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DEPARTMENT OF HEALTH AND HUMAN SERVICES Public Health Service

Centers for Disease Control
and Prevention (CDC)
Atlanta GA 30333

March 6, 2015

This letter is in response to your Centers for Disease Control and Prevention and Agency for Toxic Substances and Disease Registry (CDC/ATSDR) Freedom of Information Act (FOIA) request of September 15, 2014, regarding a copy of the following study provided to the CDC by the American Water Works Association or the Water Research Foundation: The Anthrax study completed circa 2013 under solicitation RFQ-OH-13-00006.

Enclosed are the documents you requested (85 pages).

Program staff inform me that the solicitation RFQ-OH-13-00006 is available at https://www.fbo.gov

Sincerely,

for Katherine Norris
CDC/ATSDR FOIA Officer
Office of the Chief Information Officer
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Enclosure

14-01081-FOIA

Draft Report: Anthrax Water Emergency Messaging Workshop

Disclaimer

The Centers for Disease Control and Prevention (CDC), through its National Center for Emerging and Zoonotic Infectious Diseases, and U.S. Environmental Protection Agency (EPA), through its National Homeland Security Research Center, have created this report. It has been subjected to technical and administrative reviews but does not necessarily reflect the views of either agency.

Acknowledgement

The Centers for Disease Control and Prevention, U.S. Environmental Protection Agency, and American Water Works Association wish to acknowledge all of the Subject Matter Expert Workshop participants for their significant contributions, expertise, and hard work in discussing crisis communication needs following a wide-area release of aerosolized *Bacillus anthracis* spores impacting water. Participants and their contact information are listed in Appendix A of this report.

For Additional Information

Questions concerning the workshop or this document should be addressed to the following CDC and EPA workshop leads:

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Executive Summary

A Subject Matter Expert (SME) Workshop entitled "Anthrax Water Emergency Messaging" was held in Alexandria, Virginia, on January 29-30, 2013. The workshop was co-sponsored by the Centers for Disease Control and Prevention (CDC) and U.S. Environmental Protection Agency (EPA), in partnership with the American Water Works Association (AWWA). Its purpose was to identify and discuss local, state, and federal authorities' needs and concerns related to public messaging on the safety and use of water in the immediate aftermath (first 72 hours after confirmation) of a wide-area release of aerosolized *Bacillus anthracis* (*B. anthracis)* spores. Discussion included consideration of research gaps and additional information needed to develop answers to key questions the public likely would ask about water use during such an emergency. Five major areas of focus included:

- The incident and who is affected
- Exposure to *B. anthracis* spores
- Appropriate uses of water and obtaining alternate water supplies
- Personal/individual protective actions
- Response and recovery

A CDC Anthrax Management Team (AMT) coordinates CDC's overall anthrax-related preparedness activities. One goal of the AMT has been to identify potential questions and answers related to anticipated food and water needs in the immediate aftermath of a wide-area release of aerosolized *B. anthracis* spores. Concurrent with CDC's effort, EPA has separately published a report entitled *Need to Know: Anticipating the Public's Questions during a Water Emergency*[1] which identifies the most likely water-related questions the public will ask during any kind of intentional water emergency. The objective of the SME workshop was to create a framework for public message development by CDC, EPA, and others as part of emergency response and crisis communication planning specific to a wide-area release of aerosolized *B. anthracis* spores impacting water. To address this need, the workshop organizers invited more than 30 experts from CDC, EPA, AWWA, public health agencies, the water sector, emergency response, and academia from across the country who had significant expertise and experience in crisis events involving water. In addition to AWWA, professional associations represented included the:

- Association of State and Territorial Health Officials (ASTHO)
- Association of State Drinking Water Administrators (ASDWA)
- Council of State and Territorial Epidemiologists (CSTE)
- National Association of County and City Health Officials (NACCHO)
- National Environmental Health Association (NEHA)

The workshop included introductory presentations that described the general logistics and overall goals of the workshop, presented the workshop incident scenario and potential impacts on water resources, and provided background information on the exposure and health effects of anthrax infection and crisis communication during a bioterrorism incident. These presentations were

followed by facilitated discussions organized around the five focus areas listed above. Some of the key findings from the workshop are described below.

Although the primary and greatest risk of infection from a wide-area release of aerosolized *B. anthracis* spores is through inhalation of spores in the air and from contact with spore-contaminated surfaces, all three forms of anthrax (cutaneous, gastrointestinal, and inhalational) may be possible from exposure to spore-contaminated water. One of the primary decisions that public officials will make following a wide-area aerosol release will be whether and how potentially *B. anthracis* spore-contaminated tap water can be used. This decision will be difficult because of existing uncertainty about the behavior of *B. anthracis* spores in water, the fact that no federal standard (e.g., Maximum Contaminant Level [MCL], the legally enforceable highest level of a contaminant that EPA allows in drinking water; or Maximum Contaminant Level Goal [MCLG], the level of a contaminant in drinking water below which there is no known or expected risk to health) for ingestion or inhalation of *B. anthracis* spores in water has been determined, and the high likelihood that sampling and analysis results during the first 72 hours following confirmation of a release of aerosolized *B. anthracis* spores will be limited. Despite these issues, providing clear communication to the public about water use and other important related information will be vital.

Based on the available microbiological and epidemiological data on *B. anthracis* spores and water, and limited experience from similar incidents, SME Panel opinion was that the risk of infection from exposure to spore-contaminated source water under the aerosol release scenario would be relatively low compared to the potentially much higher risk to public health and safety from shutting down the water system or issuing an order not to use the water, particularly for an extended period. For this reason, the panel concluded that a recommendation encouraging the public to continue using tap water sparingly and for essential purposes only, such as personal hydration, hygiene, and sanitation, should be considered.

This opinion was based on multiple factors, including the expected dilution of *B. anthracis* spores in both source and tap water, the potential reduction in the concentration and viability of spores resulting from various water treatment methods, and the enclosed nature of large portions of most drinking water distribution systems, which would shield the water from direct exposure to aerosolized spores. Moreover, not having water for hydration (drinking, cooking), hygiene (bathing), sanitation (flushing toilets), indoor climate control (cooling during hot summer months), and possibly fire suppression (indoor sprinkler systems or fire fighting) could pose increasingly significant health and safety risks for a large population, particularly if sustained for several days. Decontamination of spore-contaminated clothing, surfaces, and dust also requires water. It was further assumed, based on current anthrax response planning that calls for sufficient stockpiling and timely rapid distribution of antimicrobials to the entire population in a potentially impacted area, that people taking appropriate post-exposure prophylaxis (PEP) antimicrobials in the aftermath of a widespread aerosol contamination event would be protected from contracting anthrax from exposure to *B. anthracis* spores.

Open (uncovered) outdoor bodies of water, such as ponds, pools, or reservoirs can be unsafe if directly impacted by *B. anthracis* spore aerosols. Because of this, public health officials may decide to advise the public to avoid contact with such water, such as during recreational use,

until further notice. Typical levels of chlorine or bromine used in swimming pools, hot tubs, and spas will not inactivate *B. anthracis* spores.

1.0 Introduction

A wide-area release of aerosolized *Bacillus anthracis (B. anthracis)* spores, the pathogen that causes the disease anthrax, is a bioterrorism threat of major national concern. To better prepare for crisis communication during the immediate aftermath following confirmation of a wide-area release of aerosolized *B. anthracis* spores that could disrupt the normal use of water, the Centers for Disease Control and Prevention (CDC) and the Environmental Protection Agency (EPA) convened a Subject Matter Expert (SME) Workshop on "Anthrax Water Emergency Messaging" on January 29-30, 2013, in Alexandria, Virginia.

The purpose of the workshop was to identify and discuss local, state, and federal authorities' needs and concerns related to public messaging on the safety and use of water during the first 72 hours after confirmation of a wide-area release of aerosolized *B. anthracis* spores. Facilitated discussions included consideration of available scientific knowledge related to *B. anthracis* spores in water and identification of research gaps and additional information needed to develop answers to key questions the public likely would ask about water use during such an emergency. The workshop objective was to create a framework for public message development by CDC, EPA, and others as part of emergency response and crisis communication planning specific to a wide-area release of aerosolized *B. anthracis* spores. See Appendix A for the SME Workshop Agenda.

The workshop was conducted in partnership with, and facilitated by, the American Water Works Association (AWWA). The CDC, EPA, and AWWA workshop organizers identified and invited multidisciplinary experts from CDC, EPA, public health agencies, the water sector, emergency management, and academia who had significant expertise and experience in crisis events involving water and/or anthrax. Participants represented municipal, county, state, and federal organizations from geographically diverse locations across the country, including major cities such as Cincinnati, Denver, Milwaukee, New York City, Philadelphia, Phoenix, and San Francisco. (See Appendix B for a list of participants). In addition to AWWA, professional associations represented included the:

- Association of State and Territorial Health Officials (ASTHO)
- Association of State Drinking Water Administrators (ASDWA)
- Council of State and Territorial Epidemiologists (CSTE)
- National Association of County and City Health Officials (NACCHO)
- National Environmental Health Association (NEHA)

The SME Panel discussed foundations for answering questions previously identified by CDC and EPA in five major focus areas including:

- The incident and who is affected

- Exposure to *B. anthracis* spores
- Appropriate uses of water and obtaining alternate water supplies
- Personal/individual protective actions
- Response and recovery

A CDC Anthrax Management Team (AMT) coordinates CDC's overall anthrax-related preparedness activities. One goal of the AMT has been to identify potential questions and answers regarding anticipated food and water needs in the immediate aftermath of a wide-area release of aerosolized *B. anthracis* spores. Concurrent with CDC's effort, EPA separately published a report entitled *Need to Know: Anticipating the Public's Questions during a Water Emergency*[1] which identifies the most likely water-related questions the public will ask during any kind of intentional water emergency. The findings in the EPA report were developed based on focus group research, and the questions identified were used as a starting point for CDC in developing its initial anthrax-related water materials, including a number of water and anthrax-related questions which required further input from external experts to answer. The list of questions under the five focus areas was provided to the SMEs at the beginning of the workshop and is included in Appendix C.

The SME Workshop started with introductory presentations that described the overall goals of the workshop, provided background information on the exposure and health effects of anthrax infection and crisis communication during a bioterrorism incident, and presented the aerosol release scenario and its potential impacts on water resources. These presentations are provided in Appendix D. The description of the aerosol release scenario presented to the SME Panel is summarized below.

The introductory presentations were followed by an explanation of how the workshop would be conducted, how participant feedback would be captured, and how a workshop report would be developed.

1.1 Workshop Scenario Presented to SME Panel

The hypothetical scenario presented to the SME Panel at the beginning of the workshop involved the deliberate release of aerosolized *B. anthracis* spores over one or more locations of a large metropolitan area using a dispersal device such as an aircraft or sprayer truck. The aerosol could be colorless and odorless, and when released as a plume into the air has the potential to travel long distances before settling, depending on the parameters of the release, meteorological conditions, and the topography of the impacted area. Thus, the aerosol plume could be dispersed over a wide area and expose a large number of people to potentially lethal levels of *B. anthracis* spores.

