
Testimony

Before the Committee on Government Reform

Sub-Committee on National Security,

Emerging Threats, and International Relations

**CDC and ATSDR Activities at the
Southern Connecticut Processing and
Distribution Center in Wallingford, CT**

Statement of

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Good afternoon, Chairman Shays and members of the Subcommittee. My name is Kenneth Martinez, and I am Supervisory Industrial Hygienist with the National Institute for Occupational Safety and Health (NIOSH) within the Centers for Disease Control and Prevention (CDC). I am testifying today as a CDC expert on environmental sampling so we can be as responsive as possible to the technical nature of the issues at hand. Accompanying me here today is Dr. Bradley Perkins with CDC's National Center for Infectious Diseases (NCID). On behalf of the CDC and the Agency for Toxic Substances and Disease Registry (ATSDR), I am pleased to provide this testimony describing our role in the collection, analysis, and interpretation of environmental samples for biological agents, and to describe our work with the United States Postal Service (USPS) during the bio-terrorism attacks of 2001. As requested, I will review CDC and ATSDR's activities at the Southern Connecticut Processing and Distribution Center (P&DC) in Wallingford, Connecticut. I also will describe some lessons learned and report on relevant ongoing research.

As you know, CDC and ATSDR are part of the Department of Health and Human Services (DHHS). As the nation's disease prevention and control agency, CDC's responsibility is to provide national leadership in the public health and medical communities in a concerted effort to detect, diagnose, respond to, and prevent illnesses, including those that occur as a result of a deliberate release of biological agents. This task is an integral part of CDC's and ATSDR's overall missions to monitor and protect the health of the U.S. population by preventing and controlling disease, injury, and disability.

Background

During the anthrax attacks of 2001, CDC assumed a wide range of responsibilities including surveillance to

detect new cases of illness; epidemiologic investigations to assess the risks of infection; collection of environmental samples to determine the extent of contamination in affected buildings, homes, and vehicles; analysis of environmental and clinical laboratory specimens; delivery of stockpiled antibiotics and vaccine; follow-up of persons receiving stockpile items; and communication with the public and with public health professionals to provide up-to-date guidance and recommendations. In all cases, our participation in these events came at the request of the governing state or local health department.

Environmental Assessments

One important component of the CDC/ATSDR response was the environmental testing of facilities potentially contaminated as a result of the anthrax attacks. This included surface, bulk (testing a powder, dust, or article such as a carpet piece), and air sampling. This testing effort involved the work of sample collection experts at CDC's NIOSH and microbiological analysis experts at CDC's NCID, along with consultation with military and other experts. Based on the best available information and ongoing experience, CDC/ATSDR issued and subsequently updated recommendations for conducting environmental sampling and how laboratories should analyze those samples to identify contaminated areas, characterize the distribution and spread of contaminants, and guide cleanup. Existing programs such as the Laboratory Response Network for Bioterrorism (LRN), which links state and local public health laboratories with advanced capacity laboratories, were strengthened in the enormous effort to enlist resources to identify potential contamination. During the anthrax attacks, LRN laboratories tested more than 125,000 environmental specimens alone, which represented over 1 million individual laboratory tests.

Environmental sampling was extremely useful during the anthrax attacks. Sampling helped us to identify the likely source of infection, understand environmental exposure pathways and the potential for reaerosolization, and guide cleanup and reoccupancy decisions. Standard procedures for environmental sampling for *Bacillus anthracis* did not exist prior to these attacks. However, we made efforts at the outset to identify existing methods that could be used for environmental sampling and to understand any limitations of those methods. Throughout the course of the investigations, it was necessary to continually refine and improve our methods and procedures based on accumulating experience. We recognize that the most reliable sampling methods are those that have been subjected to quality control testing to examine their accuracy, consistency, and factors influencing results, and to establish the lowest limit of detection. Limited information was available on the accuracy and consistency of the existing swab or wipe methods used for surface sampling or for air sampling methods. No information was available on the lowest limit of detection for the various methods. At the outset of the anthrax attacks, CDC scientists adapted methods used for evaluating allergen exposures such as mold or dust mites to create a new sampling tool known as HEPA (High Efficiency Particulate Air) vacuum sampling. This method uses a vacuum to extract spores from the surface into a filter sock which can be analyzed further. It proved to be a useful tool for sampling over large surface areas or for complex machine surfaces.

