# Anthrax Bioterrorism, 2001 Lessons from the Front Lines


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# Outline

- Investigation – Florida and Washington, D.C
  - What were lessons at each step?
- What were the challenges faced that might guide preparedness activities for any outbreak response?

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# Outline

- Investigation – Florida and Washington, D.C
  - What were lessons at each step?

- What were the challenges faced that might guide preparedness and research activities in anticipation of the next attack?

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# Objectives of Epidemiological Investigation

1) Determine the pathogen
   - Create the differential based on symptoms – history
   - Environmental testing may lead to early detection
   - Confirm Agent – Identify

2) Determine the source of the pathogen
   - Natural?
   - Nefarious?

3) Reduce any further health threat from exposure – eliminate the source

4) Define the exposed populations for control

5) Remediate and test the effectiveness of remediation – clearance

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# Recognition: Palm Beach County, Florida


- CDC notification 10/3
- 63 yo male photo editor employed by American Media, Inc.
- Onset 9/30/01: fever, fatigue, sweats, altered mental status
- Admitted to hospital 10/2
- History of traveling to New Hampshire in incubation period by car – 1200 miles

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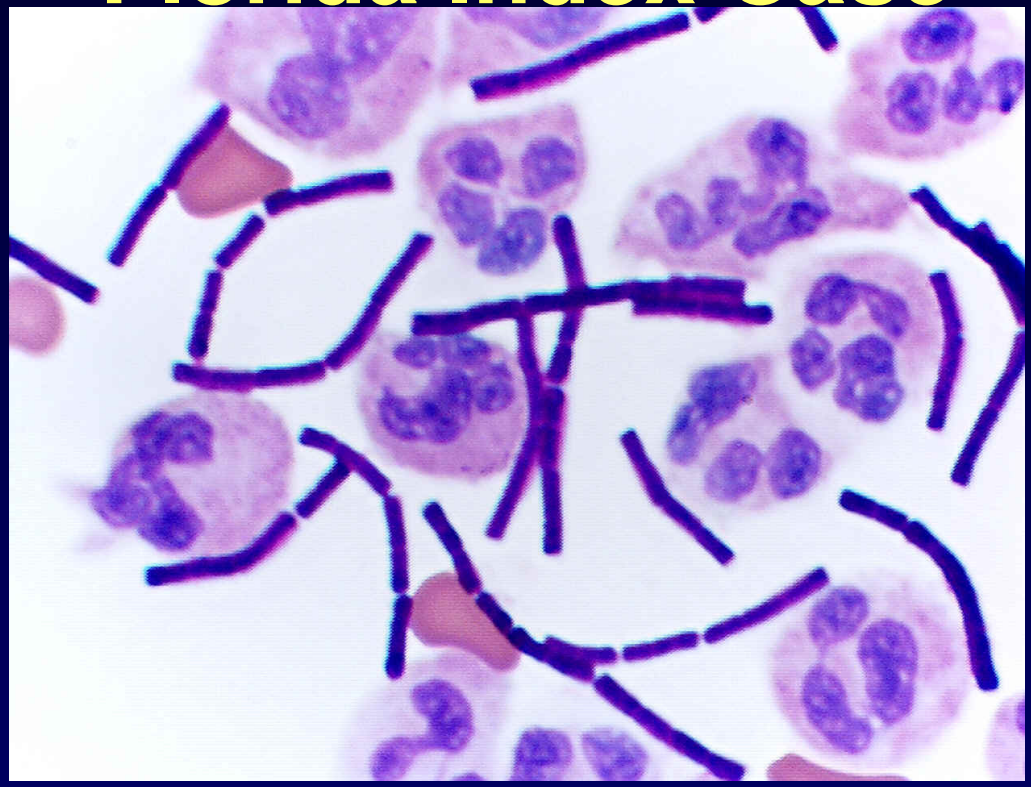
# Cerebrospinal Fluid Stain
# Florida Index Case



**Lessons:**

- Let's not forget stains and microscopy (restrictions?)
- Clinical labs are the front-line first responders with their health care providers
- Are they ready for threat agents?

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# Objectives of Epidemiological Investigation

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   - Environmental testing may lead to early detection
   - **Identify the Agent - Confirm**

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# Confirmation of the Agent

- Night of October 3 low altitude plane transports laboratory culture sample from Florica State Laboratory to CDC
- Arrives at 23:00 in Atlanta, Georgia
- Confirmation in multiple testing as B. anthracis by 03:00 am

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# Friday, October 5, 2001: The Home

Lessons:

- Entry guidelines, sampling guidelines were not ready
- What constitutes a good environmental investigation?

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# Friday, October 5, 2001: The Workplace


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# Friday, October 5: Index Case Work Space

Lessons:

- Surface sampling protocols and validation needed
- Risk to those sampling?

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# Friday, October 5: Define Exposure Area

Workplace Mailroom

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# Nefarious or Natural

- Work place cultures positive in 24 hours
- = NEFARIOUS

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# Friday, October 5, The Workplace

FBI

Public Health

Lessons

- New partnerships worked well together
- Practice will be essential
- Adequate hazardous operations training?