Such a scenario is premised on an assumed delay (i.e., 12-36 hours or longer) between the time of the aerosol release and confirmation that a release has occurred, during which time people may travel in and out of the affected areas. Everyone within the suspected area of contamination would be considered to be at some level of risk of exposure to *B. anthracis* spores, although the specific risk for any one individual would not be predictable. People throughout a broad geographical area could inhale *B. anthracis* spores as either primary or secondary aerosols or

otherwise be exposed to spores. However, it would not be possible to determine exactly which individuals were exposed and, of those, who would develop an infection.[2] This kind of incident could tax emergency response, public health, hospital, and other resources over a large area and, unless treatment and preventive prophylaxis are quickly administered, result in a high number of casualties and deaths.

Among the multiple concerns following a release of aerosolized *B. anthracis* spores will be the extent and impact of water contamination, including drinking water supplies and open (uncovered) outdoor bodies of water. Questions will arise about the safety of water for drinking, bathing, cooking, and other uses (e.g., fire fighting), and concerns regarding the risk of infection through contact with potentially *B. anthracis* spore-contaminated water will need to be addressed. Developing answers to these questions in advance is critical because during the first 72 hours of response, when fear and uncertainty are likely to be at their highest levels, public officials will be focused on multiple priorities, such as making decisions regarding overall emergency response and protective measures.

During a bioterrorism incident, the CDC is the federal agency responsible for providing public health guidance. Other federal organizations, such as the EPA, Federal Bureau of Investigation (FBI), Department of Homeland Security (DHS), and the Federal Emergency Management Agency (FEMA), as well as local and state partners, will have critical roles and responsibilities in responding to the crisis. It will be important during the crisis that responsible organizations have open channels of communication and that they coordinate crisis communication messages that are as accurate and consistent as possible.

The scenario timeframe included the first three days (72 hours) following confirmation that the contaminant was *B. anthracis*. Although it was recognized that the greatest probable health impacts of the incident would be due to direct exposure to *B. anthracis* spores through the air, the focus of the workshop was water.

Discussions focused on the following hypothetical occurrences:

- Spores get into source water that will be treated and used for drinking water
- Spores infiltrate (enter) the enclosed drinking water distribution system
- Spores are deposited onto open outdoor surface water sources, such as swimming pools, lakes, ponds, and rivers.

1.2 Scenario Assumptions

SMEs were asked to focus on the first 72 hours after authorities confirm that a release of aerosolized *B.anthracis* spores has occurred and the contaminant had been identified. Assumptions made for the scenario were:

- Other critical infrastructure sectors (transportation, power, etc) are functioning properly.

- No evidence exists to suggest direct injection of *B. anthracis* spores into the water supply or distribution system.

- Uncertainty exists about whether the distribution system has been contaminated from aerosolized *B. anthracis* spores and, if so, the locations and extent of contamination.

- No federal standard (e.g., Maximum Contaminant Level [MCL], or Maximum Contaminant Level Goal [MCLG]) for ingestion or inhalation of *B. anthracis* spores in water has been determined.

- In a wide-area aerosol release, exposure to *B. anthracis* spores in drinking water is presumed to be less hazardous than exposure to spores in the air. This is due to the likelihood that there will be a much higher number of spores present in the air than in the water and to the assumption that the estimated infective dose for ingestion is significantly higher than that for inhalation.

- Modalities (e.g., public health Points of Dispensing (PODs), retail PODs, employer PODs) are in place and will be activated to provide protection from all forms of anthrax through the distribution of post-exposure prophylaxis (PEP) antimicrobials within 48 hours of detection to the population in the areas of risk.

- People who are taking appropriate PEP before the onset of symptoms are considered to be protected from contracting anthrax through exposure to *B. anthracis* spores both in the air and in the water.

- Enough PEP is quickly available and being dispensed to the population in the impacted areas in the appropriate timeframe. Impacted areas may include those directly impacted by the airborne plume or those located outside of the plume area but which receive water from a drinking water source or utility located within the plume area.

2.0 Expert Workshop Findings

Although the SME Panel focused on critical issues related to water, deliberations were influenced by the overall context of a wide-area release of aerosolized *B. anthracis* spores. The panel recognized that the most immediate concern would be reducing risks associated with exposure to *B. anthracis* spores in the air and deposited on surfaces and providing emergency medical attention to people who are potentially infected or who may already be exhibiting symptoms. Much information will be unknown initially, and impacts of the aerosol release will become more clear only as events unfold. It is likely that emergency response and public health resources will be heavily burdened as the escalating and unprecedented disaster progresses.

During the early stages following a wide-area release of aerosolized *B. anthracis* spores, people will need information about such things as:

- What has happened?
- Which areas have been spore-contaminated?

- Who has been exposed to the pathogen?
- What are the risks associated with exposure?
- What is being done by authorities to address the incident?
- What protective measures can individuals take?
- How long will it be before the situation returns to normal?
- Where can people go for additional or updated information?

In addition to these concerns, the fundamental questions pertaining specifically to water will be "Can I use the water and, if so, for what?" and "What will happen to people who have already consumed or been exposed to water that could be spore-contaminated?"

It is important to note that members of the public can and will search the internet and other information sources and will potentially find information that is inaccurate or conflicts with official messages and instructions provided during this crisis. As part of crisis communication planning, it is advisable to perform internet searches to see the available confirmatory, conflicting, and tangential information in order to prepare messages, including those to mitigate the impact of conflicting information when necessary.

In the following sections, findings resulting from SME Panel discussions are presented for each of the five focus areas described earlier in this report. Included under each area is a description of the issue, considerations and issues that the group agreed must be addressed in developing accurate and appropriate crisis messages, and special considerations to take into account when developing messages.

2.1 Information about the Incident

Information that will be critical to people following a biological terrorist incident of this nature includes facts about what happened, such as details about the incident (what, where, when, how) and who is potentially at risk of exposure to *B. anthracis* spores. As previously stated, many of these questions will be difficult to answer during the first 72 hours because much information will initially be unknown. Uncertainty will exist, in part due to the complexity of the incident and to the limited capacity for water sampling and analysis for such a large impacted area. For example, it could take days to definitively answer the question of whether the water in the distribution system is spore-contaminated. During this time, decision makers will have to depend on the limited data at hand and on previously established conclusions, such as those presented in this report. However, despite these uncertainties, providing information to the public and others will be vital during the crisis.

2.1.1 Emergency Operations Center

Any anthrax incident of this scale will be of national significance, and responsible federal agencies will work within a unified Incident Command System (ICS) framework that includes state and local public health, emergency response, law enforcement, and other agencies. To initiate risk communication, a Joint Information Center (JIC) will be established to coordinate all public affairs activities and media releases.[3,4,5] Any communication to the public or response actions should be carried out within the ICS/JIC framework.

For water contamination issues, one of the most critical needs will be open and timely communication among water system, public health, and emergency response officials. It is important that, when the ICS is initiated in the early stages of the response, both water utility and public health officials are a part of the response discussions and are included in the Emergency Operations Center (EOC) and associated JIC. All of these groups will be interdependent on each other for the information, data, and support necessary to make informed decisions and recommendations to the public and to respond appropriately and effectively to the crisis.

2.1.2 Public Health Information

From a public health perspective, timely surveillance, epidemiologic investigation capacity, laboratory diagnostic capacity (in both clinical and public health laboratory settings), and the ability to rapidly communicate critical information at the local level to healthcare providers, governmental agencies, and those who are managing public communication through the media will be critical.[6]

2.1.3 Defining the Contamination Area and Levels of Risk

Understanding the extent of contamination will be among the most critical initial needs in order to determine the areas where people could have been exposed to *B. anthracis* spores and to limit further access and exposure. Because of the probable time lapse between spore dispersal and confirmation that an aerosol release has occurred, the precise extent of the contamination zone will not be immediately known. A wide-area aerosol release would result in a plume of *B. anthracis* spores that would generally be dispersed in the direction of prevailing wind and deposited along the plume route, as spores settle and the plume dissipates. For the most part, the contamination zone will be defined by the plume path boundaries, but this could be expanded by people and traffic moving in and out of the area, spore reaerosolization, or the introduction of spores into water that flows into previously uncontaminated areas. Public health officials will take appropriate steps to try to define the impacted areas and determine if water might be contaminated and present a potential public health risk. It is important to note that information obtained from interviews with anthrax case-patients will be critical in defining the extent of aerosolized *B. anthracis* spore contamination. Although the population exposed by aerosol in this scenario will be vastly greater than that exposed only through water (i.e., persons outside the "plume" area but exposed via water systems that have been spore-contaminated and serve communities outside the "plume"), interviewing of these "outlier" anthrax case-patients, if any, about their locations of residence, work, and activities during the presumed exposure period will provide essential information for an effective response.

2.1.4 Sampling Issues

- It will be important for first responders to collect environmental samples (air, surface, and water) to help delineate the boundaries of the impacted areas (both the airborne plume area and the water service areas). However, such testing may take days or weeks; thus while testing is occurring, the public should be provided in the interim with information about potential exposure areas and risk. It is essential that the public quickly

receive clear recommendations on water use and that resources, including PEP, are deployed to protect the public.

- Large volumes of water are needed for adequate sampling. This requires specialized equipment and is time consuming. Large cities may be better equipped than smaller communities to handle this task.

- Limited surge capacity within the laboratories may hinder rapid analysis of the many anticipated samples, including environmental and clinical samples.

- Analysis of clinical and environmental air and surface samples will likely have higher priority than analysis of water samples during the first several days, leading to difficulty in having laboratory analysis of water samples done in a timely manner.

- A clear understanding of available laboratory capacity must exist before broad statements regarding sampling are made to the public.

2.1.5 Environmental and Contaminant Transport Issues

- Water resources in areas upwind, upstream, or otherwise outside of the plume area typically will not be directly exposed to aerosolized *B. anthracis* spores. However, tap water could contain spores if the water originates from within a plume-affected area.

- Spores could be transported beyond the initial plume contamination zone by moving water, such as a river. If *B. anthracis* spores are present in a drinking water distribution system, spore-contaminated water could be spread to other service areas outside of the contamination zone. Communication must include sharing information with neighboring downstream water utilities and others about the potential migration of contamination migration toward them.

- Use of potentially *B. anthracis* spore-contaminated open outdoor water for recreational purposes, such as swimming, boating, and fishing, could pose a risk of exposure to spores; therefore, such activities should be discouraged. Typical levels of chlorine or bromine used in swimming pools, hot tubs, and spas will not inactivate *B. anthracis* spores.

- State and local public health officials typically handle messaging for these activities.

2.1.6 Water System Issues

- In the scenario described, contamination of the water to a degree relevant to public health was considered unlikely, and the risk of disease was mitigated by the administration of post exposure prophylaxis. However, without sampling and testing of water, the possibility of water contamination could not be ruled in or out Therefore, during the early response, designated officials may wish to assure the public that actions are being taken for their protection and advise them that although there is no evidence to show that the water is contaminated, out of an abundance of caution consumers may wish to use tap

water sparingly and for essential purposes only (e.g., personal hydration, hygiene, and sanitation).

- The geographical area served by a water system can potentially extend beyond the area directly impacted by the airborne plume. For example, a water system in one city might provide water to municipalities located miles outside of the city itself. In addition, there may be potential downstream impacts from wastewater effluent or the use of spore-contaminated water for irrigation or other non-potable uses.

- Staff illness and/or concern for family members could result in a shortage of personnel during the crisis, thus adversely impacting water and wastewater treatment plant operations, including sampling and mitigation. The same problem is true for all sectors, including public health and emergency response personnel.

- Because the aerosol release may have happened a day or two before discovery and confirmation, potentially spore-contaminated water may have already moved through the distribution system and people may have already consumed or otherwise been exposed to the most heavily spore-contaminated water accessible through the tap.

