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WEEKLY REPORT

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Evaluation of *Bacillus anthracis* Contamination Inside the Brentwood Mail Processing and Distribution Center — District of Columbia, October 2001

During October 19–21, 2001, four postal workers at the Brentwood Mail Processing and Distribution Center in the District of Columbia were hospitalized with inhalational anthrax; two of the workers died. The building, which was closed on October 21, was believed to have been contaminated by a letter containing *Bacillus anthracis* spores sent to the Hart Senate Office Building (HSOB) that had passed through the postal facility on October 12. A second contaminated letter addressed to another U.S. senator that was processed through the same mail sorter and sort run as the first letter was discovered on November 17. This report describes the results of CDC's evaluation of *B. anthracis* in the facility, which showed widespread contamination of the facility and suggest that wipe samples and high efficiency particulate air (HEPA) vacuum samples complement each other in assessing contamination.

A U.S. Postal Service investigation indicated that, on late October 11 or early October 12, the letter sent to one U.S. senator entered the building in a mailbag through a loading dock near the Postal Vehicle Transportation Office (Figure 1). The bag was opened and the contents separated into bar-coded trays and moved by all-purpose carrier (APC) to a large tray-sorting machine. The APC tray then went to delivery bar-code sorter (DBCS)* 17, where the letter was manually fed into the machine at 7:10 a.m. The letter was then transported by APC to the government mail section of the facility and was transported to HSOB at approximately noon on October 12. Sometime during 8 a.m.–9:40 a.m., the DBCS machine that processed the letter was opened, and compressed air at 70 lbs. per square inch was used to clean debris and dust from conveyor belts and optical reading heads.

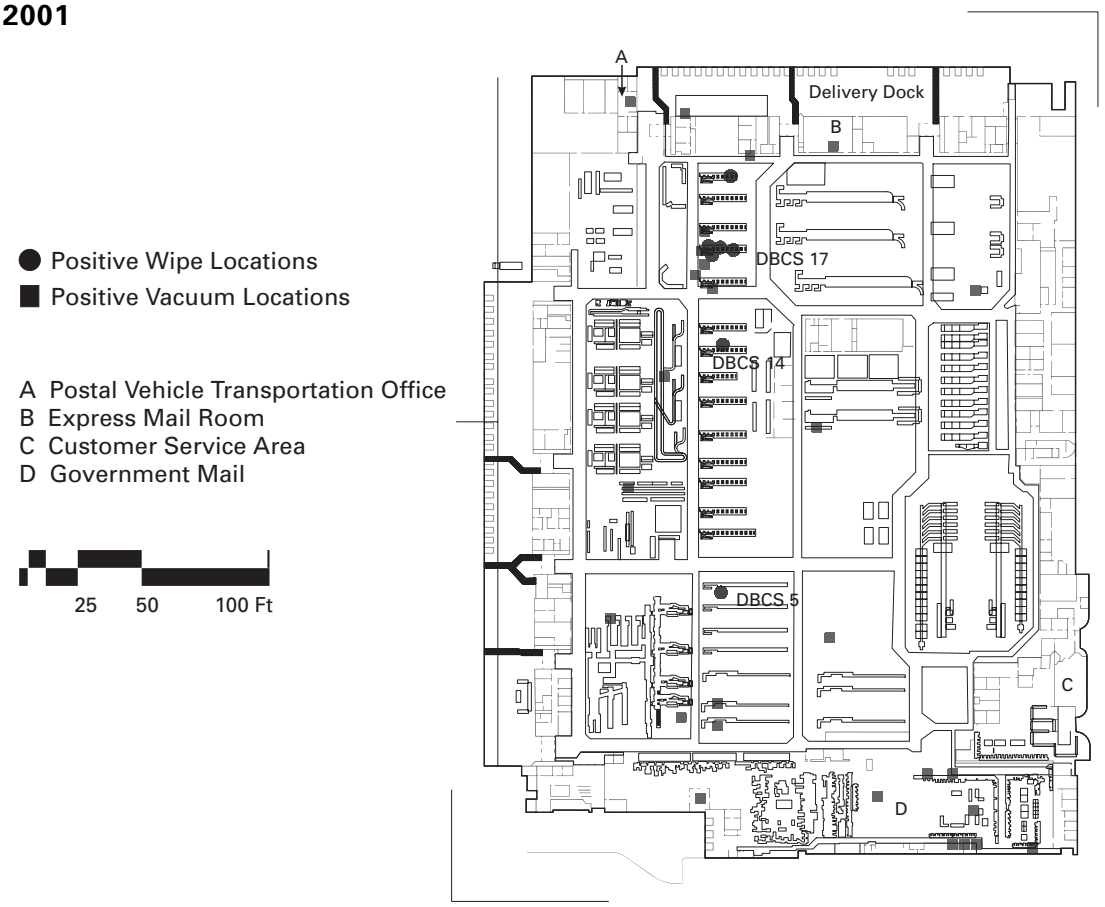
On October 18, before recognition of inhalational anthrax cases, a Postal Service contractor collected 29 swab samples from the mail sorting area of the Brentwood facility. On October 20, CDC initiated an investigation of the Brentwood facility. As part of this investigation, CDC extended the evaluation of *B. anthracis* contamination in the Brentwood facility.