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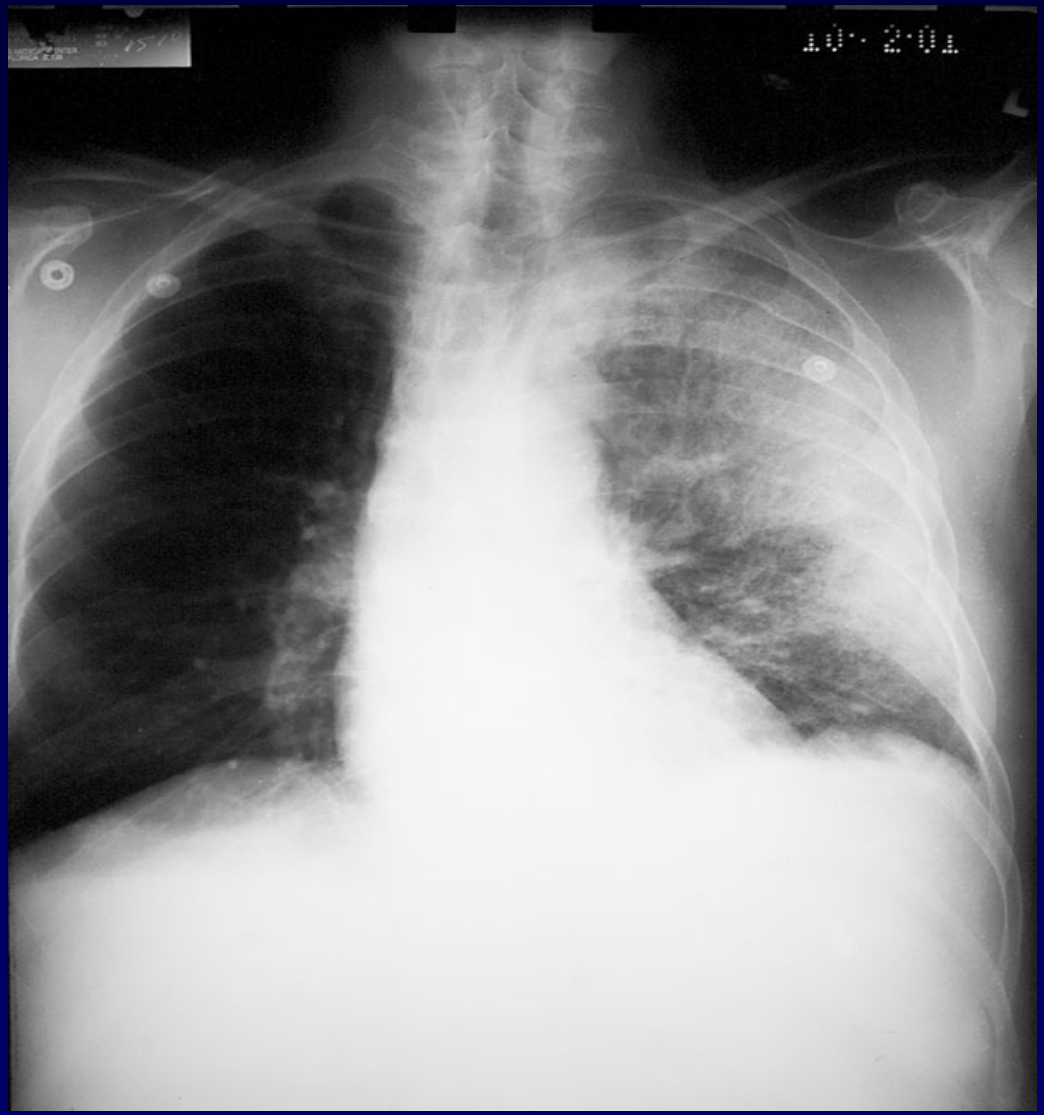
# Friday, October 5: Hospitalized "Pneumonia" in Co-worker



- 73 y/o mailroom supervisor hospitalized Oct 1
- No mediastinal lymphadenopathy
- Hemorrhagic re-accumulating pleural effusions

