Brentwood postal facility in the District of Columbia included use of one onsite PCR-based device and one CDC culture method. Of 107 samples analyzed using the CDC culture method and the PCR-based device, 95 (89%) were negative by both methods. Of six samples identified as positive by the CDC culture method, two were positive using the PCR-based device. Of eight samples identified as positive by the PCR-based device, two were positive by the CDC culture method.
Although these results indicate a poor agreement between results from the onsite PCR-based device and the CDC culture method, this assessment was not intended as a formal validation test because of limited capacity to implement adequate quality-control measures and the small number of *B. anthracis* positive samples.

The apparently poor agreement of the onsite PCR-based device could be attributed to several factors such as the concentration of spores on contaminated surfaces, sample collection and preparation procedures, sample splitting, and the methods used for removing the sample from collection material. Furthermore, PCR- or immune-based tests do not distinguish viable from nonviable spores and can produce positive scores for samples that culture methods would define as negative. As a result, these methods are not useful for evaluating the success of disinfection techniques that do not remove nonviable spores. Public health officials are urged to understand the limitations of onsite, rapid technologies for *B. anthracis* before using them for public health decision making. Until validation testing is complete and guidelines for effective use are developed, PCR- or immune-based assay results for *B. anthracis* should not be used alone, but should be confirmed with samples analyzed by culture methods to make public health decisions.
Environmental Assessment Protocols

Collection of environmental samples should conform to state protocols and guidelines. Samples submitted for analytical testing should conform to laboratory policies and procedures. In Washington, food suspected as a potential cause of illness in an outbreak should not be submitted to the Washington State Public Health Laboratories without the approval of Communicable Disease Epidemiology (206-361-2914).

Specific guidelines are available for food for analysis, depending on the organism of concern. Technical assistance can be obtained from the appropriate regional contact in the State Department of Health’s Division of Drinking Water if drinking water system contamination is suspected. The Office of Environmental Health Assessments provides technical assistance and consultation and conducts human health assessments and health education activities related to statewide and site specific releases of toxic substances. Specific protocols for collecting environmental samples to test for the presence of *B. anthracis* spores can be found in “Comprehensive Procedures for Collecting Environmental Samples for Culturing *Bacillus anthracis*,” revised April 2002, CDC.
Packaging Critical Biological Agents (Slides 14-16)

Key Point

Environmental samples collected to determine the presence of a critical biological agent should be packaged and shipped according to regulations for infectious substances.

Environmental samples collected for the purpose of determining if an organism responsible for human disease is present should be considered “Infectious Substances.” As such, these samples must be packaged, labeled, marked, and shipped according to applicable federal and international regulations (Public Health Service, Department of Transportation, the United States Postal Service, and the International Civil Aviation Organization [as published by the International Air Transport Association, Dangerous Goods Regulation]). General information on sample packaging and shipping can be obtained at http://www.bt.cdc.gov/LabIssues/PackagingInfo.pdf. It is the responsibility of the shipper to ensure correct identification, classification, packaging, labeling, marking, and documentation for all shipments of infectious substances. Investigators who will be handling and transporting infectious substances must receive training on these regulations prior to collecting samples for submission to an analytical laboratory. Chain-of-custody procedures should be followed and documented.
“Triple” (primary receptacle, water tight secondary packaging, durable outer packaging) packaging (slide 15) is required for a biological agent of human disease or materials that are known or suspected of containing them. This packaging requires the "Infectious Substance" label be shown on the outside of the package. This packaging must be certified to meet rigorous performance tests as outlined in the DOT, USPS, PHS, and IATA regulations. August 14/2002, the Federal Register published a final Department of Transportation rule under Docket HM-226 entitled "Hazardous Materials: Revision to Standards for Infectious Substances." The final rule will become effective on February 14, 2003. A summary of the revisions can be found at: http://www.saftpak.com/2002newregs.htm.

Clinical specimens with a low probability of containing an infectious agent are also required to be "triple" packaged, but performance tests require only that the package shall not leak after a four-foot drop test. DOT, PHS, and IATA require a "clinical specimen" label on the outside of the package.
Sample Analysis (Slides 17-19)

Due to the degree of complexity and safety required during analysis for agents of bioterrorist concern, samples should be analyzed at a facility that is part of the Laboratory Response Network for Bioterrorism (LRN), with adequate safety procedures in place. Additional information may be obtained at http://www.phppo.cdc.gov/nlttn/pdf/LRN99.pdf.