2.1.7 Message Considerations

2.1.7.1 Different Impact Levels Call for Different Messages

Impacts of the aerosol release will depend on the degree to which a given area has been contaminated by airborne or waterborne *B. anthracis* spores. At least three main conditions could occur during this scenario, each influencing the response of responsible officials and their choices of appropriate water-related messages:

- No spores fell in the area because it was entirely outside the plume area, and no impact on open outdoor water or tap water exists
- Spores fell in the area, and open outdoor water or tap water could be impacted
- No spores fell in the area, but potentially *B. anthracis* spore-contaminated tap water or open outdoor water comes from an area that was impacted

The public will need to be informed about *B. anthracis* spores, risks of exposure through water, protective actions to take, anthrax symptoms and treatments, and the status of their drinking water systems.

2.1.7.2 Message Framework must be Flexible

Water systems vary considerably in their sources of water, treatment processes, designs, and operation of the distribution systems. A decision messaging framework must be flexible enough to address the wide range of systems and conditions that exist.

2.1.7.3 People and Communities Outside of Contamination Zone

People who are outside of the contamination zone, even in distant communities, will have questions about the vulnerability of their water systems to such an aerosol release, what protective measures are in place to prevent such an incident, and the readiness of the water, public health, and emergency response sectors to deal with a similar wide-area contamination incident.

3.0 Information about Exposure to Contaminants in Water

Following a wide-area release of aerosolized *B. anthracis* spores, questions will be asked immediately about the risk of exposure to spores via various pathways. In addition to information about direct exposure to *B. anthrcis* spores in the air and on surfaces, people will need information about exposure pathways related to water. This includes identifying who might have been exposed to harmful levels of *B. anthracis* spores in water and how people can avoid or reduce exposure to the spores. People will also want information about factors that can influence their level of risk of exposure, what will happen if they have already been exposed to or consumed spore-contaminated water, and how long *B. anthracis* spores will remain a danger. These important issues related to the public health response are generally addressed by designated local and state public health officials in consultation with CDC. Water utilities and responsible agencies, such as EPA and the respective state water primacy agency, will also be involved.

3.1 Exposure through Water

As previously described, various water resources could potentially become spore-contaminated as a result of a wide-area release of aerosolized *B. anthracis* spores. Some vulnerability of both the source water treatment process and distribution system exists that could impact the risk of water becoming spore-contaminated during a release of aerosolized *B. anthracis* spores. While such a risk is generally considered to be low, it still must be taken into account during the emergency response. Although predicting an actual level of risk is difficult, airborne *B. anthracis* spores could potentially impact a water treatment plant or a distribution system if any of the following are within the aerosol contamination plume area:

- Water sources that are open to the air, such as rivers, lakes, or reservoirs
- Treatment plant open pre-sedimentation basins, sedimentation basins, and filter bays
- Air stripping stations
- Uncovered finished water (already treated water) reservoirs
- Drinking water storage tank and pump station air vents/release valves
- Storage tanks on tops of buildings (openings due to disrepair or air vents)
- Vents in the water transmission mains

The level of risk of a given individual for developing anthrax from exposure to water would depend on the concentration of *B. anthracis* spores present in the water, the nature and amount of contact with the spore-contaminated water, the physical condition and individual susceptibility to anthrax of the person exposed to the water, and whether or not the person is taking appropriate antimicrobial prophylaxis. In theory, all three forms of anthrax infection are possible from to

exposure to *B. anthracis* spore-contaminated water, depending on the circumstances under which contact occurs. Cutaneous anthrax can occur from skin contact with spore-contaminated water through such activities as bathing, swimming, washing, or cleaning. Pharyngeal or gastrointestinal anthrax can occur from consumption of spore-contaminated water or of food products processed or washed with spore-contaminated water. Inhalational anthrax can develop in people exposed to spore-contaminated aerosolized water droplets.

3.2 Level of Risk from Exposure to *B. anthracis* Spores

- The risk of sickness or death from the inhalation of *B. anthracis* spores is likely to be greater than the risk of sickness or death from gastrointestinal exposure or cutaneous exposure to non-intact skin (abrasions, scratches, open wounds)[7]. It will be critical to provide information about specific risks for each of these pathways in order to provide clear direction for appropriate protective measures.

- The risk of infection is dependent on the dose of *B. anthracis* spores a person receives from exposure, his or her physical condition and individual susceptibility to anthrax (which cannot be determined from one person to the next), and whether he or she is taking appropriate antimicrobial prophylaxis. An individual's overall risk of infection may increase with increased time of exposure. Messages should include the length of time the spores have been in the water, if known.

- The level of risk of adverse health effects to the population from exposure to *B. anthracis* spore-contaminated water depends on many factors, some of which include the:

    - Volume of spore-contaminated water consumed or inhaled

    - Concentration of spores in contaminated water

    - Viability of spores in contaminated water

    - Degree of direct contact with potentially spore-contaminated water used for activities such as showering, washing clothes, washing dishes, preparing food, making ice, flushing toilets, firefighting, etc.

    - Degree of contact with commercial water uses, such as in restaurants, evaporative coolers, produce misters in grocery stores, or hospital/dental offices.

- It is imperative to effectively communicate the risk associated with inhalation or ingestion of, or cutaneous contact with, *B. anthracis* spores and the absolute necessity of taking PEP as directed. The state and local health agency should convey specific instructions on the use of PEP, including specifically defining the populations at risk. A person's perceptions of what the level of risk may be can adversely affect his or her willingness to comply with important protective measures.

3.3 Reducing Exposure

There are multiple possible actions authorities can take to help prevent or reduce potential exposure to *B. anthracis* spores in water. These include:

- Limiting access to spore-contaminated areas and water resources
- Closing or bypassing potentially impacted raw water sources and switching to alternative raw water sources if available.
- Closing intakes of downstream treatment plants until spore-contaminated water passes
- Appropriately managing potentially spore-contaminated water run-off, from both natural meteorological events and decontamination activities
- Isolating, if possible, spore-contaminated water in parts of the distribution system (i.e., by closing valves) to limit further contamination and exposure
- Discontinuing use of all irrigation and similar spraying equipment for all applications because of the danger posed by re-aerosolization of the spores when the water is sprayed into the air
- Advising people to avoid contact with and use of all open outdoor water within the contamination zone, such as water from swimming pools, uncovered hot tubs, decorative fountains, ponds, lakes, etc. Typical levels of chlorine or bromine used in swimming pools, hot tubs, and spas will not inactivate *B. anthracis* spores.
- Providing clear information regarding the risks of exposure, including any uncertainties, and how to prevent or minimize exposure to spore-contaminated water

Authority to close businesses that may have been contaminated and present a risk to public health generally rests with the state or local health department. If potentially *B. anthracis* spore-contaminated water is an issue, the health department generally should involve the local water system authority when making such decisions and developing messaging associated with such actions.

3.4 What Will Happen if Potential Exposure to *B. anthracis* Spores in Water May Already Have Occurred?

- People will need information about how to determine if they may have been exposed to *B. anthracis* spore-contaminated water, including information about symptoms to look for.

- People will want to know what could happen to them or their loved ones if they were exposed to *B. anthracis* spore-contaminated water.

- People will need information about appropriate steps to take if they may have been exposed to *B. anthracis* spore-contaminated water, including how long it takes for symptoms to develop, whether anthrax is contagious, whether anthrax is treatable, how and where to get treatment, and what the treatment involves.

- People will need to know where to get additional information about exposure to *B. anthracis* spores and about anthrax.

- The state or local health department, in collaboration with appropriate federal agencies such as the CDC, typically will be responsible for creating and conveying all messages that address the clinical manifestations, diagnosis, and treatment of anthrax.

3.5 How Long Will *B. anthracis* Spores Remain a Concern?

Generally, any spore-contaminated water in streams and distribution systems will flow downstream and the spore concentration will be diluted. If spore-contaminated water gets into the distribution system, it should flow through quickly, except in areas where flow is restricted or where water potentially remains for longer periods of time, such as in water storage tanks. Research shows, however, that spores can adhere to corrosion and biofilm on the interior walls of drinking water distribution system pipes and persist there until either sloughing off over time into the water or effective decontamination occurs.[8,9,10,11] Spores are also likely to persist in sediment present in hydrants, storage tanks, and open reservoirs. The degree to which this occurs is subject to the attributes of the individual water system.

3.6 Message Considerations

3.6.1 Messages for people who may have already used potentially B. anthracis spore-contaminated water for drinking, formula or food preparation, etc., could include information such as:

- Be vigilant in watching for signs and symptoms of anthrax and immediately seek medical care if any symptoms appear.

- If not already taking PEP because of potential exposure to the plume, obtain PEP as quickly as possible and take it as directed. In the meantime, out of an abundance of caution, use tap water sparingly and for essential purposes only (e.g., personal hydration, hygiene, and sanitation).

3.6.2 Communicating with Downstream Communities

It may be necessary to develop messages to communicate potential impacts to downstream water systems and communities. This will be particularly important if there is a potential for contamination in areas outside of the aerosol release zone and where people are not taking PEP. Analyses of downstream water and effluent may be needed to inform exposure risks.

3.7 Concerns

- If spore-contaminated water enters the drinking water treatment plant or distribution system, such as through open vents or apertures, contamination "hot spots" may occur. For example, spores could collect in filters, pumps, valves, or pipe elbows, which could increase the risk of residual spores subsequently being released from biofilms. Appliances like water heaters, home water filtration devices, and ice makers could present similar problems. Spores could also collect in the wastewater treatment system infrastructure, increasing the exposure risk for wastewater treatment workers.

- Some activities, such as fire fighters using spore-contaminated water to extinguish fires, water utility staff turning valves to control water flow, and water utility, hazmat, public health, or criminal investigative staff collecting large volume water samples for analysis, may need to continue despite uncertainty regarding exposure.

- Some water systems may be constrained by an inability to shut down parts of their treatment or distribution system in order to isolate known spore-contaminated water. In other cases, such as in cities located in hot, dry climates where evaporative coolers are used as part of air conditioning systems, shutting down the water system may not be feasible.

4.0 Uses of Water and Availability of Alternative Water Supplies

In a 2004 CDC study on information the public will need during a terrorist incident involving *Yersinia pestis* (plague)[12], public focus group participants indicated that they would do the following in the face of a biological attack on their cities:

- Seek out information
- Contact family members to see if they were all right
- Take steps to protect themselves and their families
- Look for food, shelter, and water

One of the primary decisions responsible officials must make following a release of aerosolized *B. anthracis* spores is whether and how potentially spore-contaminated tap water can be used. People will need to know right away whether they can use tap water for such things as drinking, bathing, showering, brushing teeth, washing dishes, making baby formula, preparing and cooking food, watering gardens, making ice, and flushing toilets. Other questions will focus on the impact on hospitals, dialysis units, schools, day cares, and restaurants, and on whether the water can be used for firefighting, agriculture, industrial processes, and similar uses.

4.1 Issuance of Protective Orders

In crises involving water contamination, responsible officials have the authority to issue protective orders restricting or prohibiting the use of tap water. These include *Boil Water, Do Not Drink, and Do Not Use* orders, notices, or advisories, and limited use advisories (described below). Officials can also issue advisories to limit exposure to surface water bodies (e.g., lakes, rivers, reservoirs) or to limit other uses of water (e.g., agricultural irrigation, water park operations, etc.). Issuing protective orders can have serious implications related to disruption of the public and the economy, and they will be implemented only after careful consideration of the probable existing level of risk to public health. Another important consideration for all protective orders before they are issued is determining what it would take (e.g., scientific evidence indicating that the water is usable) to discontinue such orders. Commercial and industrial users of water will typically follow the same guidance as residential users.