**Lesson**
- Variable clinical findings
- Epidemiology confirms

**Nefarious**

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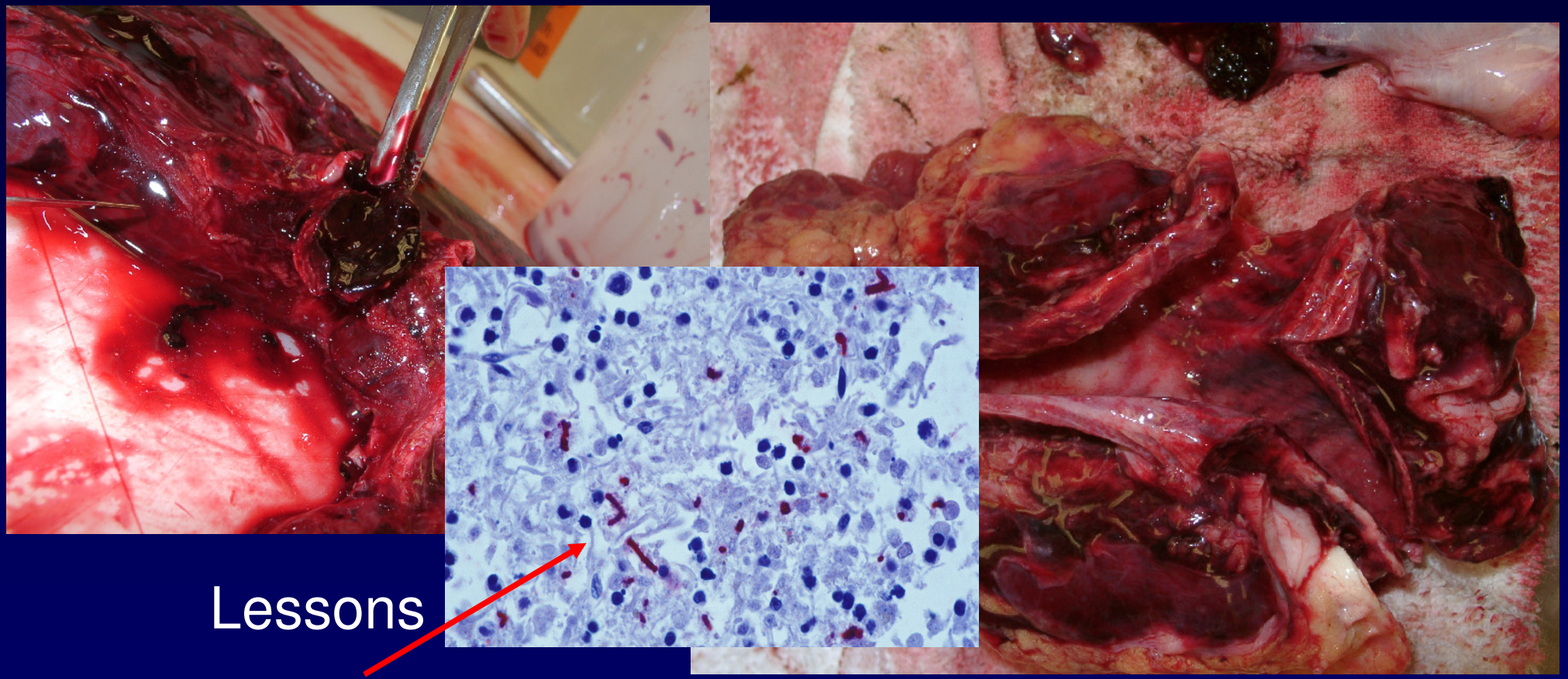
# Patient Expired Oct 5
# Autopsy Consistent with Inhalational Anthrax



Lessons

- IHC developed in anticipation of event
- Critical

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# Monday, October 8: Assessing Exposed and Providing Intervention


- **Samples collected from those in building**
- **Antibiotic prophylaxis offered to workplace employees & visitors (n=1,114)**
  - **Why – considered single air space**
- **Nasal swabs: 1 of 1,075 positive**
- **Serosurvey: 0 of 436 positive**

Lessons

- Exposure assessment with clinical lab tests difficult at best
  - Potentially, nasal swabs not useful for long
  - Serology apparently not useful, but exposed?
- Rapid distribution plans for antibiotics are needed
- Stockpile and delivery were ready and successful

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# Recognition: New York City

- **Suspect cutaneous case reported 10/11**
- **Female, 38 y/o, NBC TV anchor assistant**
- **Onset 9/25**
- **Immunohistochemical staining of skin biopsy showed *B. anthracis* on 10/12**
- **Recalled handling letter with powder**
- **Postmarked from Trenton, NJ, Sept 18**
- **Powder subsequently positive for *B. anthracis***

Lessons

- Cutaneous anthrax is a risk following BT release
- Antibiotic treatment complicates diagnosis
  - "Typical" presentation may be changed
  - Laboratory confirmation is difficult

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# Epidemiologic Investigations


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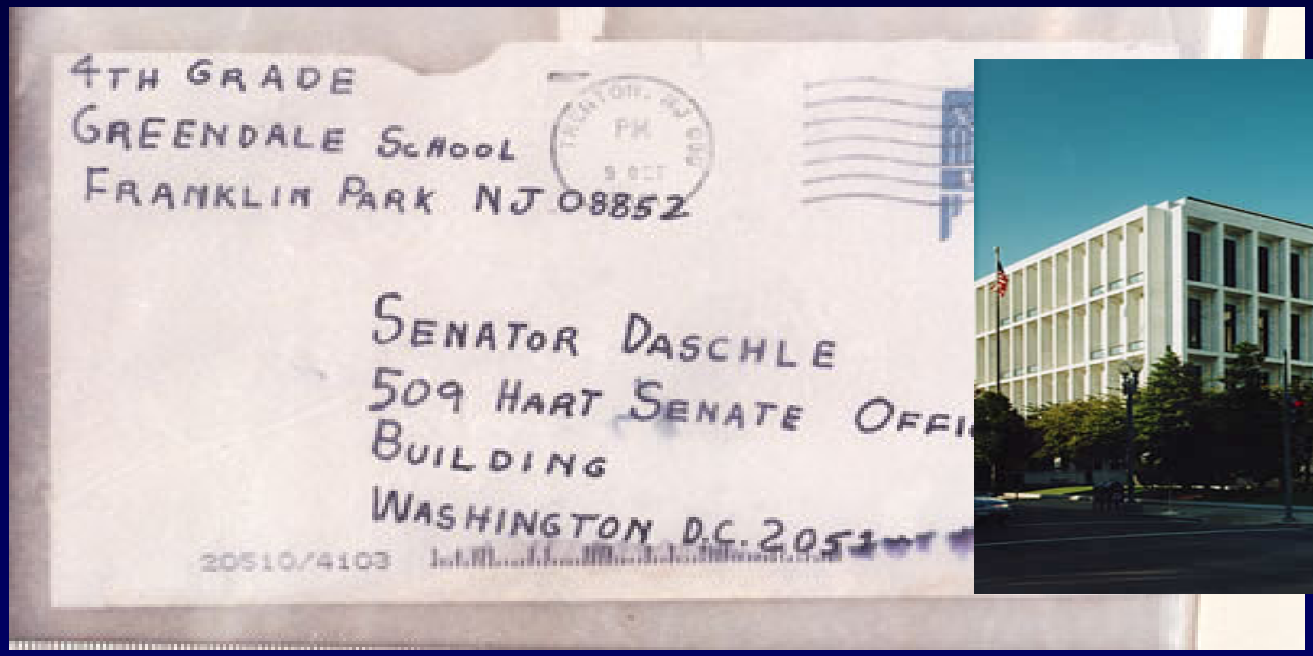
# Recognition: Senator Daschle Suite, Capitol Hill, Monday, October 15 @ 9:45 A.M.