On October 23, CDC investigators and Postal Service contractors selected and marked sampling locations. Sampling for *B. anthracis* spores began on October 24 using three

*The DBCS machines move mail along internal conveyor belts and rollers through a series of turns and compressions at 32 miles per hour until the mail lands in the appropriate collection bin for distribution.

Brentwood Facility — Continued

FIGURE 1. Diagram of Brentwood Mail Processing and Distribution Center and location of positive identification of *Bacillus anthracis* spores — District of Columbia, October 2001



techniques: surface wipe sampling, surface vacuum sampling, and air sampling (*1*). The evaluation focused on the path of the HSOB letter through the facility and the work locations of the known anthrax patients. To evaluate the extent of *B. anthracis* contamination, additional samples were collected throughout the facility, including the administrative areas on the second level and the customer service area at the front of the building. Wipe samples were submitted to CDC for culture and analysis. Vacuum and air samples were analyzed by a contract laboratory. Suspect culture colonies were screened using standardized Laboratory Response Network (LRN) Level A testing procedures for identification of *B. anthracis* (*2*) and were confirmed by direct fluorescent antibody staining and gamma phage lysis (*3*).

Surface Wipe Sampling

Selected surfaces (e.g., table or desk tops, sorting machines, sorting bins, control consoles of sorting machines, and ventilation ducts) were sampled using moistened sterile cotton gauze pads. Cultures from samples were reported as either positive or negative for colonies of *B. anthracis.*

Twelve days after the contaminated letter sent to HSOB passed through the facility, eight (7%) of 114 surface wipe samples were positive for isolates of *B. anthracis*. Four of the positive samples were collected on and around DBCS machine 17, which processed

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the contaminated letters, and one was from an air supply duct approximately 12 feet above the machine. The remaining three positive samples were from areas on distant DBCS machines. None of the wipe samples collected in the administration area or in the customer service area was positive for isolates of *B. anthracis*. All wipe samples collected in the Postal Vehicle Transportation office, express mail room, and the government mail area were negative.

Surface Vacuum Sampling

Surface vacuum samples were collected by inserting a cone-shaped filtering "sock" (dust collection trap) into the nozzle of a HEPA vacuum cleaner with a high-efficiency (0.1 μm pore size) filter. The vacuum nozzle was mechanically cleaned with an alcohol wipe between samples to dislodge spores and prevent cross-contamination. Several grams of dust were collected inside each vacuum sock (*1*) and were submitted to a contract laboratory for culture and analysis. Results were reported as number of colony forming units per gram of material collected (CFU/g); a CFU can represent a single *B. anthracis* spore or an aggregate of several spores and may not correlate directly to the number of spores present.