It will be imperative to provide clear information and instructions about why such an order is needed, how it will be carried out, and how the decision will be made to discontinue it. This is especially true because the response to water contamination with *B. anthracis* spores is different than the response to more familiar, regulated, indicator bacteria such as *E coli*. It may also be necessary to provide information about obtaining alternative water supplies, if available, that can be used until the protective orders have been lifted. An important factor in determining acceptable uses for water in this situation is whether people in the impacted areas have received and are taking PEP antimicrobials, because doing so would provide protection against contracting anthrax.

4.1.1 Boil Water Notice/Advisory/Order

A frequently used and effective method for inactivating pathogens commonly associated with contamination in drinking water is to bring the water to a boil for one minute (three minutes at altitudes above one mile) before using it for drinking, brushing teeth, washing dishes, or similar activities. The general public is familiar with *Boil Water orders, notices, and advisories* because they are issued for water systems experiencing a short operational exceedance of microbial contamination. In the case of *B. anthracis* spores, however, an EPA/CDC study indicates that holding water at a rolling boil for 1-3 minutes in an open vessel does not result in spore inactivation.[13] A University of Michigan study suggested that boiling water contaminated with *B. anthracis* spores can result in aerosols generated during the vapor phase of boiling.[14] This may constitute a risk of exposure to spores via aerosol inhalation and surface deposition. If a significant concentration of *B. anthracis* spores were to be present in water, routine boiling of the contaminated water could pose a greater health risk than not boiling.

After considering available research and the specific factors and assumptions related to the incident scenario (e.g., universal use of PEP; absence or very low number of spores expected in tap water; much greater risk of exposure to spores from the original aerosol release and from reaerosolization from surfaces), the opinion of the SME Panel is that agencies should consider not issuing a *Boil Water Notice* in this scenario.

4.1.2 Messages Needed to Discourage Routine Boiling of All Tap Water

Because a Boil Water Notice/Advisory/Order is generally considered the first line of defense by most public health and water agencies following a biological water contamination incident, such agencies should be made aware, preferably before a *B. anthracis* spore contamination incident occurs, of the rationale for why a standard Boil Water Notice/Advisory/Order would not be appropriate for such an incident.

People in areas familiar with standard *Boil Water Notices/Advisories/Orders* might be tempted to boil their water despite the lack of a *Boil Water Notice* from authorities. To discourage this, it is important to provide clear messages similar to the following:

- Boiling water to kill environmentally hardy *B. anthracis* spores is different from boiling water to kill other bacteria. The traditional method of boiling water for one minute will not kill *B. anthracis* spores. Boiling all tap water to try to kill all *B. anthracis* spores may also pose a health risk from potential exposure to spores in the steam, particularly if a significant concentration of spores is present in the water.

4.1.3 Do Not Drink Order

While not as common as *Boil Water Notices/Orders*, *Do Not Drink Orders* are typically used in limited circumstances when boiling water is ineffective and would not make tap water safe to consume. However, a *Do Not Drink Order* requires the provision of alternative sources of water. Water systems and public officials need to be aware and plan accordingly to meet the significant challenges (such as large quantities of water required and the logistical requirements for transportation and distribution) of supplying enough water to meet the essential needs for an affected large metropolitan area for any length of time. For these reasons, the SME expert panel concluded that authorities should consider not issuing a *Do Not Drink Order* under the workshop scenario.

4.1.4 Do Not Use Order

In the absence of a *Boil Water Notice*, water primacy agencies, public health agencies, or other officials may exert pressure to issue a *Do Not Use Order*, which is a blanket prohibition on the use of all tap water for any purpose for the duration of the order. The order could also direct people to discard any products prepared with water collected during the period of concern, such as baby formula, food, and ice cubes.

The opinion of the SME Panel is that issuing a *Do Not Use Order* under this scenario could have significant negative public health and public safety implications for a community. For example, such an order could lead to an unofficial evacuation that would present challenges for administering PEP to dispersed persons, increase the risk of transporting *B. anthracis* spores to new locations, and hamper the transport of emergency supplies, emergency responders, and law enforcement personnel. Moreover, the difficulty in obtaining sufficient alternative water supplies for essential purposes, such as fire suppression, drinking, cooking, bathing, flushing toilets, cooling (e.g., if the aerosol release occurs during the summer), and decontamination, could pose significant health and safety risks for a wide population, particularly if sustained for

several days. The ability to use water for firefighting could also be in question under a *Do Not Use Order.*

4.1.5 Consider Issuing a Limited Use Advisory/Order

It is the opinion of the SME Panel that, under the aerosol release scenario, a *Do Not Drink* or a *Do Not Use* order/notice/advisory would have the potential to result in a greater negative health and safety impact than if the public is directed to use tap water sparingly and for essential purposes only. The call for limited tap water use should specify acceptable essential uses, such as personal hydration, hygiene, and sanitation. The public should also be told to refrain from using or having contact with potentially *B. anthracis* spore-contaminated open outdoor water sources, based on the possibility that spores may have settled in open outdoor water (because of the aerosol nature of the release) and the fact that the safety of open outdoor water may be difficult to assess during the early stages of the incident.

4.2 Message Considerations

4.2.1 Messages Should be Clear and Transparent

All orders and advisories will require clear communication regarding directed actions in order to inform people about why the actions are needed and the possible ramifications of non-compliance. Because the directed actions for *B. anthracis* spores, such as not routinely boiling all tap water, may be considered counterintuitive to what people usually expect for water contaminated by other microorganisms, it will be necessary to explain reasons for the differences. Providing as much information about the situation as possible will be important when explaining decisions. Given that available data will be limited, caveats such as "given the information we have at this time …" and "We expect to have updated instructions when new information is available" should be considered. Communication should be as clear and transparent as possible, and be conducive to building and maintaining trust, in order to encourage cooperative appropriate behaviors.

4.2.2 Convincing People that the Water is Useable May not be Easy

Convincing people that tap water is usable following this kind of incident may be difficult, even when tests indicate that no *B. anthracis* spores are detectable in the water. The message may need to be corroborated by people or organizations considered to be trusted sources by the impacted communities. For example, showing a trusted public figure drinking the tap water or a similar type of gesture might be needed.

4.3 Alternative Sources of Water

Even if there is a recommendation to continue to use tap water on a minimal basis, communities affected by this kind of scenario will likely look to augment their potable water supply with alternative sources. This will especially be true if the crisis lasts for several days or weeks. People will need to know what alternative water supplies are available and how to obtain them.

Water utilities plan for emergencies and many have aid arrangements in place with neighboring utilities to obtain emergency water supplies.[15] If bottled water or tanker trucks of water are needed, it is important to note that FEMA and the National Guard will not likely be able to supply enough drinking water for a large metropolitan area for any length of time and should not be relied upon to do so.

SME Panel members commented that significant challenges are likely to be associated with distributing alternative sources of water in a "hot zone." For example, If there is a "hot zone" with controlled entry and a requirement to decontaminate when leaving, then supplying water to the hot zone over land will increase the pressure on that process. It would increase the number of vehicles to be decontaminated, the number of personnel to be protected and the amount of contaminated waste (water bottles) for disposal. Some people may also be required to travel within the hot zone to the water distribution points, potentially increasing their exposure.

Providing a mere 2 liters of water per person per day overland to a population of 5 million people assuming a minimal 1 kg of packaging for each 10 kg of water, would require, at the least, approximately 250 fully loaded 18-wheel semi-tractor trailor load deliveries per day. This must incorporate the logistical burdens of fuel; drivers; support for drivers; security; loading, unloading, and operation of distribution areas; equipment repair; payroll; record keeping; traffic management; coordination with other deliveries; waste disposal of packaging; replacement of shipments due to misdirection or broken equipment.

Overland provision of water in an affected area is not necessarily insurmountable. However, it is greatly expensive and creates a large scale additional logistical burden that is entirely avoidable if the existing water distribution system can be used.

5.0 Actions People Can Take to Protect Themselves and Others

Although it is not known exactly how a given population will react to a wide-area release of aerosolized *B. anthracis* spores, reports from previous natural disasters and disease outbreaks indicate a pattern of generally effective and adaptive collective actions.[16] As with any crisis event, people will want information about what actions they can personally take to protect themselves, their families, and others in order to reduce the risk of exposure to *B. anthracis* spores and infection. With regard to water, they will want to know if there are things they can do themselves to inactivate or remove the spores from their water, such as boiling, adding disinfectant chemicals, or using filters or purification devices.

5.1 Taking Protective Personal Actions

The most important protective action for people who have potentially been exposed to *B. anthracis* spores will be quickly obtaining and taking all recommended PEP (antimicrobials and/or vaccine) as directed. Other actions they can take include such things as avoiding open exposed outdoor water that may have been spore-contaminated, watching for symptoms of anthrax, and immediately seeking medical attention if symptoms develop.

5.2 Self-Evacuation

As discussed previously, self-evacuation could spread *B. anthracis* spores to areas beyond the original contamination zone, disrupt the timely delivery of PEP, and hinder emergency response efforts. The SME Panel recognized that if responsible officials decide to issue a *Do Not Use Order,* a massive self-evacuation of the population could result.

In 1979, when a partial meltdown occurred at the nuclear power plant at Three Mile Island in Pennsylvania, almost 40% of the population within 15 miles of the nuclear plant evacuated the area on their own. In the absence of clear information from public safety officials, residents made the decision to remove themselves from a situation of unknown and potentially significant risk.[16]

The above example illustrates that clearly and quickly communicating recommendations (e.g., to continue to use water for essential purposes) and informing people that PEP may not be as readily available outside of the impacted area will be important in order to minimize the number of self-evacuations and help ensure that persons at risk will have timely access to PEP.

5.3 Chemical Disinfectants

Although adding disinfectant chemicals (e.g., chlorine bleach; iodine solution, tablets, or crystals) to water contaminated with certain pathogens is effective, a high volume and concentration of such chemicals would be needed to inactivate *B. anthracis* spores. Messages must be clear that people should not rely on or use chemical disinfectants (like chlorine bleach) because *B. anthracis* spores are much more difficult to kill than typical waterborne pathogens.[17,18,19]

5.4 Filters and Purifiers

Many members of the public will want to know whether home filtration units, such as those that are fitted to the home's main water line, are designed for personal use at home (e.g., pitcher filters or faucet-mounted filters), or are used for camping, are effective for removing *B. anthracis* spores. To help answer such questions, EPA conducted an extensive literature review in 2006, investigating the use of available Point-of-Use (POU) and Point-of-Entry (POE) treatment devices as a means of providing water security.[20] POU devices are designed to purify only that portion of incoming water that is being used for drinking and cooking purposes, while POE devices treat all the water coming into a house or facility.

The study investigated the most promising technologies and combinations of technologies (e.g., treatment trains) with regard to principles of operation; effectiveness for removing radiological, biological, or chemical contaminants; and limitations. The devices reviewed used various types of technologies, including solid block activated carbon, granular activated carbon, reverse osmosis, ultraviolet light, microfiltration, ultrafiltration, and nanofiltration. Results show that, because the type of contaminant threat can be so variable and unpredictable, a combination of treatment technologies offers the best chance of protection for various contaminants.