Lessons

- BT training of staff paid off

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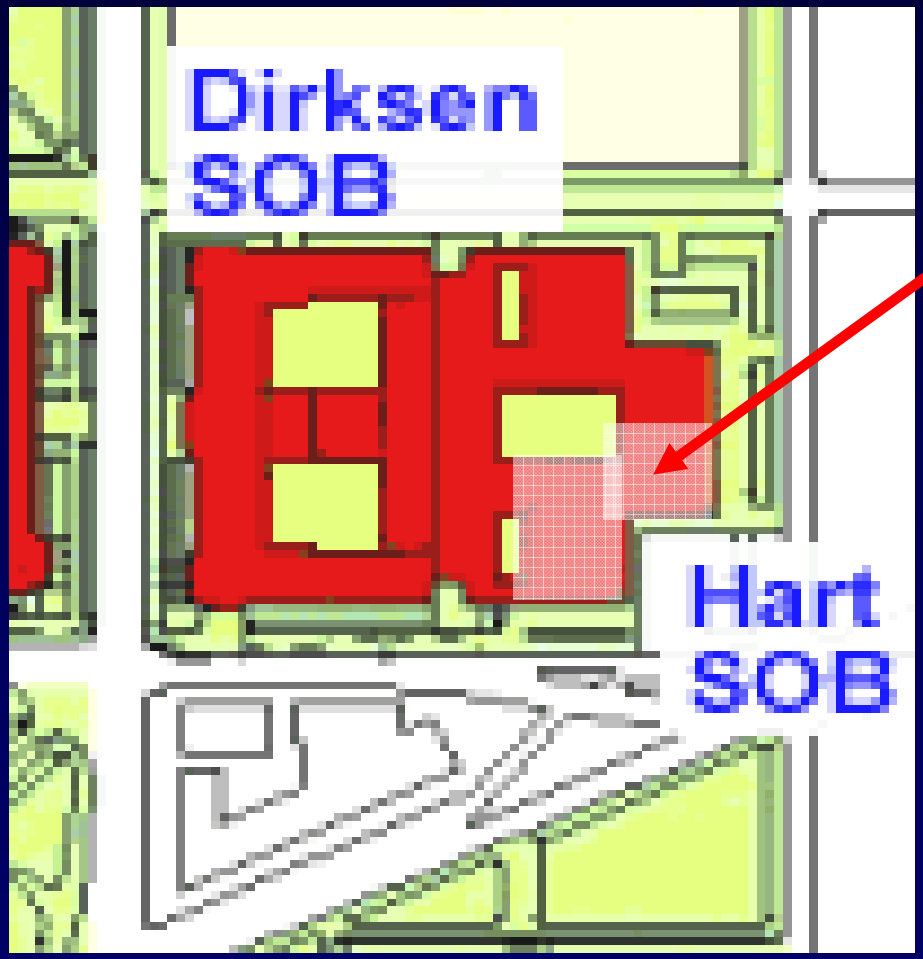
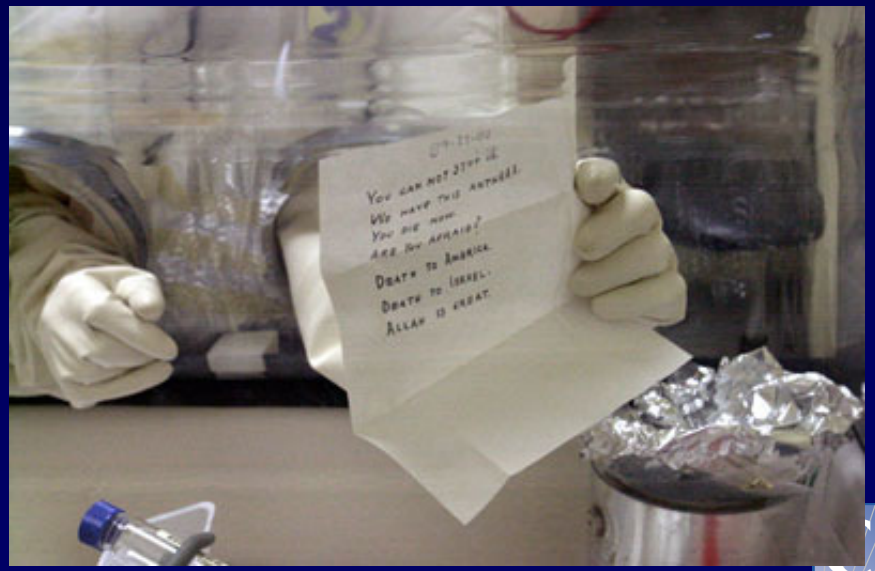
# Define Exposure Area and Population at Risk
# Contiguous Separate Air Space