Of 39 vacuum dust samples, *B. anthracis* was isolated in 27 (69%). Reported *B. anthracis* concentrations in positive samples ranged from 3 CFU/g to 9.7 million CFU/g. All eight samples collected in the government mail area were positive. No wipe samples collected in this area were positive. All samples from the high-speed sorting machines and from areas near DBCS sorting machines were positive (8,700 CFU/g to 2 million CFU/g). A relatively high concentration of spores was found in the sample collected on the overnight hot mail sorting bin (13,000 CFU/g), which was near the end of DBCS machine 5 that had a positive wipe sample collected inside it but had not processed the contaminated letters addressed to the U.S. senators. Concentrations on the loading dock and in the express mail room were relatively low. Although the concentrations tended to decrease with distance from the DBCS machine that processed both letters, spores also were found in areas far from DBCS machines. The three samples collected in the second floor administration area and two samples collected in the customer service area were negative. The vacuum samples indicated wide distribution of *B. anthracis* spores, with the greatest concentrations associated with work areas along the path of the HSOB letter.

Air Sampling

Air samples were collected on open-faced 37 mm mixed cellulose ester filters (0.8 μm pore size) in polystyrene cassettes attached to sampling pumps operated at 2.0 liters per minute. The sampling pumps were placed in fixed locations throughout the facility for approximately 30 hours. Results were reported as positive or negative for isolates of *B. anthracis*.

Twelve air samples for airborne *B. anthracis* spores were collected 12 days after the contaminated letters were processed, which was 4 days after the building was closed and the ventilation system was turned off. The ventilation system was not operating during the sampling period. All air samples were negative for *B. anthracis,* indicating that no airborne spores were detectable during the sampling period.

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Editorial Note: The four inhalational anthrax cases among Brentwood facility employees indicate that aerosolization of *B. anthracis* occurred at the facility. The extent to which environmental sampling can detect potential aerosol dispersion and widespread contamination is uncertain. In the absence of positive air samples, contamination detected by wipe or vacuum sampling away from the path of the known source of contamination (i.e., the letters addressed to the two U.S. senators) could indicate either airborne dispersion from that source or contamination from a different, unrecognized source (e.g., another contaminated letter). However, even without positive air samples, two patterns of sampling results are particularly useful as evidence of possible aerosolization. Either contamination of surfaces such as air ducts and rafters, which would be unlikely to have contact with a contaminated source, or the dispersion pattern of multiple positive samples suggest the likelihood of aerosolization.

Environmental sampling results in this investigation indicated widespread contamination from the letters processed for delivery to the offices of two U.S. senators. Most vacuum sample results were positive, indicating *B. anthracis* spore contamination in areas that were negative by wipe testing, and this contamination was found throughout the mail processing area. One possible explanation for this difference may be the use of a cotton wipe material, which subsequently was found to decrease spore recoveries; CDC investigators now use rayon-tipped swabs or rayon wipes moistened with sterile water (*1*). Only the second level administrative area and the customer service area appeared to be free of spores by all methods. The air sampling results indicated that airborne spores were not detectable during the sampling period. However, these samples were not collected under normal airflow conditions when mail was being processed or when dust was blown from machinery with compressed air. The use of compressed air to clean sorting machines may have contributed to the aerosolization and dispersion of *B. anthracis* spores in the Brentwood facility. Therefore, HEPA vacuum cleaning has been substituted for blowing for cleaning sorting machines.

Although sampling with surface wipes has been the standard sampling method and has advantages for sampling some small surfaces, surface wipes have several limitations. Wipe samples might miss minimally contaminated surfaces or smaller, discrete contaminated areas. Also, the method of extracting *B. anthracis* from the wipe samples might yield different results than the extraction method for vacuum sock samples. Because it is not feasible to wipe-sample all surfaces within a building, vacuum samples provide an important tool for maximizing the surfaces that can be evaluated during an investigation. The vacuum sample locations at the Brentwood facility were selected to collect large quantities of dust and to cover broader surface areas than wipes. Although cross-contamination between vacuum samples is possible, precleaning of the vacuum nozzle before each sample and use of a high-efficiency filter appeared to be effective because negative vacuum samples were interspersed among heavily contaminated samples.