Where possible, CDC conducted comparative studies using different methods to evaluate the strengths and limitations of various sample collection techniques. These studies were done in partnership with the USPS and their contractors once the primary response mission was complete. For example, CDC conducted "side-by-side" sampling at the Brentwood (now Curseen/Morris) postal facility to compare the effectiveness of different surface sampling methods for detecting anthrax spores. This applied research

also examined the performance of Polymerase Chain Reaction (PCR) technology in comparison with culture approaches (PCR is a technique that amplifies DNA and compares sequences to known test probe standards for *Bacillus anthracis*. Positive findings must be cultured for confirmation.) At the Trenton postal facility, CDC performed "side by side" testing to evaluate the sensitivity of different air sampling methods. The results from these evaluations were shared with USPS, the Environmental Protection Agency (EPA), and other investigators to improve overall assessment ability. CDC also provided advice and recommendations to investigators from other organizations regarding sampling methodology, strategies, laboratory analysis, and data interpretation to maximize interagency testing consistency.

We do not yet have information on the limit of detection (i.e., the minimum concentration of anthrax spores that can be detected) for our methods, but we are partnering with the U.S. Army Dugway Proving Grounds to accomplish this objective. We have always included a discussion of limitations in our guidance on environmental sampling.

Interpretation of Results

Care must be taken in interpretation of environmental sampling results. A number of factors must be taken into account, as described briefly below.

Types of sampling

Not all environmental sampling is performed the same way. The scientific objectives of the sampling (what questions it is designed to answer) will determine how and where sampling is done, and what information the results provide. For example, much of the initial response sampling performed by CDC and USPS was

“screening” sampling, structured to examine whether contamination was present. It was often done with minimal information about the likely location of contamination and was designed to sample across a number of possible locations to increase chances of finding contamination. “Targeted” sampling, where information (such as postal codes, information from interviews with workers) identified suspect locations, was also an important type of sampling. “Epidemiologic” sampling was done in close coordination with CDC epidemiologists looking for possible clues for how patients with anthrax may have been exposed. “Characterization” sampling is performed once a positive location has been identified. It involves sampling in concentric circles around and above positive locations to understand more about the possible migration of contamination via foot traffic or aerosol formation. This information can be used for understanding the types of exposures that might have occurred and to begin planning cleanup strategies. “Verification” sampling is done after a contaminated location has been cleaned up. It involves re-sampling the original surface to ensure that no spores can be detected. It can also involve the use of fans to stir up any settled spores so that they can be detected during air sampling. This is called “aggressive” air sampling. These different types of sampling have all been used at different times at the Wallingford PD&C and other facilities.

Comparisons across methods

Each of the available sampling methods has specific advantages in particular applications, and it is often necessary to use a combination of methods. For example, swabs are very useful for crevices and small surfaces such as keyboards. Wipes are preferable for surfaces with light dust loadings, whereas HEPA vacuum samples are better for heavy dust loadings or complex machine surfaces. HEPA vacuum samples also provide an important tool for maximizing the surface that can be tested during an investigation.

Selection of methods must be made in consultation with laboratory personnel to determine the capabilities and analytical process of the laboratories involved. In some cases, the capability of the laboratory dictated the use of a specific sample collection technique. For example, fewer labs had the capabilities needed to analyze HEPA vacuum samples. Whatever methods are selected, it is important to note that because different methods have different efficiencies and uses, it is inappropriate to directly compare the results from different methods.

Limitations in quantifying results

The first samples collected for *Bacillus anthracis* spores during the anthrax investigations were qualitative in that the results were listed as either positive or negative. Over time, efforts were made to report estimates of the numbers of colony forming units (CFUs) reported for positive samples. However, CDC has always viewed these estimates as "semi-quantitative" in nature since the different methods have their own limitations in accuracy. Findings with higher orders of magnitude (10,000 vs 10 CFUs) can be useful to point investigators toward potential contamination sources.

Air vs. surface results

Because inhalation anthrax is more deadly than cutaneous anthrax, the level of *Bacillus anthracis* spores in air is most relevant to potential risk. However, even though spores are small and can stay suspended for extended periods, it has been our experience that sampling several days after ventilation has been turned off and the facility closed reduces the likelihood of finding spores in the air. In addition, finding a positive air sample does not allow you to identify the source of the contamination. There were no positive air sample results obtained during the outbreak investigations. However, positive results were obtained in

research sampling where conditions were re-created (machines turned on, etc.) to examine the types of exposures that could have occurred.

Investigators during the anthrax investigations relied more heavily on surface samples. While surface samples help to identify the location of contamination, they do not provide results that are directly translatable to risk. Surface levels suggest that a given location is a potential reservoir of spores which, if disturbed, could create aerosols and result in inhalation exposures. We know from research done in the Hart Senate office building that spores can become airborne very easily. In addition, two patterns of surface sampling results are particularly useful as evidence of possible aerosolization: one is contamination of surfaces such as air ducts and rafters, which would be unlikely to have contact with a contaminated source; the other is the dispersion pattern of multiple positive samples. Each of these suggests the likelihood of aerosolization.