Southeast quadrant Hart Senate Office Building: 5th and 6th floors



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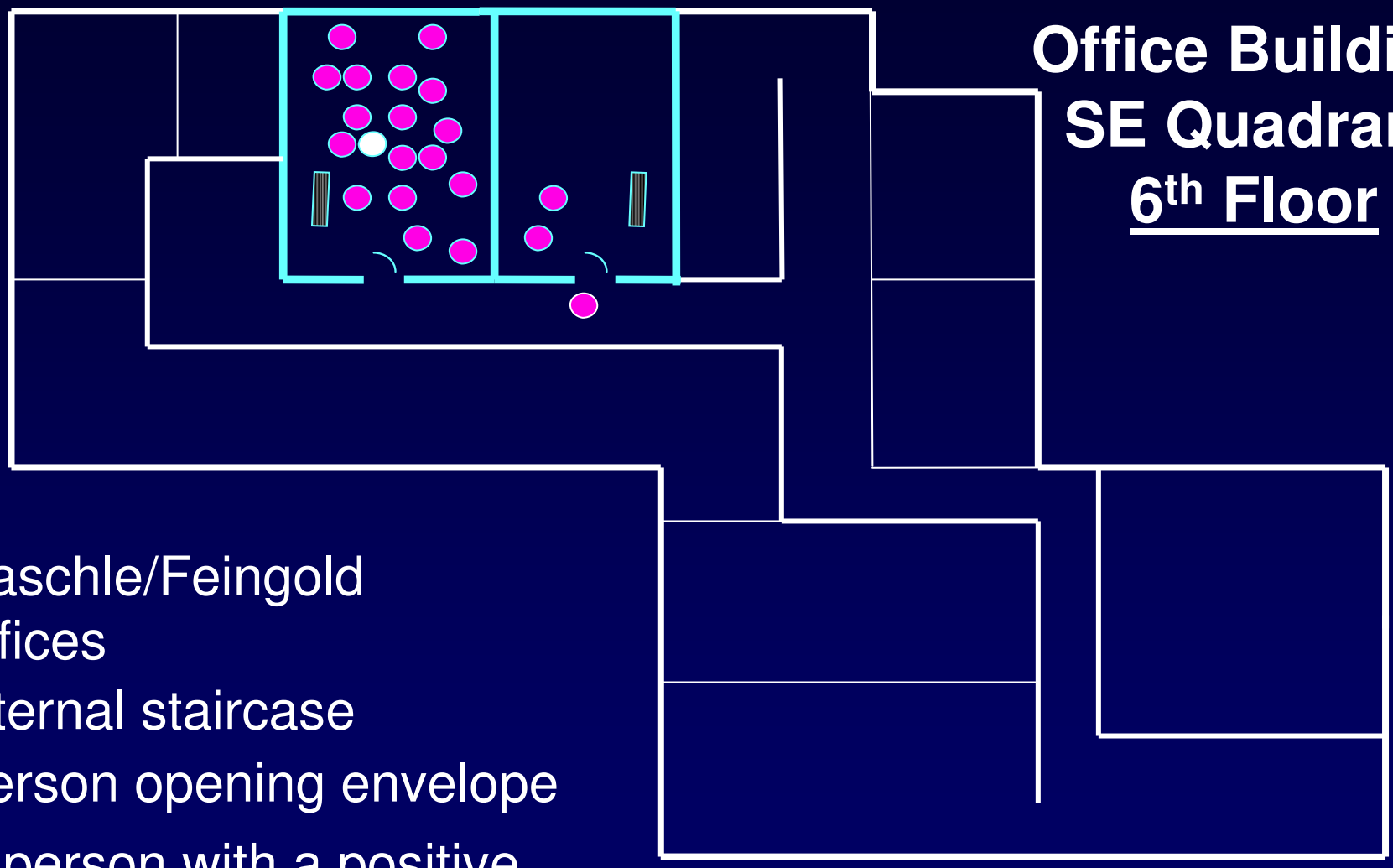
# Define Exposure – Nasal Swabs

**Hart Senate Office Building**
**SE Quadrant**
**6th Floor**



- Daschle/Feingold offices
- Internal staircase
- Person opening envelope
- A person with a positive nasal swab

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# 6th Floor Persons with Positive Nasal Swabs

| Location | Total No. | Positive NS No. | (%) |
|---|---|---|---|
| Daschle office | | | |
| Staff | 13 | 13 | (100) |
| Responders | 5 | 5 | (100) |
| Feingold office | | | |
| Staff | 15 | 2 | (13) |
| Hallway | | | |
| Responders | unk. | 1 | unk. |

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# Defining Population at Risk:
## Hart SE Quadrant, 5th and 6th Floors

| Category | | Total No. | Positive NS* No. |
|---|---|---|---|
| Senate Staff | Daschle | 38 | 20 |
| | Feingold | 27 | 2 |
| | Other | 252 | 0 |
| Known visitors | | 66 | 0 |
| Responders | | 59 | 6 |
| Total | | 442 | 28 |

*NS= Nasal Swab

Lessons
- Responders exposed (risk of disease?)
- Nasal-swabs positive when collected early
- Nasal-sample results reflect air space concern