POU devices were not recommended for use following contamination with infectious agents because these devices may over time leach trapped, absorbed, or adsorbed contaminants. This effect is of particular concern for immuno-suppressed individuals and other sensitive subpopulations. An important concern related to the use of these filters among the general population involves the safe disposal of the filters and/or filter media after they are used (and therefore contain a concentrated amount of the contaminant). Personal protective equipment, which would not be available to most people, would be needed to safely handle spore-contaminated devices and filters.

Refrigerators and ice makers use carbon filters that are ineffective for removing *B. anthracis* spores. Traditional disinfectants like chlorine and iodine are sometimes present in typical home filters but are not present at high enough concentrations to inactivate *B. anthracis* spores. Lastly, even if some filters were proven to be effective, the issue mentioned above of what to do with a filter contaminated with *B. anthracis* spores still presents a number of problems.

The opinion of the SME Panel was that messaging regarding the use of filters and purifiers in this scenario should clearly explain the potential dangers associated with their use and state unequivocally that people should not rely on such devices to make water usable.

5.5 Message Considerations

5.5.1 Addressing Potential Self-Evacuation

It is important to acknowledge that some affected residents will be tempted to leave the area, be skeptical of treatment, or be afraid of taking PEP antimicrobials. Messaging to address such concerns should emphasize that:

- Inhalation or consumption of *B. anthracis* spores can be fatal
- Appropriate use of PEP antimicrobials can prevent anthrax from developing in people who have been exposed to *B. anthracis* spores but have not yet developed symptoms
- Taking appropriate PEP as soon as it is available can keep people from getting sick or dying
- PEP may not be as readily or quickly available outside of the impacted area

5.5.2 Directions for Obtaining Additional Information

Crisis communication will need to include instructions for obtaining additional information and getting advice about things people can do to protect themselves (e.g., keeping the toilet lid down or not handling home purification filters unless advised to do so by responsible authorities).

5.6 Concerns

It is anticipated that individuals may be approached by bottled-water delivery companies, for-profit laboratories, or companies that sell home treatment devices, with offers to test the tap water. These entities might not possess the appropriate instrumentation to detect *B. anthracis* spores, or they may only be able to conduct presence-absence tests that may not have been proven to be effective. Unless the companies have been approved by responsible authorities, individuals should be advised to view these offers skeptically.

6.0 Response and Recovery

Because the focus of the workshop was the first 72 hours following confirmation that a wide-area release of aerosolized *Bacillus anthracis* spores has occurred, the SME Panel did not spend significant time discussing longer term response and recovery issues. It was recognized, however, that questions about recovery may be asked early during the response, even though they pertain to later stages, and that public officials will need to address such questions as the emergency situation comes under control. The EPA will be the lead federal agency responsible for cleanup, including cleanup of water systems, in partnership with state and local authorities, including public health agencies. Procedures for consequence assessment and remediation are outside the scope of this report. Information about recovery and remediation is available on the EPA, AWWA, individual state, and numerous other websites.

6.1 General Questions about Response and Recovery

The SME Panel discussion touched upon some of the general concerns and questions residents will have at some point during the event. These may also pertain to businesses, schools, hospitals, etc. Issues discussed focused on identifying questions, such as those listed below, that the public will have regarding the overall water system and their individual residences.

6.1.1 Questions about the Water System

- How long will it be until the water supply returns to normal?
- Where can I get information about my water?
- What will be done with the water contaminated with *B. anthracis* spores?
- How is the water distribution system being decontaminated?
- Will the chemicals being used to decontaminate *B. anthracis* spores cause harm?
- How long will the disinfectants last in the water supply?
- How am I going to be sure when the water is usable again?
- What about the water at the office, school, mall, recreational facility, etc.?

6.1.2 Questions about Individual Residences and Buildings

- How do we decontaminate our residence/building?
- Will *B. anthracis* spores remain in my residence/building (e.g., in pipes, faucets, toilet tank, water heater, washing machine, dish washer, etc.)?
- Do I need to flush the water system in my residence/building (e.g., pipes, faucets, water heater, dishwasher, washing machine, water filters/purifiers, water softener, etc)?
- Are my small appliances still okay to use (e.g., coffee makers, water filter pitchers, etc.) and, if not, how do I decontaminate them?
- Are there specific plumbing (or infrastructure materials) that retain spores?
- How do I get samples tested from my residence/building? (The public will want proof the water is okay to drink.)
- What can I do with water from open outdoor sources contaminated with *B. anthracis* spores?
- What do I do about home water filters, in terms of replacement and maintenance, once the crisis has passed?
- Who will pay for decontaminating my residence/building?

6.2 Message Considerations

6.2.1 People Should Wait for Instructions

An important message will be for people to wait for instructions regarding appropriate actions related to remediation of their residences/buildings, such as whether and how to flush interior plumbing.

6.2.2 System Clearance

Even when sampling and analysis data clearly indicate that there are no detectable *B. anthracis* spores in the water, convincing the public that the water is useable may be difficult. The general perception of the public is that water is not safe unless it contains zero contamination. Collaboration with trusted sources, such as public health agencies or local elected officials, will be critical for affirming the credibility of decontamination/clearance messages. Effective presentation of the extent and results of testing in clear and understandable terms will be important.

7.0 Conclusion

Following a wide-area release of aerosolized *Bacillus anthracis* spores, presenting credible and timely public health information related to water use will be crucial in helping to mitigate the impacts of the incident and potentially save lives. Failures of communication and inconsistent messages in these circumstances can inhibit efforts to halt the spread of disease and cause individuals to seek alternative (and perhaps less accurate) sources of information.

Based on available epidemiological data on *B. anthracis* spores and water, and on experience from similar incidents, the SME Panel that convened in January 2013 agreed that the risk of infection from exposure to spore-contaminated water in the aftermath of a wide-area release of aerosolized *B. anthracis* spores could be relatively low based on the following knowledge and assumptions:

- Spores falling into untreated water sources that provide water to drinking water treatment plants or distribution systems would likely become highly diluted. Also, in some areas, there is not likely to be contamination of source water because it is distant from the population center.

- Standard drinking water treatment processes[21] would likely reduce the concentration of viable spores in finished/treated drinking water (however *B. anthracis* spores are generally resistant to typical concentrations of disinfectants used for drinking water treatment, such as chlorine and monochloramine[18,19,22,23,24,25]). It is possible that some places in the water distribution system could be subject to contamination and therefore require decontamination.

- The public health risks in this scenario from *B. anthracis* spores in water is likely much lower than from *B. anthracis* spores in the air and on surfaces

- Modalities (e.g., public health, retail, and employer points of dispensing [PODs]) are in place and will be activated to provide protection from all forms of anthrax through the distribution of PEP antimicrobials to persons in the areas of risk within 48 hours of detection.

With these considerations in mind, and the understanding that instituting a *Do Not Use Order* for tap water could pose significant health and safety risks for a wide population if sustained for several days, the opinion of the SME Panel is that a recommendation encouraging the public to

use their tap water sparingly and for essential purposes only (personal hydration, hygiene, and sanitation) should be considered.

The panel also acknowledged that drinking water that is distributed from within the plume area to locations outside of the plume area could present a possible, although likely small, public health risk. Therefore, the panel recognized that individuals residing or otherwise present in these locations may need to receive the same messaging regarding PEP and water use as those living within the plume area.

Open outdoor sources of water within the plume area would be considered unsafe due to the potential for direct contact with *B. anthracis* spore-contaminated air. Because of this, the public would be advised to avoid contact with open outdoor water in the area impacted by the plume until notified otherwise by public officials.

Key research gaps identified during the SME Workshop include:

- The level of risk of infection following exposure to *B. anthracis* spore-contaminated water based on various factors (type of exposure, age of exposed individual, etc.)

- Tolerance of *B. anthracis* spores to disinfectants; understanding whether known bioweapons will display similar clinical results when ingested as they do when acquired via airborne or dermal exposure

- Effective POU and POE water treatment devices and management of such devices after they are used and/or become spore-contaminated

Addressing these and similar gaps will be essential to establishing a more comprehensive understanding of the public health threat posed by *B. anthracis* spores in water and, in turn, developing the most appropriate, evidence-based response to a bioterrorist incident involving the wide-area release of aerosolized *B. anthracis* spores.

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4. Any additional??

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Appendix A. Subject Matter Expert Workshop Agenda

Tuesday, January 29, 2013

8:30 AM--8:45 AM	Welcome, introductions, logistics, ground rules *Alan Roberson, PE, Director of Federal Relations, AWWA*
8:45 AM --9:00 AM	Opening remarks *John C. Watson, MD, MPH, Captain, US Public Health Service, Medical Epidemiologist, Centers for Disease Control and Prevention (CDC)* *Hiba Ernst, PhD, Director, Threat and Consequence Management Division, National Homeland Security Research Center (NHSRC), USEPA*
9:00 AM--10:00 AM	Summary of wide-area aerosolized *B. anthracis* spore contamination incident *Attack scenario and potential impacts on water resources, Scott Minamyer, NHSRC, USEPA* *Exposure and health effects of anthrax infection, Sean V. Shadomy, DVM, MPH, DACVPM, Bacterial Special Pathogens Branch, CDC* *Crisis communication during the incident, Cynthia Yund, PhD, NHSRC, USEPA*
10:00 AM--10:30 AM	Categories of questions that will be asked during initial stages of crisis and workshop objectives *Alan Roberson*
10:30 AM--10:45 AM	Break
10:45 AM--11:45 AM	Facilitated expert session: questions about the incident and who is affected
11:45 AM--12:30 PM	Lunch (provided)
12:30 PM--2:00 PM	Facilitated expert session: exposure issues (what is known, what is partially known, and what additional information is needed to develop answers)

2:00 PM--3:00 PM	Facilitated expert session: uses of water and alternate sources
3:00 PM--3:15 PM	Break
3:15 PM--4:00 PM	Facilitated expert session: individual personal actions
4:00 PM--5:00 PM	Facilitated expert session: response and recovery actions
5:00 PM--5:15 PM	Wrap-up and plan for next day

Wednesday, January 30, 2013

8:30 AM--9:00 AM	Recap first day and any unfinished business
9:00 AM--9:15 AM	Objectives for Day 2
9:15 AM--10:15 AM	Facilitated expert session: developing answers to questions about the incident and who is affected
10:15 AM--10:30 AM	Break
10:30 AM--12:00 PM	Facilitated expert session: developing answers to questions about exposure issues
12:00 PM--12:45 PM	Working lunch
12:45 PM--1:45 PM	Facilitated expert session: developing answers to questions about uses of water and alternate sources
1:45 PM--2:45 PM	Facilitated expert session: developing answers to questions about individual personal actions
2:45 PM--3:00 PM	Break
3:00 PM--4:00 PM	Facilitated expert session: developing answers to questions about response and recovery actions
4:00 PM--4:30 PM	Wrap-up and future uses of workshop results
4:30 PM	Adjourn

Appendix B. Subject Matter Expert Workshop Participants

* Member of Organizing Committee, ** Workshop Facilitator

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Appendix C. CDC/EPA Theme Area Questions Provided to SME Panel

Who is affected?

- What are the specific areas affected? (with respect to risk from exposure/use of water)
- What should special needs customers do? (i.e., with respect to exposure/use of water)
    - Issue: Immunocompromised persons; pregnant women; infants/children; the elderly; disabled persons; hospitals; dialysis units; schools; day care; restaurants.