Environmental Results and Risk

It is important to point out that surface samples provide evidence of *contamination*, which is different from evidence of *exposure* or *risk*. We are unable to directly link such environmental testing results to risk. First, additional engineering and work practice information is important in understanding the potential for exposure. For example, a surface on top of a machine has less potential for worker contact than a machine console surface. Engineering information such as the use of compressed air for cleaning is an important factor which contributes to exposure potential.

In summary, there are numerous variables which can affect the potential for aerosol formation. Even in the

unlikely event that air sampling could be performed during an attack, or reconstructed afterward, it would be difficult to precisely estimate the risks involved. Because there are no science-based exposure limits for *Bacillus anthracis*, CDC uses a variety of information sources, including environmental sampling, epidemiology findings, and work practice and engineering information, when looking at risks at affected facilities.

CDC/ATSDR Environmental Assessment Activities at the Wallingford P&DC

On November 19, 2001, inhalational anthrax was diagnosed in a 94-year old woman from Oxford, Connecticut. On November 20, at the request of the Connecticut Department of Public Health (CT DPH), a CDC/ATSDR team was deployed to Connecticut. CDC/ATSDR, USPS, and CT DPH began holding conference calls twice a day to coordinate activities, ensure effective communication, discuss findings, and determine appropriate follow-up activities.

The investigation focused on mail as the source of the anthrax, and efforts to detect *Bacillus anthracis* at the Wallingford P&DC, the postal facility that serves the region, were initiated. Prior to the Connecticut anthrax case, independent contractors working for the USPS tested postal processing and distribution plants nationwide to determine if any had become contaminated with *Bacillus anthracis* following the bioterrorism events. As part of this screening effort, the Wallingford P&DC was tested on November 11, by the USPS contractor. Fifty-three samples were randomly collected with dry synthetic swabs, including one from a delivery bar code sorter (DBCS); the samples were analyzed at the CT DPH laboratory and all results were negative for *Bacillus anthracis* contamination. After the report of the 94-year-old woman with anthrax in Connecticut, a second independent contractor hired by USPS collected an additional 64 dry

swab samples from surfaces where letters, flats, and parcels were processed. These samples, along with others collected from air circulating units, were analyzed by the CT DPH Laboratory; all results were negative. Although initial environmental testing at the facility yielded negative results, post-exposure prophylaxis (PEP) with antibiotics was recommended as a precautionary measure for postal workers in the Wallingford P&DC, and the first of several PEP clinics and "town hall meetings" were held. Over 900 of 1,122 postal workers were given antibiotics. CDC and CT DPH epidemiologists reviewed postal worker absenteeism records, hospital visits, and surveillance information for influenza-like illness and cutaneous conditions to evaluate the possibility of other cases among postal workers. Additionally, 472 nasal swabs from Wallingford postal workers were collected and analyzed at the CT DPH laboratory; all nasal swabs were negative for *Bacillus anthracis*.

On November 25, CDC/ATSDR investigators collected their first samples at the Wallingford PD&C (note that this was the third round of sampling at Wallingford). Sixty samples were collected with wet synthetic swabs and processed from the letter canceling and sorting machines, flat and parcel sorting machines, and five facility vacuum cleaner filters. The samples were analyzed by the CT DPH laboratory; all samples were negative for *Bacillus anthracis*.

On November 28, targeted sampling was performed, using epidemiology and postal code information to help guide the sampling. This fourth sampling round extensively sampled DBCS machines including those likely to have processed stamped and bulk mail delivered to the patient's address. For example, because 80% of the mail from the patient's home was bulk mail, sampling was performed for the first time on DBCS machine #10, which is used primarily (75%) to process bulk mail; a HEPA vacuum sample obtained from

the feeder portion of this machine identified an elevated reading. Two hundred twelve samples were collected from the canceling and sorting machines using wet synthetic 2x2-inch wipes (102 samples) and HEPA vacuum (110 samples). Wet wipes were used for sampling hard surfaces such as stacker bins, and the HEPA vacuum was used to sample other portions of the machine, including inaccessible areas. The samples were collected and transported according to CDC recommended methods and were cultured and analyzed at a CDC contract laboratory. On December 2, positive *Bacillus anthracis* cultures were confirmed from four DBCS machines sampled during the fourth round and the machines were taken out of service; no quantitative results were known at that time.

On December 2, characterization sampling was performed in response to these results to examine the extent of contamination found on the four DBCS machines where positive results had been found. For this fifth round of sampling, the four machines were isolated and enclosed using plastic barriers and negative pressure ventilation. Two hundred wipe samples were collected on the sorting bin positions of the four machines. These results confirmed the high contamination of DBCS machine # 10, and provided additional epidemiology findings for machine #6. Machine #6 was used for final mail sorting for several zip codes, including the town where the patient lived. The only column of sorting bins that was found positive included the bins for the carrier route for the patient's home.