The results of the environmental sampling at the Brentwood facility might be used to assess the extent of contamination and are consistent with the aerosolization indicated by the cases of inhalational anthrax. They also should help guide cleanup efforts and can serve as a baseline for follow-up environmental assessments after the building has been cleaned. In addition, these results suggest that vacuum sampling is a useful complement to wipe surface samples, particularly when widespread contamination is suspected. CDC continues to assess optimal strategies and methods for sampling of contamination by *B. anthracis*. Current guidelines for collecting environmental samples are available at http://www.bt.cdc.gov/DocumentsApp/Anthrax/11132001/final42.asp.

Brentwood Facility — Continued

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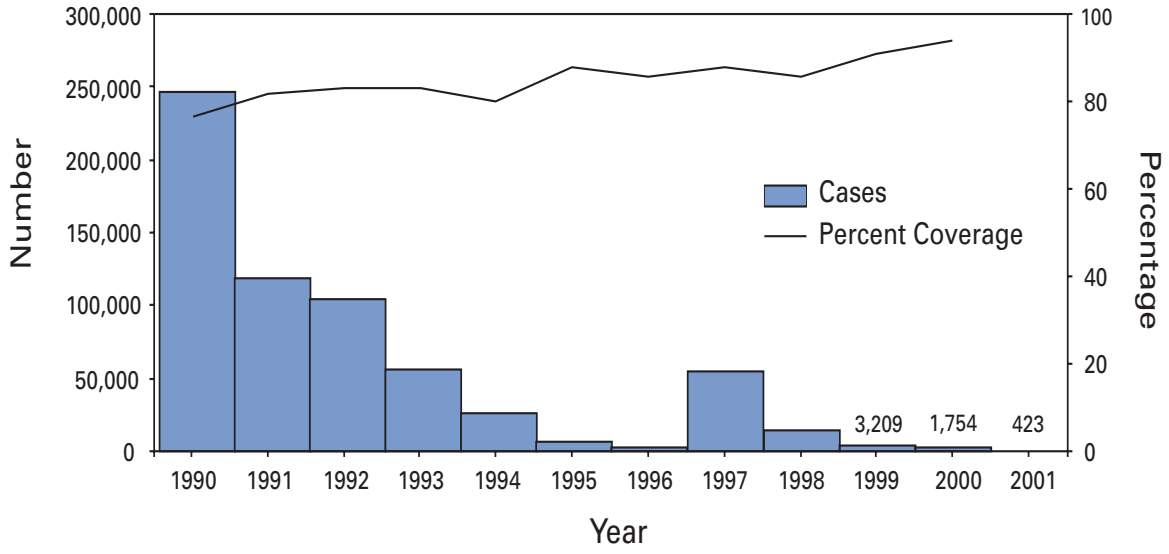
Progress Toward Interrupting Indigenous Measles Transmission — Region of the Americas, January–November 2001

In 1994, countries in the Region of the Americas set a goal of interrupting indigenous measles transmission by the end of 2000 (*1*). During 1990–2000, measles cases declined 99.3%, from approximately 250,000 to 1,754 (Figure 1). During 2000, transmission occurred in five of 41 countries that report to the Pan American Health Organization (PAHO) (Argentina, Bolivia, Brazil, the Dominican Republic, and Haiti), and confirmed cases were reported in 16 (<1%) of 12,010 municipalities (*2–4*). During 2001, measles transmission occurred in the Dominican Republic, Haiti, and Venezuela; no outbreaks were reported in Argentina, Bolivia, or Brazil. This report summarizes measles circulation patterns and efforts to interrupt measles transmission in the Americas during 2001.

FIGURE 1. Number of reported and confirmed measles cases* and percentage of routine measles vaccination coverage among infants, by year — Region of the Americas, 1990–2001†



* 1990–1994=total number of reported cases; 1995–2001=total number of confirmed cases.
† As of November 26, 2001 (423 confirmed cases from nine countries).