For example, swab samples collected for rule-out testing of *B. anthracis* can be analyzed at an LRN Level A laboratory (generally a CLIA-certified clinical laboratory) using BSL-2 facilities and BSL-3 safety practices. All other samples including bulks, wipes, air samples, or vacuum samples should be analyzed for *B. anthracis* at an appropriate LRN Level B or C laboratory using BSL-3 facilities.

In addition, all culture isolates that cannot be ruled out and are, therefore, presumptively positive should be referred to an LRN Level B or C laboratory for confirmatory testing. LRN personnel should be consulted when a sampling plan is designed and at subsequent stages of the investigation.

Safety considerations for laboratory personnel involved with analytical processing of samples are paramount. Laboratory personnel must be adequately trained to handle infectious agents and must use proper procedures to reduce exposure during analysis. Additional information regarding safe laboratory practices can be obtained at http://www.phppo.cdc.gov/nlttn/default.asp and the Biosafety in Microbiological and Biomedical Laboratories (BMBL) 4th Edition located at http://www.cdc.gov/od/ohs/biosfty/bmbl4/bmbl4toc.htm.
Slide 18 lists the biosafety levels required in labs performing diagnostic testing of the Category A agents. Note that all of the agents require confirmatory testing at a public health laboratory. Most of the agents require BSL-2 (in Washington – DOH Public Health Laboratories in Shoreline and Spokane Regional Health District lab); however, the causative agents of smallpox and viral hemorrhagic fevers require BSL-4 (CDC).

CDC has established a multi-level Laboratory Response Network (LRN) for bioterrorism. Labs are identified by increasing levels of proficiency to respond to bioterrorism, from Level A to Level D; these categories take into consideration the biosafety level capacity of the labs, as well as other resource and capacity issues.

**Level A** - Most labs are Level A, and include public health and hospital labs with a certified biological safety cabinet as a minimum.

**Level B** - State and local public health labs with BSL-2 facilities that incorporate BSL-3 practices.

**Level C** - BSL-3 facilities with the capability to perform nucleic acid amplification, molecular typing, toxicity testing [Washington Public Health, for example].

**Level D** - Possess BSL-3 and BSL-4 biocontainment facilities and include the CDC and USAMRIID labs.

Level B/C labs can register for the LRN and then have password-protected access to information over the Web.
Environmental Decontamination (Slides 20-34)

Key Points

1. Biological decontamination of buildings/facilities may use a combination of vapor methods, surface decontamination, sterilization, and incineration.

2. Agents used in biological decontamination include disinfectants and sterilants/sporicides.

3. Bleach (hypochlorite) solutions are adequate for surface decontamination of most critical biological agents.

4. Buildings housing smallpox patients require extensive decontamination by vaccinated personnel.

5. Soap and water is adequate personal decontamination for direct contact exposures involving intact skin.

There is limited experience with biological decontamination of buildings and facilities. Standard procedures do exist for the Department of Defense biological laboratories (e.g., USAMRIID), but there are limitations in how well they can be translated to public buildings. The biological laboratories were built with the decontamination requirements in mind.

Public facilities, on the other hand, may be large or have many corners and crevices that present a challenge to creating an air-tight seal around the area being decontaminated. HVAC systems can become contaminated and disseminate biological particles to other areas of the building. Chemicals used for decontamination may damage electronic or other sensitive equipment. Vapor is readily absorbed by porous materials, such as books and clothing, making adequate decontamination of the facility more difficult. Finally, the lack of standards to indicate when a building is considered “clean” and safe for re-entry presents yet another challenge in the decontamination of buildings.
The decision to decontaminate a facility, as with the decision to conduct environmental sampling, should be made in consultation with experts at state and federal agencies. Under OSHA, 29 CFR 1910.120(1), pathological releases are considered HAZMAT incidents and, thus, at the federal level fall under the authority of the Environmental Protection Agency (EPA).