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# Washington DC Processing & Distribution Center - "Brentwood"

500,000 sq. feet

2421 employees

59 million pieces of incoming mail processed between 10/12 and 10/21

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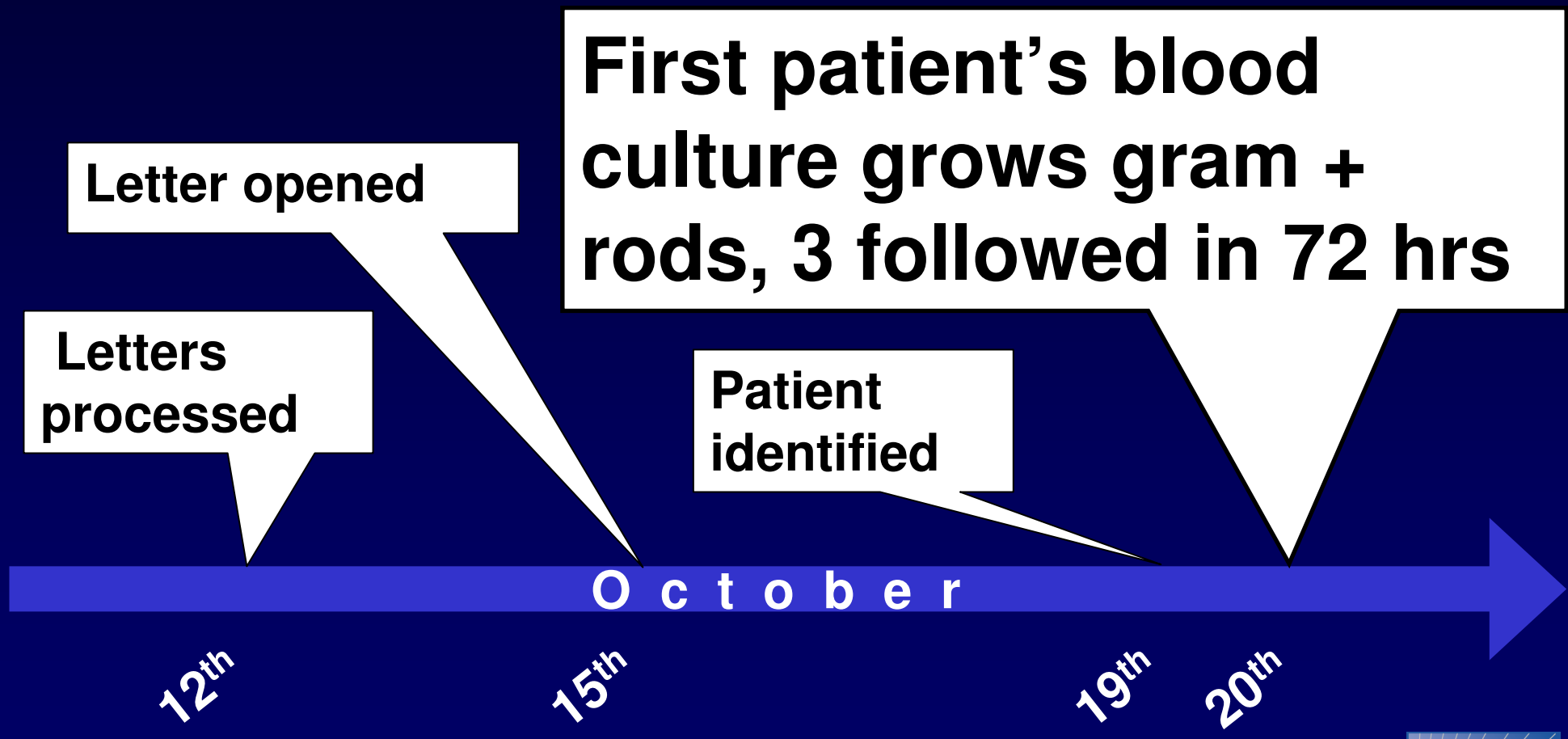
# How the Brentwood story begins…