Exposure Issues

- How long has the water been contaminated with spores?
    - Issue: What if I've already used water for drinking, baby food/formula, preparing food, etc.?
- What is going to happen if I drank some of the water?
    - Issue: Can level of risk be defined/determined for ingestion?
- What's going to happen if I was exposed to the spore-contaminated water?
    - Issue: Can level of risk be defined/determined for cutaneous and/or inhalation exposure?
- What are the potential health effects from exposure to the spore-contaminated water?
    - Issue: Health effects are known, but can level of risk be defined for the different routes of exposure, including cutaneous, gastrointestinal/ingestion, and inhalational exposure due to aerosolization of water?
- Am I in danger of adverse health effects?
    - Issue: Can level of risk of exposure to water be determined, based on location, type of exposure, age, other factors?
- How do I know if I have been exposed to spore-contaminated water?
- Will fire protection still be available? Is it okay to spray water on a house?

- Can I use a swimming pool?
- Can I use a hot tub?
    - Issue: What if it was filled with water last week versus filled with new water?
- Is it okay to eat fish I catch?
- Is water along the beach useable? Is there danger in being near the surface water (lake)?
- I watered my garden. Is the food okay/contaminated?
- Will my pets be harmed?
- How can I tell if the water in my pipes is useable?
- Is there a danger being near a water tower?
- Is the water in my pipes contaminated with spores? How can I tell?
- Is it okay to use a drinking fountain?

Uses of Tap Water

- Is the water drinkable?
    - Issue: Can specific level(s) of risk of adverse health effects from water exposure be determined? Can we develop an algorithm/decision tree to determine how the risk could be calculated?
- What can people do and not do with tap water?
    - Drink?
    - Make juices and beverages?
    - Make ice?
    - Shower?
    - Bathe?
    - Make baby formula? Make baby cereal/food?
    - Cook?
    - Rinse/wash unopened food and beverage packaging/cans/bottles/etc.?
    - Wash and prepare food?
    - Flush the toilet?
    - Give to pets?
    - Water plants/houseplants?
    - Wash dishes/eating and cooking utensils?

  - Wash laundry?
  - Washing floors, kitchen counters, and/or other things?
  - Wash cars?
  - Wash pets?

- How about industry (commercial) or other uses of water?

  - Restaurants
  - Hospitals
  - Firefighting
  - Cooling towers

Alternate Sources of Water

- How and where does one get water that is usable? Is there a backup water supply?
- Can I use bottled water?
- Can I use well water?
- If I shut the main water valve off, can I use the water in my pipes or water heater tank?
- Can I use rainwater?
- Can I use water from a cistern?

Individual Personal Actions

- What actions do I need to take to protect myself and my family from adverse health effects from exposure/use of water?
- Can I boil the water to make it usable? (If yes, how?)
- Can I filter the water to make it usable? (If yes, how?)

  - Issue: Must address all types of water filters/purifiers, including portable water filters/purifiers such as those used for camping.

- Can I use chlorine bleach to make the water usable? (If yes, how?)
- Can I use iodine solution, tablets, or crystals to make the water usable? (If yes, how?)
- Can I use any other types of water purification tablet(s) or solution(s) to make the water usable? (If yes, how?)

- Can I use a UV device/pen to make the water usable? (If yes, how?)
- What should I do with the water I already have (e.g., in dog bowl)?
- Should I turn off my main water valve?

Response and Recovery

(Note: These questions may be asked early in a response, even though they pertain to later stages of response and recovery)

- How long will it be until the water supply returns to normal?
- How am I going to be sure when the water is usable again?
- Do I have to flush the water system in my house/building (e.g., pipes, faucets, water heater, dishwasher, water filters/purifiers, water softener, etc)?
- Are my small appliances still okay to use? (e.g., coffee makers, water filter pitchers, etc.)
- Will anthrax remain in my home (e.g., pipes, faucets, toilet tank, hot water heater, washing machine, etc.)?
- What will be done with the water contaminated with spores?
- What can I do with water from open outdoor sources contaminated with spores?
- Are there specific plumbing or infrastructure materials that retain spores?
- Where do I go to get information about my water?
- What about the water at the office, school, mall, recreational facility?

Attributes of Effective Messages

- Public respondents typically express preferences for:
    - Direct answers to the questions
    - Short concise sentences in active voice
    - Protective actions for self and family
    - Directive (e.g. do/don't) information rather than "recommendations"
    - Information on results rather than process ("studying", "assessing", "investigating")
    - Imparting a sense of time/predictability to the extent possible
    - Utilization of diverse media (e.g., TV, radio, web, social media, 911)

Other Potential Questions

- Questions about sampling and analysis
    - How are you taking samples to know that there are spores?
    - If so, what do the numbers mean?
    - Can you be sure this is zero?
    - Who is responsible for taking samples? EPA? Utility?
    - How do I get samples tested from my house?
    - Are the results publically available?
    - Are they interpreted? Or just in a raw data format?
    - What does 'non-detect' mean?
    - Who is responsible for the quality of the data?
- Questions about decontamination
    - How do we decontaminate our home?
    - How is the physical distribution system being decontaminated?
    - Will the chemicals (or substances used) being used to decontaminate cause harm?
    - How long will the effects of the disinfectants last in the water supply?

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Appendix D. Introductory Presentations

Provided as separate pdf file

Appendix D. Introductory Presentations

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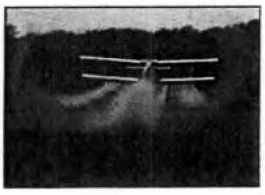
Workshop Scenario: Intentional Release of *B. anthracis* Spores

Anthrax Water Emergency Messaging Workshop
1/29/13
Scott Minamyer
USEPA National Homeland Security Research Center

EPA United States Environmental Protection Agency

Attack Scenario: Wide Area Contamination Event

- Deliberate airborne release of aerosolized anthrax spores over one or more areas of a city
- Various dispersal mechanisms possible



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Anthrax Spores

- Naturally-occurring, rod-shaped Gram-positive, spore-forming microorganism
- *Bacillus* spores are a tough, dormant form of cells that are resistant to desiccation, heat, and a variety of chemical and radiation treatments that are otherwise lethal to vegetative cells
- Most commonly occurs in wild and domestic animals (e.g., cattle and antelopes) but can occur in humans when exposed
- Spores are resistant to adverse environmental conditions and can remain viable in soil for 40+ years (also persistent in water)

EPA United States Environmental Protection Agency

Weaponized Anthrax Spores

- In a bioterrorism event, weaponized anthrax will most likely be aerosolized in the form of a white powder
- Aerosol release generally involves:
  - Use of small particles (~1-3 microns)
  - A high concentration of spores
  - Treatment to reduce clumping
  - Neutralization of the electrical charge
- Re-aerosolization is a consideration
- Aerosol release would have potential to travel long distance before settling

EPA United States Environmental Protection Agency

Focus of Workshop is Water

- **Focus of this workshop is entirely on water**
  - What if the spores get into surface water, swimming pools, beaches, etc.?
  - What if spores get into source water?
  - What if spores get into the drinking water distribution system?
- Timeframe is first 24-72 hours
- Information people will need about water during the emergency





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Surface Water Contamination

- Spores could deposit onto recreational waters, ponds, swimming pools, fountains, bird baths, etc.
- Initial focus would be limiting exposure for areas identified as being potentially contaminated
- Later focus would be mitigation


EPA United States Environmental Protection Agency

Source Water Contamination

- Intentionally contaminating most surface source waters with sufficient quantities of spores would be logistically difficult
  - Nationally, most reservoirs contain from 3–30 million gallons of water
  - Larger cities may be served by reservoirs that contain several hundred billion gallons of water
  - Lakes and rivers also have large volumes of water
- There are source water protection measures in place (covering reservoirs)
- Water treatment is typically effective

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Source Water Treatment

- Water plant treatment includes multiple processes to remove/inactivate contaminants
  - Flocculation (coagulation of smaller particles into larger particles)
  - Sedimentation (settling out from water of coagulated particles using gravity)
  - Filtration (physical removal of particles)
  - Disinfection (chemical or ultraviolet inactivation of microbial contaminants)
- **If typical water treatment system is working properly, it is very unlikely that significant numbers of spores would be in water leaving the treatment plant**

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If Treatment System Fails

- A waterborne outbreak of Cryptosporidium in Milwaukee in 1993 due to treatment system failure:
  - Killed an estimated 50-plus people
  - Affected the health of over 400,000 more
  - Cost millions in lost wages and productivity
- That outbreak, completely unrelated to terrorism, gives some sense of the potential vulnerability of modern water systems to similar, intentionally caused, contamination events

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Water in Distribution System

- In a typical community, treated water is transported under pressure through a distribution network of buried pipes, where it may be diverted into storage facilities or delivered directly to consumers
- There is secondary disinfection within distribution system
  - Typical chlorine residual level is ~1.1 mg/L
  - Typical monochloramine level is ~2.0 mg/L
  - Effective for regulated nonsporulating pathogens
- Anthrax spores are highly resistant and would not be inactivated at these levels
- **Because the system is closed, there is an extremely low probability that a significant number of aerosolized spores could enter**

EPA United States Environmental Protection Agency

Can We Use the Water?

- Among emergency response concerns, officials will need to advise impacted people regarding appropriate protective actions they should take
- A key concern will be whether or how people can use water
- Decision-makers will need to provide information about the impact on water and public health risks
  - Can prepare many crisis communication messages ahead of time
  - Will need to refine messages to fit incident
  - Additional information will be needed for some questions

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Disclaimer

The material in this presentation is based partially on work funded by the U.S. Environmental Protection Agency. However, it does not necessarily reflect the views of the agency, and no official endorsement should be inferred.

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12

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Questions ?

Introduction to Anthrax: Exposure and Health Effects of *Bacillus anthracis* Infection

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Bacterial Special Pathogens Branch, Epidemiology Team

Anthrax Water Emergency Messaging Workshop
January 29-30, 2013
Alexandria, Virginia

National Center for Emerging and Zoonotic Infectious Diseases
Division of High-Consequence Pathogens and Pathology

CDC

Topics

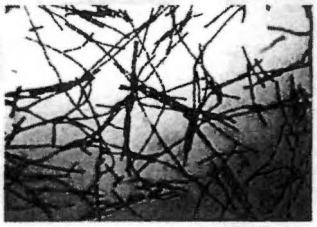
- Anthrax Overview
- Epidemiology
- Human Anthrax
- Post-Exposure Prophylaxis (PEP)
- Treatment

ANTHRAX OVERVIEW

Agent, Spores and Vegetative Form, Virulence Factors

Agent: *Bacillus anthracis*

- Belongs to the genus *Bacillus*, along with *Bacillus cereus* and *Bacillus thuringensis*
- Gram-positive, non-motile, encapsulated, spore-forming rod (bacillus)
- Two forms: spores & vegetative

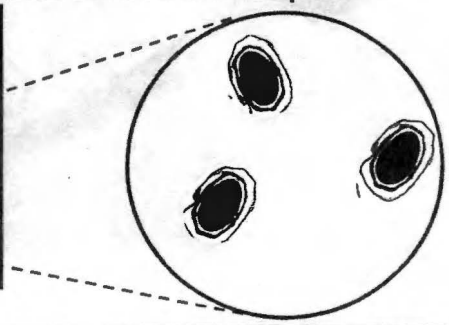


Bacillus anthracis Vegetative Form

- Large, gram-positive, nonmotile rod (1µ x 4µ)
- Long chains in vitro
- Single cells or short chains in stained clinical samples or smears

Bacillus anthracis Spores

- Oval, 1µm x 2µm
- Bacilli sporulate in blood and discharges from infected animals in 7-8 hours in presence of O_2
- Spores are highly resistant and capable of surviving in soil for decades
- Can be released as an aerosol as a bioweapon



Bacillus anthracis Spores

- **Infective form is the spore**
- **Spores are inhaled, ingested, or enter through breaks in the skin**
- **After inhalation spores are taken up by phagocytic cells such as macrophages and taken to pulmonary lymph nodes**
  - Germination occurs in or en route to lymph nodes
- **Germination occurs locally at the site of entry in either cutaneous or gastrointestinal infection**

Fernelius AL. *J Bact.* 1960;79:755-6.