The lab at USAMRIID uses a combination of vapor methods, surface decontamination, sterilization and incineration to ensure decontamination. A few of the chemicals and other methods used for decontamination are listed in slides 21 and 22. The most appropriate agent depends on the biological agent being targeted.
Anthrax (Slides 23-26)

The causative agent of anthrax is *Bacillus anthracis*, a gram positive, spore-forming bacteria (slide 23). Anthrax is primarily a disease of herbivores (e.g., sheep, cows), which acquire infection via exposure to *B. anthracis* spores in soil. Humans contract infection through contact with infected animals or contaminated animal products; therefore, hunters and textile workers (‘woolsorter’s disease’) have historically been high-risk groups.

Animal vaccination programs have dramatically decreased the number of animal deaths due to anthrax; and industrial hygiene practices and restrictions on imported animal products helped to decrease the incidence of anthrax among humans in the United States. Although cutaneous anthrax is by far the most common natural form of the disease (gastrointestinal anthrax is very rare), the inhalational form is the most likely presentation in a BT attack.
Inhalational anthrax follows the deposition of spore-bearing particles, 1 to 5 µm in diameter, into alveolar spaces (slide 24) (spore size is approximately 1 µm. The greatest risk for contracting inhalational anthrax after an aerosol attack occurs after primary aerosolization (i.e., before particles hit the ground, probably within one day, depending on environmental conditions and the chemical properties of the aerosol). Secondary aerosolization is thought to be unlikely, as these particles will be mostly larger particles (> 5µm) that require large amounts of energy to be re-suspended; however secondary aerosolization is dependent on several factors, including the characteristics of the aerosolized particles, the environmental surfaces, and human and mechanical activity occurring in the affected area. A study conducted during the 2001 anthrax outbreak demonstrated that routine activity in an environment contaminated with *B. anthracis* spores could cause significant spore resuspension. Thus, care should be taken not to disperse dust particles into the air during clean-up.
Decontamination (Slides 25-26)

Washing with soap and water is adequate decontamination for persons coming into direct contact with substances alleged to contain anthrax. Antibiotic prophylaxis may be also be necessary, if the exposure involved airborne particles. Antibiotic prophylaxis may be recommended, as a secondary precaution, for workers conducting environmental decontamination. The appropriate personal protective equipment will depend on the anticipated exposure risk associated with different response situations; interim recommendations are available at URL: http://www.bt.cdc.gov/DocumentsApp/Anthrax/Protective/10242001Protect.asp.

Several different antimicrobial pesticides and devices were used in building clean-up efforts during the 2001 anthrax outbreak, including chlorine dioxide, ethylene oxide, bleach, paraformaldehyde, hydrogen peroxide and peroxyacetic acid, and methyl bromide (see http://www.epa.gov/epahome/hi-anthrax.htm for more information on these agents and anthrax clean-up efforts).

Scientific assessments have concluded that methyl bromide contributes to the destruction of the ozone layer, and thus, its use as a pesticide is currently being phased out in the United States and all other countries. Applications of methyl bromide in decontamination efforts related to the 2001 anthrax outbreak were limited to use in a vacant mobile home on the premises of the University of Florida.
Antimicrobial agents are categorized as sanitizers, disinfectants, and sterilants, according to the degree of contamination possible with the agent. A sanitizer is a substance that significantly reduces the bacterial population in the inanimate environment, but does not destroy or eliminate all bacteria or other microorganisms.

- A disinfectant is a substance that destroys or eliminates a specific species of infectious or other public health microorganism, but not necessarily bacterial spores, in the inanimate environment.
- A sterilant is a substance that destroys or eliminates all forms of microbial life in the inanimate environment, including all forms of vegetative bacteria, bacterial spores, fungi, fungal spores, and viruses.
- A sporicide is used to destroy or eliminate all forms of microbial life including fungi, viruses, and all forms of bacteria and their spores.

Spores are considered to be the most difficult form of microorganism to destroy. EPA considers the term sporicide to be synonymous with sterilizer and sterilant.