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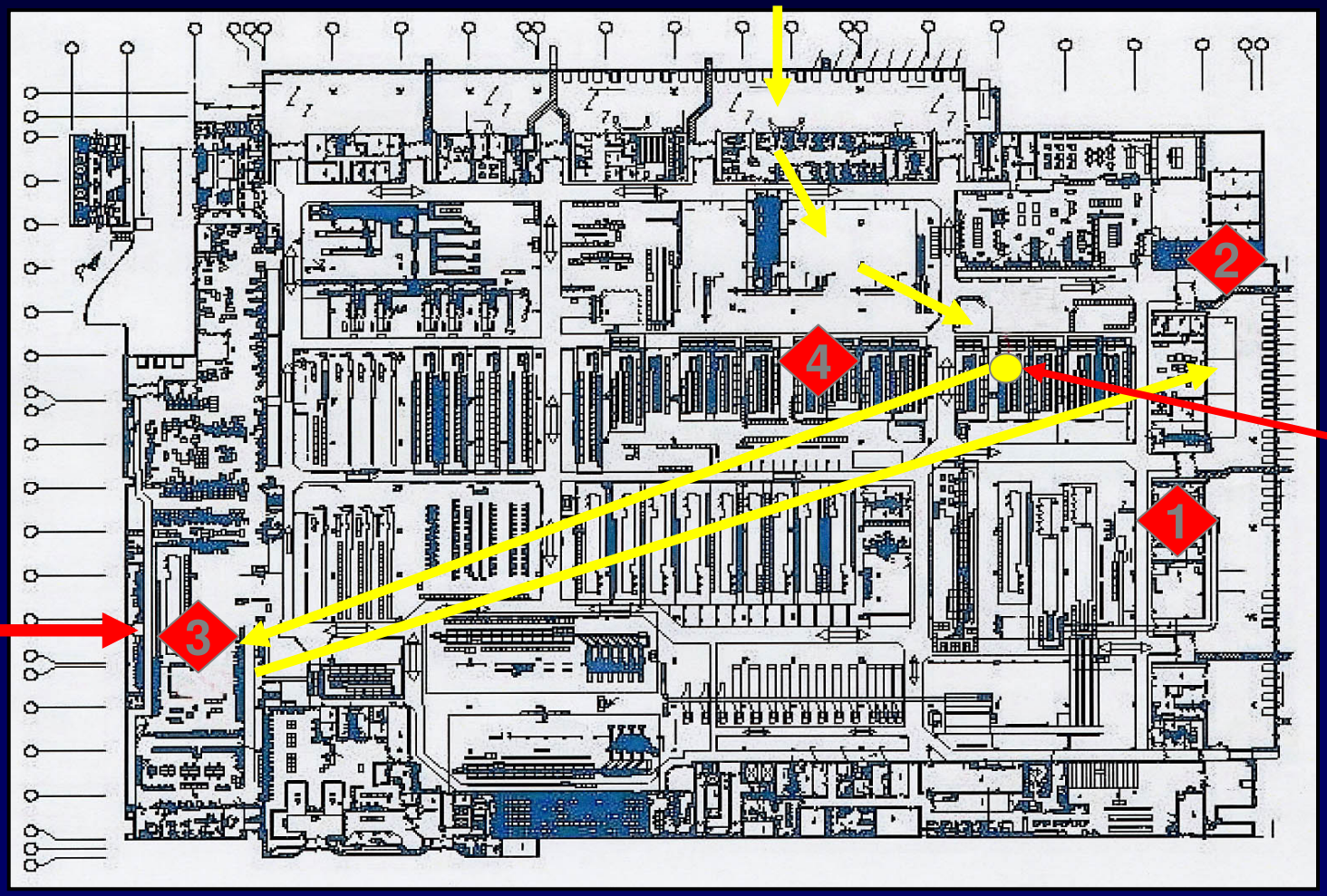
# Spatial Association of Cases & Letter Route




High Speed Sorter

Govt. Mails

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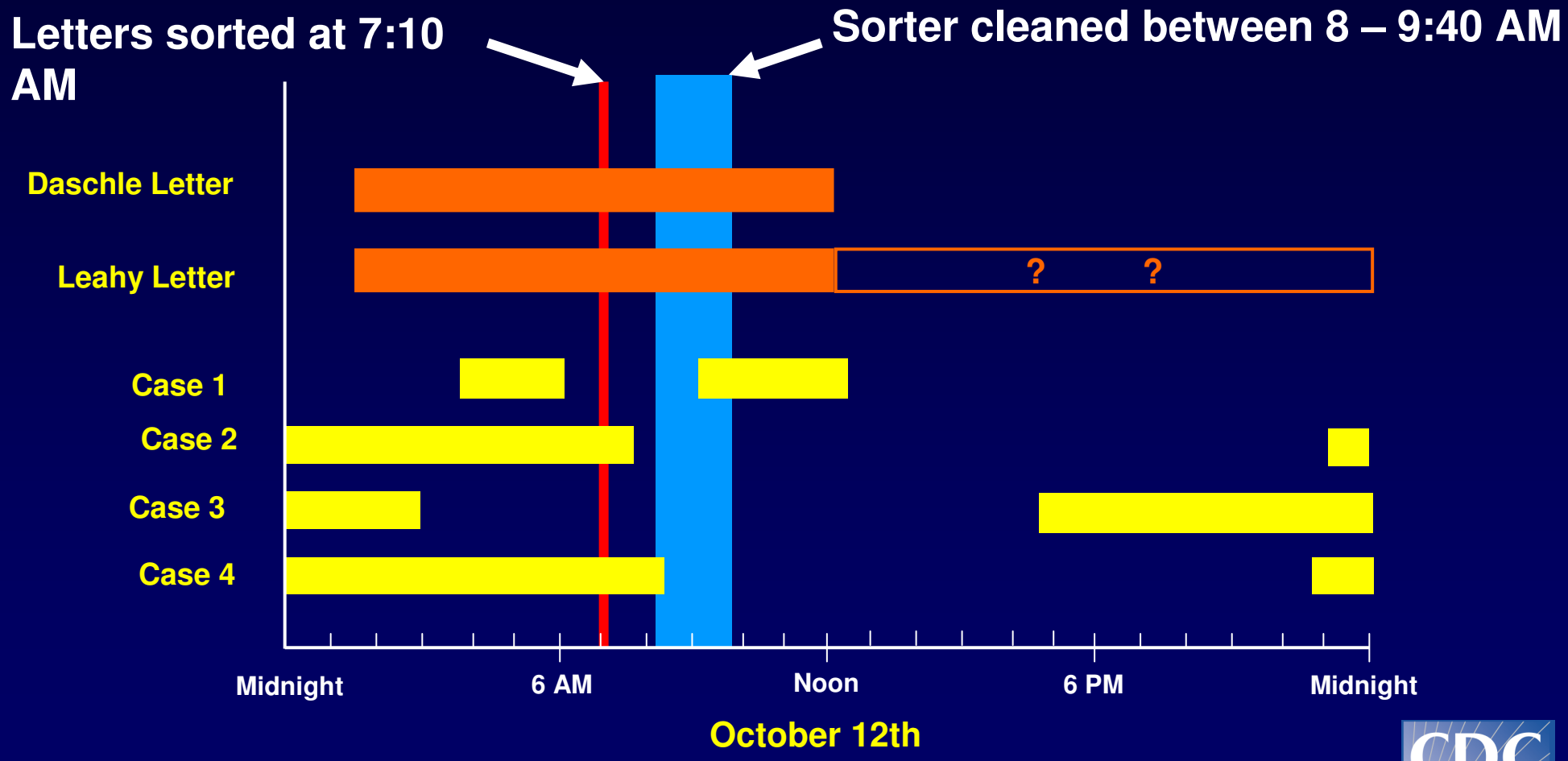
# Brentwood Postal Facility
# Temporal Association of Cases & Letters