Virulence Factors/Toxins

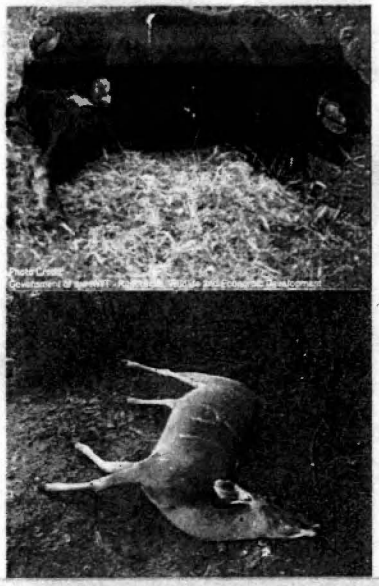
- **Poly-D-glutamic acid capsule (on plasmid pXO2) that inhibits phagocytosis**
  - Inhibits macrophage phagocytosis, and weakly antigenic
- **Protein exotoxins (on plasmid pXO1)**
  - Protective antigen (PA) permits toxin entry into host cells
  - Lethal Factor (LF) + PA → Lethal Toxin (LT)
    - Causes macrophage lysis, hypoxic tissue injury and liver failure, fatal toxic shock
  - Edema Factor (EF) + PA → Edema Toxin (ET)
    - Causes tissue edema, interrupts cytokine modulation, and inhibits neutrophil function

EPIDEMIOLOGY

Ecology and Epidemiology, Transmission, Distribution, Biowarfare and Bioterrorism

Ecology and Epidemiology

- The soil is the natural reservoir
- Primarily disease of herbivorous animals
- Infection of herbivores follows ingestion of spores on vegetation or in soil or water
- Epizootic cycles occur/recur for decades or longer



Anthrax Transmission to Humans

- **Human cases primarily dependent on contact with infected animals or animal products or carcasses**
- **Butchering and eating of contaminated carcasses**
  - Both cutaneous and gastrointestinal cases
- **Incidental inhalation of spores from work or hobby**
  - Woolsorter's disease, drummer cases
- **Inhalation of spores from biowarfare or bioterrorism**
- **No significant person-to-person risk**

Anthrax: Global Distribution

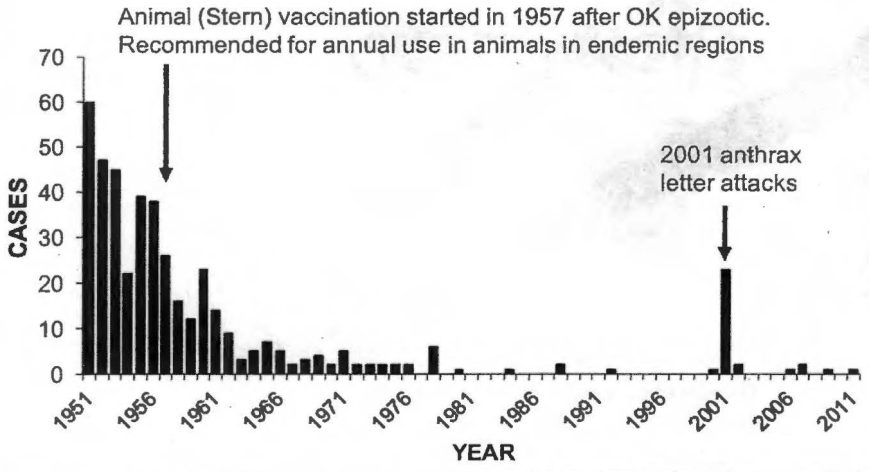
Occurrence worldwide ranges from anthrax-free to hyperendemic regions

World Anthrax Data Site, http://www.vetmed.lsu.edu/whocc/mp_world.htm

Naturally Occurring Anthrax in US

- **Sporadic animal cases in West & Midwest**
- **Prevention and control measures in US**
  - Routine livestock vaccination in endemic areas and animal processing controls
  - Regulation of imported animal products
- **Average <2 naturally occurring human cases reported per year since 1980**

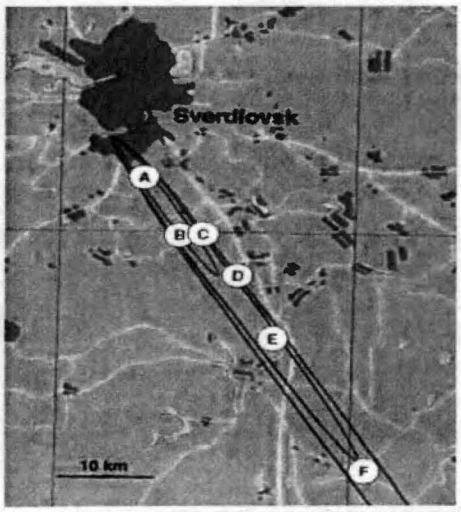
Cases of Human Anthrax in US, 1951–2011 (n = 439)



Biowarfare & Bioterrorism

- **Biowarfare**
  - WWI (targeting draft animals)
  - WWII, cold war
  - Sverdlosk (USSR), 1979: accidental release from BW facility with ≥ 96 cases and 66 deaths
- **Bioterrorism**
  - 1993 - Japan
  - 2001 - US anthrax letter attacks

Biowarfare: Sverdlovsk Outbreak, 1979



ANTHRAX: CLINICAL PRESENTATIONS

Pathogenesis & Presentations

Types of Anthrax

- Cutaneous
- Injection
- Gastrointestinal
- Inhalation
- Meningitis

Cutaneous Anthrax

- Most common form (>95% of cases worldwide)
- Transmission: spores introduced through skin (usually through pre-existing abrasions) → local germination → phagocytized by macrophages → painful regional lymphadenitis
- Infectious dose: ?
- Germination: 1-3 hours after inoculation
- Incubation: 1-12 days

Cutaneous Anthrax

- Symptoms: pruritic papule to vesicle to depressed black necrotic ulcer; significant edema may be present
- Most common sites: head, forearms, hands
- ~1/3 febrile[1]
- Case fatality rate (CFR):
  - Without treatment: 5-20%
  - With treatment: 1.7%[1] or less
  - Death due to airway compromise with head and neck lesions or to sepsis
- Half (11) of 2001 cases were cutaneous

1. Beatrice Road Infectious Disease Hospital (n=712), Davies JC. *Cent Afr Journ.* 1985. 31(9);176-80.

Cutaneous anthrax in a 10 y/o Zimbabwean girl whose family butchered and ate a dead goat, 1985

Photo: K Hendricks, MD

Cutaneous anthrax in a 17 y/o Iranian girl, 2009

Photo: M Esfandbod, MD & M Malekpour, MD
N Engl J Med 2009; 361:178

Photo: bt.cdc.gov

Gastrointestinal Anthrax

- **2nd most common form of naturally occurring anthrax**
- **Transmission: ingestion – unclear whether it is spores or vegetative cells in poorly cooked meat[1]**
- **Two forms: oropharyngeal and abdominal**
  - Both may be present at same time
- **Symptoms:**
  - Oropharyngeal infection may include sore throat, fever and swelling of the neck
  - Gastrointestinal syndrome begins with nonspecific symptoms of nausea, vomiting, and fever
- **Incubation: 1 - 6 days[2]**
- **CFR with treatment: 40%[2]; may be higher in children[3]**

1. Inglesby TV. JAMA. 2002;287(17):2236-52.
2. Beatty ME. *Arch Intern Med.* 2003;163:2527-31.
3. Ndyabahinkuka DG. *Ann Ist Super Sanita.* 1984;20(2-3):205-08.

Gastrointestinal Anthrax

- **Point-source outbreaks:**
  - Primarily seen in countries with food shortages or inadequate veterinary inspection
  - Slaughter and consumption of animals sick or dead from anthrax
  - Concurrent cutaneous cases from butchering and handling animals and meat
  - No reports in association with contaminated water consumption in endemic areas

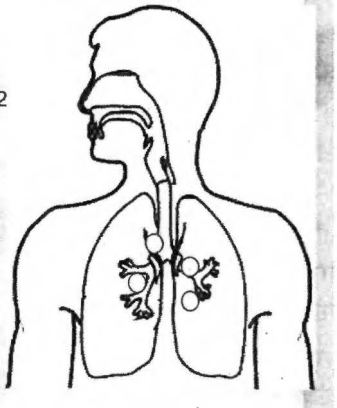
Gastrointestinal Anthrax

- **Infectious dose: ?;10^8 spores failed to produce disease in guinea pigs, rabbits, and monkeys[1]**
- **Swine model[2]**
  - 50 pigs fed $1.6 \times 10^7 - 6.9 \times 10^9$ Ames strain spores in feed
  - Monitored temperature & signs; cultured saliva & stool, blood and tissues
  - 66% of animals had clinical illness (i.e. anorexia, lethargy, ataxia, constipation, diarrhea, melena); most were febrile 24 – 48 hours post dosing
    - 2 of 50 died - received estimated doses of 1.6×10^7 & 7.8×10^7 spores
  - Additional 6 of 50 positive blood or tissue sample culture

1. Beatty ME. *Arch Intern Med.* 2003;163:2527-31.
2. Redmond C. *Vet Record.* 1997;244-247.

Inhalation Anthrax (IA)

- **Transmission: inhalation of spores from aerosolization of spores from animals/hair/hides or BW- or BT-related events**
- **Lethal dose: 2,500 – 760,000**[1]
  - ID2 may be as low as 9 to 2,300 spores[2]
- **Incubation:**
  - May be as short as 24-48 hours
  - Sverdlovsk: 2-43 days (mode 9,10)
  - 2001: 5-13 (mode 7)[3]
  - Can be up to 60 days or more based on animal studies, up to 43 days in humans observed at Sverdlosk



1. ACIP. *MMWR.* 2010;59(RR-6): 16.
2. Watson A, Keir D. Epidemiol Infect 1994;113:479–90.
3. Jernigan DB. *EID.* 8(1):1019-28.