The EPA grants a registration, based on the evaluation of safety data, allowing the distribution, sale, and use of the agent for particular purposes. Section 18 of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) authorizes EPA to allow certain state and federal agencies to use a pesticide for an unregistered use for a limited time if EPA determines that emergency conditions exist. The use of antimicrobial pesticides to decontaminate facilities following a biological release would fall under the latter authorization. Hydrogen peroxide, per oxyacetic acid, and sodium hypochlorite are liquids that can be used to sanitize or disinfect. Chlorine dioxide in liquid form is a disinfectant, but as a gas, it can be used as a sterilant. Pure ethylene oxide is a colorless gas at room temperature and a mobile, colorless liquid below 54 degrees Fahrenheit. It is sold as a mixture with either carbon dioxide or fluorocarbon 12. When used directly in the gaseous form or in non explosive gaseous mixtures with nitrogen or carbon dioxide, ethylene oxide can act as a disinfectant, fumigant, sterilizing agent, and insecticide.
Paraformaldehyde is a white, crystalline powder. When heated, paraformaldehyde releases formaldehyde gas, which may be used as a decontaminant. Bleach is registered for use as a sterilant and disinfectant; available published data suggest that bleach will also reduce bacterial spore populations under specific conditions including concentration, pH, and contact time.

The science of anthrax decontamination is rapidly evolving, and the procedures for applying bleach (see below) have changed based on more recent laboratory testing conducted by EPA.

**Applying Bleach**

- Only hard surfaces may be treated.

- A bleach solution close to but not above pH 7 (neutral) and 5,000 to 6,000 parts per million (ppm) can be prepared by mixing one part bleach (5.25%-6.00%) to one part white vinegar to eight parts water. Bleach and vinegar must not be combined together directly, rather some water must first be added to the bleach (e.g., two cups water to one cup of bleach), then vinegar (e.g., one cup), and then the rest of the water (e.g., six cups). The pH of the solution should be tested with a paper test strip.

- Treated surfaces must remain in contact with the bleach solution for 60 minutes (repeated applications will be necessary to keep the surfaces wet).
Smallpox (Slides 27-29)

The causative agent of smallpox is Variola major or Variola minor (causes a much milder form of disease). It is transmitted primarily by respiratory secretions between close contacts (i.e., people within 6-7 feet of one another), but can also be transmitted by aerosol (i.e., via air, for distances longer than 6-7 feet) and by direct contact (e.g., contaminated clothing or bedding). Studies of a vaccinia, a virus from the same family as variola, indicate that in the right conditions (i.e., cool, dry climate without exposure to ultraviolet light), vaccinia can survive as long as 24 hours. Variola virus has been found in scabs from smallpox patients as long as 13 years later.

Decontamination (Slides 28-29)


Only vaccinated personnel should perform decontamination procedures. Protective clothing including, gowns, gloves, shoe covers, caps, and masks should be worn. Although it was not considered a common mode of transmission during the smallpox era, infection with smallpox via contaminated bedding or fomites did occur rarely. Ideally, all disposable protective clothing worn by decontamination personnel should be placed in biohazard bags and autoclaved or incinerated before disposal.
However, if needed due to shortages of protective clothing, reusable protective clothing that can be laundered may be transported to the laundry in biohazard bags and then laundered using hot water (71°C) and bleach according to the standard proportions recommended by the manufacturer. The contaminated clothing should be wetted before sorting by laundry personnel, as this should help prevent the aerosolization of contaminated particles during sorting. (see Fenner, et al., Smallpox and its eradication, 1988: p.194, and Henderson, et al. JAMA. 1999; 281(22): 2127-2137.). Re-useable materials should be laundered on site, and all personnel handling laundry must be recently vaccinated (within three years). Decontamination personnel should immediately shower with soap and water after the contaminated protective clothing is removed. Vacuum cleaners used in decontamination should be disinfected with a phenolic germicidal detergent (e.g., industrial strength Lysol, Amphyl, or other commercial decontamination solution) after use to further disinfect the nondisposable parts of the vacuum cleaner (nozzle, hose, etc.).

Contaminated horizontal surfaces may be decontaminated using a 5% aqueous solution of a phenolic germicidal detergent (e.g., industrial strength Lysol, Amphyl, or other commercial decontamination solution). All surfaces should be thoroughly wet with the solution. Allow the solution to stand for at least 20 minutes then wet vacuum or wipe with clean cloths or disposable wipes. If a wet vacuum is not available or practical and mops are used, disposable mop heads should be used for no more than 500 sq. ft. of floor area. The cloths or disposable wipes, mop heads, vacuum cleaner contents, and protective clothing worn by the decontamination personnel should be bagged and incinerated or autoclaved.
If needed because of material shortages, re-useable protective clothing and cleaning materials that can be laundered may be bagged and then laundered using hot water (71°C) and bleach as outlined above. Facilities or rooms that were used to house smallpox patients should be decontaminated once they are no longer used to house such patients. Once surface decontamination has been done, formaldehyde decontamination should be performed, if possible. Formaldehyde decontamination should only be performed by personnel experienced with this method of decontamination. An Amphyl fogger following manufacturer recommended procedures may also be used. All disposable items should be bagged and incinerated or autoclaved.