The findings from these two sampling rounds were considered as soon as they became available. PEP recommendations were revised and the duration of treatment extended to 60 days. Antibiotics were subsequently distributed to postal workers to provide enough doses to complete a 60 day course. On December 3, a representative from the CT DPH and the CDC team leader met with union officials and

management to discuss the results. A "town hall" meeting was conducted with employees at the Wallingford P&DC. On December 6, additional information regarding the samples collected on November 28 was received, and the laboratory quantified the HEPA vacuum results by providing the estimated number of spores per gram of material. These quantitative results, including the 5.5×10^6 CFU of *Bacillus anthracis* per gram of sample material collected from DBCS machine #10, were discussed on conference calls whose participants included CDC, CT DPH, and USPS. On December 7, preliminary results from the samples collected on December 2 from DBCS machines were reported; although the final number of positives was not confirmed at that time, a total of 30/52 columns of bins from DBCS machine #10 were positive. On or about December 8, a representative from the CT DPH explained the findings of the December 2 sampling to management and union officials.

The contract lab that processed the samples reported the results directly to the CT DPH. The sampling that identified the contamination and produced these results was designed and implemented to assure maximum sensitivity for detecting spores from machine surfaces. Similar measurements (greater than 1 million CFUs/gr) at the Brentwood postal facility had previously been reported to USPS. These findings indicated that the feeder section of the machine was the most contaminated location in the facility, but did not support direct interpretations on exposure or risk. The actions taken to protect workers in response to the findings would have been the same whether the reported results were qualitative (e.g. "positive") or quantitative. Upon receipt of these results, CDC communicated and discussed them via telephone conference call with multiple parties, including USPS representatives, and appropriate public health actions were immediately taken, including shutting down and isolating the machine (and all areas identified as contaminated) and performing appropriate follow-up activities (e.g., additional characterization sampling

and offering of antibiotic prophylaxis to potentially exposed workers).

Environmental Sampling and Remediation

Following the assessment component of the investigation, CDC/ATSDR provided technical assistance to the USPS in determining the most appropriate methods for decontaminating the machines. CDC/ATSDR personnel provided input into the scope of work and were present on site to provide technical guidance during the decontamination of the machines and subsequent environmental sampling to verify the efficacy of the decontamination. At the Wallingford P&DC, an additional level of environmental monitoring was conducted to ensure the machines were adequately cleaned. This entailed conducting "aggressive" air monitoring (within the enclosures surrounding DBCS #10) after the machine had been cleaned and all subsequent wipe samples were found to be negative. Aggressive air sampling entails using compressed air to "blow down" the machine in an attempt to dislodge any spores that may be present so that they could be detected by air samplers within the enclosure. Additionally, surface samples were collected from ventilation grilles and other surfaces. The criterion used for determining if the cleaning was effective was zero growth. The results of this testing, analyzed by the CT DPH were reported on December 20, 2001. No *Bacillus anthracis* was detected, and the machines were put back into service.

In April 2002, additional testing of the Wallingford P&DC was conducted by the USPS to determine if *Bacillus anthracis* might be present in the "high bay" areas of the facility above the previously contaminated DBCS machines. This sampling found that 3 out of 71 sample locations tested positive for *Bacillus anthracis*. The CDC was notified of these results and participated in a subsequent working group comprised of representatives from CT DPH, USPS, postal unions, EPA, and the Occupational Safety and

Health Administration. CDC provided advice and on-site technical assistance regarding additional sampling activities, remediation strategies, employee communication, and post-remediation sampling.

Summary/Lessons Learned

The environmental investigation was central in demonstrating a possible source of infection for the case of inhalational anthrax in Connecticut. Our investigation showed that extensive sampling was required and that epidemiologic investigation was essential in identifying sites for sampling. None of the dry or wet swab samples was positive; however, positive samples were obtained from wet wipes and HEPA vacuums. Therefore, for future investigations of large facilities, we recommend that wet wipe and HEPA vacuum sampling be included.

As mentioned, CDC has research underway with the Army's Dugway Proving Grounds to clarify the sensitivity of the sampling and analytical methods for *Bacillus anthracis*. In addition, CDC is currently updating its "Interim Anthrax Response Plans and Guidelines" originally published on November 9, 2001. These guidelines provide decision logic and directions for interventions for anthrax response should future investigations be needed. CDC will be taking a close look at issues related to communication, sampling, and interpretation of results.

Thank you for this opportunity to testify. I would be pleased to answer any questions.