Inhalation Anthrax

- **Symptoms: often biphasic**
- **Brief prodrome of 2-4 days duration resembling a "viral-like" illness**
  - Malaise, myalgia, fatigue, fever and chills, nonproductive cough
- **Fulminant phase**
  - Sudden onset of severe respiratory distress, dyspnea and hypoxia, cyanosis and shock, death within 1 day
- **CFR**
  - Pre-2001: ~90%
  - 2001: 45%
  - Post-2001: 50%
    - Decrease in mortality is likely due to improved critical care

Sepsis & Meningitis

- **Massive sepsis can develop: 10^7 to 10^8 bacteria /ml of blood → high fever, shock, death**
- **Meningitis can accompany inhalation, gastrointestinal, or cutaneous disease**
  - 21/38 (55%) brains that were examined from the fatal cases in Sverdlovsk had hemorrhagic meningitis
  - Anthrax meningitis is usually fatal

1. Holty JE. *Ann Int Med.* 2006;144:270-80.
2. Grinberg LM. *Mod Pathol.* 2001;14(5):482–95

Host Susceptibility

- **Susceptibility in animals ranges from most susceptible (herbivores) to least (carnivores and scavengers)**

Herbivores	Omnivores	Carnivores / Scavengers
Cattle	Rats	Dogs
Goats	Pigs	Hyenas
Deer		Cats
Bison		
Kudu		
Hippos		

- **Wide range of susceptibility in human populations**
  - Potential risk factors - gender, immune status, diet or nutrition status, pre-existing pulmonary conditions, etc.

Systemic Anthrax, Affected Groups, 1 of 2

- **Drummers (not necessarily previously healthy)**
  - 2006 50 y/o drummer who died from inhalation anthrax: remission from AML & vegetarian[1]
  - 2008 34 y/o drummer who died (inhalation anthrax): history of tuberculosis[2]
  - 2010 24 y/o drum event participant who survived (GI anthrax): vegan, active intestinal parasite infection (over 50 persons at drumming event, contaminated drums had 10-plus year history of sporadic use)

1. [personal communication, D Stephens, 2006.]
2. Health Protection Agency. 2009.

Systemic Anthrax, Affected Groups, 2 of 2

- **Injecting drug (heroin) users[1]**
  - longer history of IVDU
  - alcohol intake
- **Sverdlovsk inhalation anthrax cases**
  - 77 cases total with 66 deaths[2]
  - Patients with arc welder's lung or silicosis were more likely to have hemorrhagic pulmonary consolidation[3]

1. Palmateer NE CID. 2012.
2. Meselson M. Science. 1994.
3. Walker D. Arch Pathol Lab Med. 2012.

POSTEXPOSURE PROPHYLAXIS (PEP)

Antimicrobials & Anthrax Vaccine Adsorbed (AVA)

PEP Protocol to Prevent Inhalation Anthrax

- **For inhalation exposure to aerosolized spores: 60 days oral antimicrobial treatment and 3-dose regimen with Anthrax Vaccine Adsorbed (BioThrax):**
- **First-line choices: Doxycycline and Ciprofloxacin**
  - FDA approved for PEP of IA in adults and children
- **Second-line choice: Levofloxacin**
  - FDA approved for PEP of IA in adults and children
  - Safety data for >28 days lacking
- **Amoxicillin for special populations (e.g. nursing and pregnant women)**
  - When other antibiotics not as safe to use or not tolerated, and susceptibility demonstrated
- **3-dose vaccine regimen (day 0, and 2 & 4 weeks) for adults**

1. ACIP. *MMWR*. 2010;59(RR-6): 16.

TREATMENT

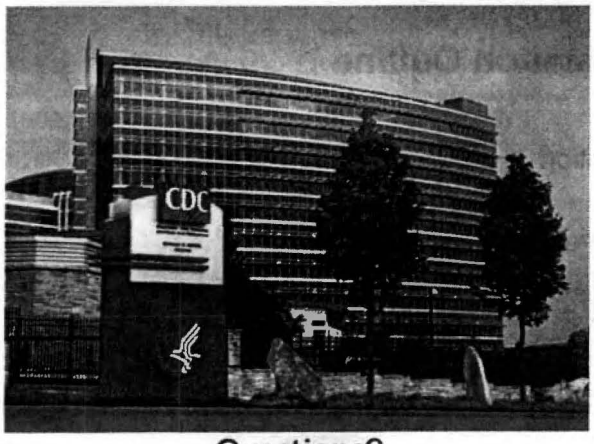
Draft Guidance, 2012

Patients Requiring Hospitalization and Intravenous Antimicrobial Therapy

- **Anthrax meningitis**
- **Inhalation anthrax**
- **Gastrointestinal anthrax**
- **Injection anthrax**
- **Cutaneous anthrax with/accompanied by**
  - Head, neck, upper chest, or upper extremity lesions
  - Large, bullous, or multiple lesions
  - Significant edema
  - Altered vital signs or leukocytosis

DRAFT 2012 Guidance for Systemic Anthrax: Critical Care

- ❑ **Follow standard sepsis/septic shock treatment and diagnostic guidelines**
- ❑ **Multidrug antimicrobial therapy**
  - Cover for meningitis unless it has been ruled out
- ❑ **Drain pleural fluid and ascites**
- ❑ **Aggressive supportive care**
  - Ventilatory support
  - Early and aggressive drainage for fluid in chest and abdomen
- ❑ **Antitoxin therapy for all hospitalized cases**



Questions?

For more information please contact Centers for Disease Control and Prevention
1600 Clifton Road NE, Atlanta, GA 30333
Telephone, 1-800-CDC-INFO (232-4636)/TTY: 1-888-232-6348
E-mail: cdcinfo@cdc.gov Web: www.cdc.gov

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Anticipating Water Specific Questions during an Intentional Release of *B. Anthracis*

Anthrax Water Emergency Messaging Workshop
1/29/13
Cynthia Yund, Ph.D.
Office of Research and Development
National Homeland Security Research Center

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Presentation Outline

- Crisis communication introduction
- Findings from 'Anticipating the Public's Questions during a Water Emergency'
- Implications for workshop

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Crisis and Emergency Risk Communication Defined

–Urgency of disaster communication
- Information about the event

–Risks and benefits of outcome
- Expected type
- Magnitude

- Communicator: Post event expert
- Audience: Stakeholders and public
- Message purpose: Empower decision making

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The Issue

➢During water emergency, communication is critical to inform the public, reduce misinformation, and encourage appropriate behaviors

➢Purpose is to protect health, safety, and the environment by keeping the public informed.

➢ Rapid and clear communication increases the quality of decisions made in a crisis.

Be First, Be Right, Be Credible

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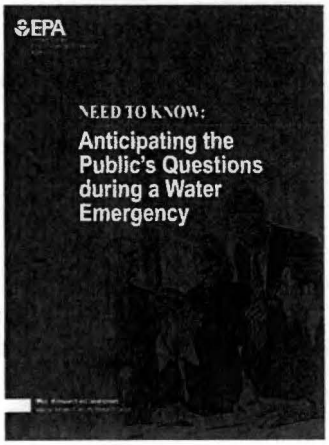
'Need to Know' Research Study

- Objectives
  - Identify critical information needs of public during water emergency
  - Identify differences in perceptions between professional and public
  - Inform crisis communication planning



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National Homeland Security Research Center

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Public Response to Water Disruption

- 75 percent ranked a 2-3 day disruption of service as severe situation
- Water uses clearly recognized
  - Drinking
  - Food preparation
  - Sewage disposal

"You can't live without water."

"Losing water – that's devastating."

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National Homeland Security Research Center

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Professional versus Public use of information

- Professionals
  - Control
  - Remediation
  - Public health directives
- Public
  - Actions to be taken
  - Personal safety
  - Obtaining "safe" water

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General Question Categories

- Questions sorted into nine general categories
  - Details about the incident
  - Who has been affected
  - How the tap water can be used
  - Alternate sources of water
  - Actions consumers can take to purify water
  - Exposure to the contaminant
  - How to get additional information
  - Response and recovery

"If you can keep the…public informed…you can help the public manage the situation."

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OBSERVATIONS

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Public Reactions to Attack Scenario

- Terms like "attack" and "terrorism" carried significant negative connotations
- Strong emotional reaction
- Desire to know how their supply is being protected
- Public typically believed that
  - Likely point of attack will be source water (e.g., reservoir, river)
  - Contamination will spread throughout the system

"anger…panic…will there be others?"

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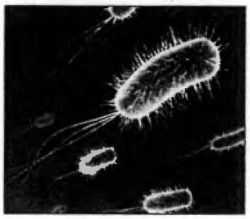
Intentional Biological Contamination More Concern than Pesticide

- Bacterium or virus is alive
- Remediation of a biological agent perceived as more difficult
- Pesticides less alarming
  - Ingested when eating fruit/vegetables
  - Used in homes



"Big difference…we eat pesticides."

"A biological agent will grow rather than be diluted."

"[Biological agent] automatic…sick, gut-wrenching feeling"

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Perception of Public: "Safe" Water = Zero Contamination

- Public respondents demonstrated little knowledge of routine testing
  - The frequency of testing
  - The idea of maximum allowable levels

"You didn't figure this out until enough people got sick?"

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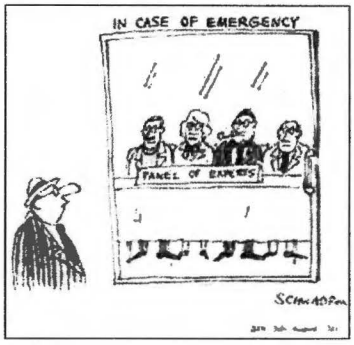
Convincing the Public Water Is "Safe" Could be Tough

- Collaboration with public health agencies would be critical to affirm credibility of messages
- Elected officials important
  - –Varied by location
- Clear presentation of extent of testing would be essential



Professional: "The health information must come from health officials."

Public: "I'd have to have someone come out, open the faucet, and drink it."

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Distribution Systems Difficult to Understand

- Complexity
- Ability to isolate portions of the system
- Alternative sources of water
- Extent and limitations of protection of water quality

Professional: "The public takes most of this for granted."

Public: "I don't know if I believe it could be that isolated."

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Draft Messages

- Preference for
  - Directives (i.e., do/do not) rather than recommendations
  - Short concise sentences
  - Protective actions
  - Results rather than process
  - Sense of time/predictability

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Message Map Example

- *Credible Threat Involving Chemical Contamination of a Reservoir*
- *Audience/Stakeholder: Public/Media*

- *Spokesperson: Public Health, City Manager, and/or Mayor*

- *Stage of Crisis: __ Possible*
- *X Credible*
- *__ Confirmed*
- *__ Remediation/Recovery*

- *Question: Who are most at risk if they have been exposed to contaminated water?*

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Message Map Example (continued)

Children, the elderly, and others with weaker immune systems are most at-risk.

- Children have less developed body defenses.
- The elderly and people with diseases such as HIV/AIDS or hepatitis may have weakened immune systems.
- Such individuals should take extra precautions.

At-risk persons should avoid contact with tap water.

- Parents should not prepare infant formula or cook food using the water.
- Children and the elderly should not drink beverages prepared with the water.
- Bottled water will be distributed at [insert locations and times].

At-risk persons with symptoms should call 911.

- Early symptoms include [insert symptoms].
- A child or elderly person who has been exposed should not be encouraged to vomit.
- A child or elderly person who has been exposed should not be given liquids.

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Disclaimer

The United States Environmental Protection Agency through its Office of Research and Development funded and managed the research described here. It has been subjected to Agency's administrative review and approved for publication. The views expressed in this paper are those of the authors and do not necessarily reflect the views or policies of the Agency. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

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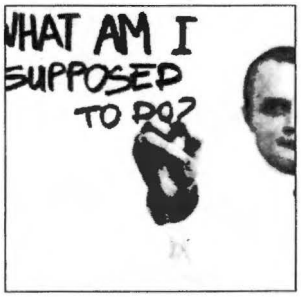
Workshop Implications

Categories for discussion

1. The incident
2. Exposure issues
3. Uses of water and alternative sources
4. Consumer personal actions
5. Response and recovery



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