1. All horizontal surfaces, furniture, fixtures, and walls should be decontaminated as outlined above (surface decontamination).

2. All mattresses, mattress covers, pillows, curtains, clothing, and other removable cloth items should be bagged and autoclaved, incinerated, or laundered in hot water (71°C) and bleach as described.

3. Items that should not be autoclaved or incinerated should be bagged and decontaminated using ethylene oxide.

4. Place paraformaldehyde in water in an electric deep-fat fryer in each of the spaces to be decontaminated (an electric skillet is a suitable substitution if a deep-fat fryer is not available).

   The amount of paraformaldehyde to be used should be sufficient to dose the space at approximately 0.3 gm/ft³, to yield 0.8% in air (7% to 73% in air will explode if ignited). The application rate of 0.3 gm/ft³ equals 1 lb. per approximately 1200 cu. ft. The relative humidity of the space should be between 50% and 60% for best disinfection. The recommended temperature is approximately 75°F (24°C).

5. Open all drawers and doors within the area(s) to be decontaminated.

6. Remove all equipment, devices, or materials that may not withstand exposure to paraformaldehyde and decontaminate by using one of the other methods outlined above (whichever method is appropriate for the equipment, device, or material) or by thoroughly wiping down with a 5% aqueous phenolic germicidal detergent (e.g., Lysol, Amphyl).

7. Seal the room or facility to be decontaminated with masking or duct tape, as paraformaldehyde diffuses readily.

8. Turn off ventilation in the room/facility during decontamination.
9. Cover supply-air grilles with plastic and seal them with tape. Seal the exhaust-air duct downstream from the air filter in the same manner.

10. Set the deep-fat fryer(s) or electric skillet(s) to operate at approximately 350°F (177°C).

11. Use a timer to turn the unit(s) off after 2 hours.

12. Allow at least 12 hours to pass before entering the room/facility after the vaporization unit(s) have been turned off. A portable self-contained breathing apparatus must be used if it is necessary to enter the space within 24 hours unless the room/facility has been completely aired out and formadehyde levels have been checked.

13. After the room/facility has been aired to remove vapors, ventilation may be turned back on, and personnel may enter the room.

If smallpox patients are housed in their own homes, the above procedure for paraformadehyde decontamination may be impossible or impractical. At a minimum, the following decontamination procedures should be performed:

1. All disposable items that came into contact with the smallpox patient should be bagged and incinerated. If incineration takes place in an area other than the home where the patient was housed, the outside of the bag should be sprayed with a suitable disinfectant (e.g., Lysol, household bleach) prior to transportation to the area for incineration.

2. Bedding, linens, clothing, curtains, or other cloth material that came into contact with the smallpox patient should be transported in biohazard bags to be laundered using hot water (71°C) and bleach or incinerated.

3. Surfaces, furniture, fixtures, and walls should be thoroughly cleaned with a 5% aqueous solution of a phenolic germicidal detergent (e.g., Lysol, Amphiyl).

4. Carpets and upholstery should be cleaned using a 5% aqueous solution of a phenolic germicidal detergent (e.g., Lysol, Amphiyl).
Plague (Slides 30-31)

_Yersinia pestis_, a non-spore forming bacteria, is the causative agent of plague. Plague can be transmitted to humans by the bite of an infected flea or rodent or by inhaling aerosolized plague particles. The former produces painful, swollen lymph nodes known as _buboes_. The latter produces plague pneumonia and can be transmitted person-to-person (bubonic plague, however, is not contagious). Plague can also present as a blood infection (septicemic plague).

In the event of a plague aerosol release, environmental decontamination would probably be unnecessary. _Yersinia pestis_ is sensitive to heat and light and, thus, would not be expected to survive long in the environment. Persons in direct contact with plague particles need only wash exposed surfaces and clothing with soap and water. Antibiotic prophylaxis may be also be necessary if the exposure involved airborne particles.
Botulism (Slides 32-34)

A toxin produced by the bacteria, *Clostridium botulinum*, is the causative agent of botulism. The spores produced by the bacteria are hardy and ubiquitous, but the toxin is easily inactivated by heat, sunlight, and chlorine. Contamination of the water supply is thus unlikely (this would also require a large, impractical amount to achieve a high enough concentration in the water). Contamination of untreated beverages and food is possible and could result in disease if not heated sufficiently prior to consumption. The toxin is absorbed via mucosal surfaces (i.e., inside the mouth and gastrointestinal tract) or wounds. It is not transmitted person-to-person.

Slide 33 lists the four potential types of botulism. Inhalation botulism could result following the inhalation of aerosolized particles. With the exception of three accidental cases in veterinary personnel in 1962, inhalation botulism is not a naturally occurring form of botulism.
Decontamination (Slide 34)

Sensitivity of the botulinum toxin to temperature, sunlight, and humidity would result in substantial degradation by two days following an aerosol release. Thus, environmental decontamination may not be necessary if the area of contamination can be avoided during this time period. If earlier entry into the contaminated area is unavoidable, surfaces should be cleaned with a 0.1% hypochlorite solution, and a mask and protective clothing should be worn. Persons in direct contact with C. botulinum spores should wash exposed surfaces and clothing with soap and water.

The botulinum spore, as opposed to the toxin, is not infectious. Under conditions of low oxygen, such as a wound or improperly canned food, the spore can produce toxin. All foods suspected of contamination should be promptly removed from potential consumers and submitted to public health authorities for testing. Heating to an internal temperature of 85°C for at least five minutes will detoxify contaminated food or drink.
Tularemia (Slides 35-36)

*Francisella tularensis*, a non-spore forming bacteria, is the causative agent of tularemia. It is sensitive to heat and disinfectants, but can survive for weeks in a cold, moist environment (e.g., water, moist soil or hay, dead animal carcasses). Humans can be infected by direct contact with infected animals or contaminated water, food, or soil, by the bite of infective insects and ticks, or by inhaling aerosolized particles. Tularemia is not transmitted person to person and, in its naturally occurring state, is rarely fatal.

Surfaces heavily contaminated with *F. tularensis* should be sprayed with a 0.5% hypochlorite solution (1:10 dilution of household bleach). After 10 minutes, a 70% solution of alcohol can be used to further clean the area and reduce the corrosive action of the bleach. Soap water can be used to flush away less hazardous contaminations. Persons in direct contact with *F. tularensis* should wash exposed surfaces and clothing with soap and water. Antibiotic prophylaxis may also be necessary if the exposure involved airborne particles. Standard chlorination levels of municipal water systems are sufficient to protect against water contamination with *F. tularensis*.
Viral Hemorrhagic Fevers (Slides 37-38)

Four families of viruses serve as causative agents of viral hemorrhagic fever. The illness course, geographic occurrence, and virus reservoir differ with each particular agent, but the initial presentation (febrile illness with blood clotting abnormalities) is similar in all cases. A few of the more well-known types of viral hemorrhagic fever are listed in slide 37. Mortality rates vary by agent, from 0.5% reported for Omsk hemorrhagic fever to 53-92% reported in outbreaks of Ebola hemorrhagic fever. Person-to-person transmission of the viral hemorrhagic fever viruses is possible via contact with body fluids (e.g., blood, secretions, urine, feces, semen) and, rarely, by airborne transmission.

Excreta and contaminated equipment should be autoclaved, if possible, or disinfected with hypochlorite or phenolic solutions. A 0.05% hypochlorite solution (1:100 dilution of household bleach) can be used to disinfect surfaces, bedding, re-useable protective clothing prior to laundering, and contaminated waste prior to disposal. A 0.5% hypochlorite solution (1:10 dilution of household bleach) should be used for excreta and for preparing bodies for burial.
Summary of Key Points (Slides 39-42)

Summary of Key Points

- Appropriate personal protective equipment for workers conducting environmental sampling includes a powered air purifying respirator with full facepiece and HEPA filter, disposable clothing, and gloves.

- The decision to conduct environmental sampling is based on the nature of the contamination and the characteristics of the contaminated facility.

Summary of Key Points

- Environmental sampling, packaging, and transportation should follow appropriate state protocols and federal regulations.

- Samples should be analyzed for agents of bioterrorist concern at a facility that is part of the Laboratory Response Network for Bioterrorism (LRN).

Summary of Key Points

- Persons having direct contact with agents of bioterrorist potential should wash with soap and water.

- Antibiotic prophylaxis may be necessary if the biological agent exposure involved airborne particles.

- Only vaccinated personnel should perform smallpox decontamination.
Summary of Key Points

- The decision to sample or decontaminate a facility is a multi-agency decision and should include experts at the local, state, and federal levels.

- Environmental decontamination is probably not necessary for agents with a short survival time (e.g., plague, botulinum toxin), if the area can be avoided to allow natural degradation.

Resources (Slide 43)

- Centers for Disease Control & Prevention

- CDC Office of Health and Safety Information System (personal protective equipment)
  - [http://www.cdc.gov/od/isr/](http://www.cdc.gov/od/isr/)

- Environmental Protection Agency
  - [http://www.epa.gov](http://www.epa.gov)

- USAMRIID
  - [http://www.usamriid.army.mil](http://www.usamriid.army.mil)

- Johns Hopkins Center for Civilian Biodefense Studies
  - [http://www.hopkins-biodefense.org](http://www.hopkins-biodefense.org)
References

**General Bioterrorism Information and Web Sites**


**Emergency Response Planning**


**Health Surveillance and Epidemiologic Investigation**

CDC. Case definitions under public health surveillance. MMWR; 1997;46(RR-10):1-55.


Last Revised December 2002
List of nationally notifiable infectious diseases.
http://www.cdc.gov/epo/dphsi/phs/infdis.htm


**Diseases of Bioterrorist Potential**

Advisory Committee on Immunization Practices (ACIP). Use of smallpox (vaccinia vaccine), June 2002: supplemental recommendation of the ACIP.

http://www.bt.cdc.gov/ncidod/hip/GUIDE/infectcont98.htm


Webcast: http://www.sph.unc.edu/about/webcasts/

Webcast: http://www.sph.unc.edu/about/webcasts/

CDC. Considerations for distinguishing influenza-like illness from inhalational anthrax. MMWR 2001;50(44):984-986.


Centers for Disease Control and Prevention. Smallpox vaccination and adverse events training module, 2002.
http://www.bt.cdc.gov/training/smallpoxvaccine/reactions/default.htm

Centers for Disease Control and Prevention, American Society for Microbiology & American Public Health Laboratories. Basic diagnostic testing protocols for level A laboratories.
http://www.asmusa.org/pcsrc/biodetection.htm#Level%20A%20Laboratory%20Protocols


Working Group on Civilian Biodefense Consensus Recommendations:
Environmental Sampling and Decontamination


Environmental Sampling and Decontamination


CDC. Use of onsite technologies for rapidly assessing environmental Bacillus anthracis contamination on surfaces in buildings. MMWR. 2001;50(48):1087.


Environmental Protection Agency. EPA’s role in responding to anthrax contamination. http://www.epa.gov/epahome/hianthrax.htm#FORRESPONDERS.

Consequence Management


CDC. Interim recommendations for the selection and use of protective clothing and respirators against biological agents http://www.bt.cdc.gov/Documents/App/Anthrax/Protective/10242001Protect.asp


Psychological Aftermath of Trauma


Communication and Informatics


Covello T, Peters RG, Wojetteck JG, Hyde RC. Risk communication, the West Nile Virus epidemic, and bioterrorism: responding to the communication challenges posed by the intentional or unintentional release of a pathogen in an urban setting. J Urban Health: Bulletin of the NY Academy of Medicine 2001;78(2):382-391.

Appendix A: Modules (MS® Powerpoint files)

**Introduction to Bioterrorism**
One module (33 slides)

**Emergency Response Planning**
One module, with one custom show for personnel without planning oversight responsibilities
- Public health leaders (36 slides)
- Other public health staff (24 slides)

**Diseases of Bioterrorist Potential**
Six modules
- Overview (25 slides, with 20-slide custom show for staff without health care responsibilities)
- Anthrax (29 slides)
- Smallpox (44 slides)
- Plague and Botulism (33 slides)
- Tularemia and VHF (38 slides)
- Environmental Sampling and Decontamination (43 slides)

**Health Surveillance & Epidemiologic Investigation**
One module (32 slides)

**Consequence Management**
Three modules
- Public health leaders (51 slides)
- Public health professional staff (51 slides)
- Other public health staff (30 slides)

**Communication & Informatics**
One module (42 slides)
Appendix B: Glossary

**Bulbar**: Referring to the cranial nerves

**Coagulopathy**: A disease affecting the coagulability (clotting) of the blood

**Confluent**: Joining, running together

**Conjunctivitis**: Inflammation of the conjunctiva; “red eye”

**Depigmentation**: Loss of pigmentation (color)

**Diplopia**: Double vision

**Dyspnea**: Shortness of breath

**Edema**: An accumulation of an excessive amount of watery fluid in cells or tissues

**Enanthem**: A mucous membrane eruption (rash)

**Epistaxis**: Nose bleed

**Erythema**: Redness

**Eschar**: A thick, coagulated crust or slough

**Exanthem**: A skin eruption (rash) occurring as a symptom of an acute viral or coccal disease

**HAZMAT**: Hazardous materials management; HAZMAT workers respond to discharges and/or releases of oil, chemical, biological, radiological, or other hazardous substances.

**Hematemesis**: Vomiting of blood

**Hemoptysis**: Coughing up blood

**Hemorrhagic mediastinitis**: Bloody inflammation in the chest cavity

**Hypotension**: Low blood pressure

**Indolent ulcer**: Chronic ulcer, showing no tendency to heal

**Leukocytosis**: Elevated white blood cell count

**Lymphadenitis**: Inflammation of a lymph node or lymph nodes
Lymphadenopathy: A disease process (e.g., swelling) affecting a lymph node or nodes

Macule: A small, discolored patch or spot on the skin, neither elevated above nor depressed below the skin's surface

Malaise: General ill feeling

Myalgia: Muscle aches

Papule: A small, circumscribed solid elevation on the skin

Percutaneous: Denoting the passage of substances through unbroken skin; passage through the skin by needle puncture

Petechiae: Pin-head sized hemorrhagic spots in the skin

Pharyngitis: Inflammation of the tissues of the pharynx; “Sore throat”

Pleuropulmonary: Relating to the pleura and the lungs

Preauricular: Anterior to the auricle of the ear

Prodrome: An early or premonitory symptom of a disease

Prophylaxis: Prevention of a disease, or of a process that can lead to disease

Prostration: A marked loss of strength, as in exhaustion

Pustule: A small circumscribed elevation of the skin, containing purulent material

Sepsis: The presence of various pus-forming and other pathogenic organisms, or their toxins, in the blood or tissues

Stomatitis: Inflammation of the mucous membrane of the mouth

Vesicle: A small, circumscribed elevation on the skin containing fluid (i.e., blister)

*Reference: Stedman’s Medical Dictionary, 26th Ed.*
In the wake of the 2001 anthrax attacks, thousands of people and organizations across the country have scrambled for information on how to protect themselves, their families, and their employees from anthrax and other potential agents of bioterrorism. Health officials have been flooded with requests to deliver presentations on bioterrorism preparedness and response at community forums, clinical conferences, business meetings, and other public venues. Potential instructors and trainers, however, have been handicapped by the lack of up-to-date, basic orientation resources on bioterrorism preparedness and response.

*Preparing for and Responding to Bioterrorism: Information for the Public Health Workforce* is a series of train-the-trainer resources that addresses the public health aspects of bioterrorism. It is scientifically accurate, up-to-date (as of the date of publication), and immediately relevant to the public health workforce. The series consists of thirteen PowerPoint™ slide sets, each accompanied by a detailed instructor’s manual. The slide sets cover emergency response planning, surveillance and epidemiologic response, diseases of bioterrorist potential, consequence management, and communication and informatics. They are flexible and can be customized for local community needs. Included in each slide set and instructor’s manual is a list of resources, references, and contacts for further information on bioterrorism preparedness and response—before, during, and after an incident.

We hope these resources will help the public health workforce to plan for and respond to public health emergencies, including a bioterrorist attack, and facilitate coordination between public health and other emergency responders.