Lesson: Re-suspension risk unknown

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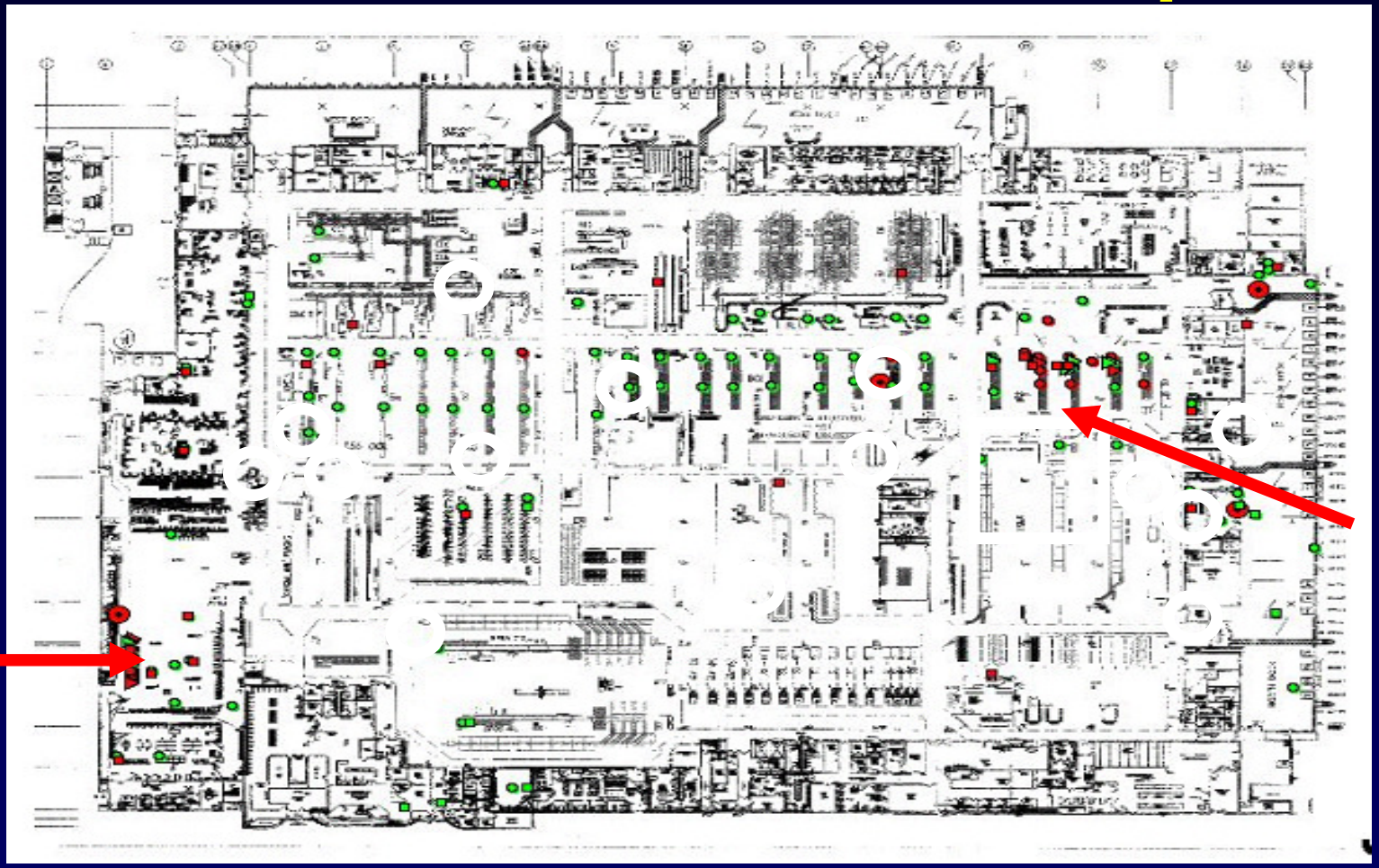
# Surface Environmental Samples



Govt. Mails

High Speed Sorter

Lessons

- Postal system – a complexity not anticipated
- Are we prepared for other scenarios: food, water?
- Surface sampling seemed to reflect risk area?

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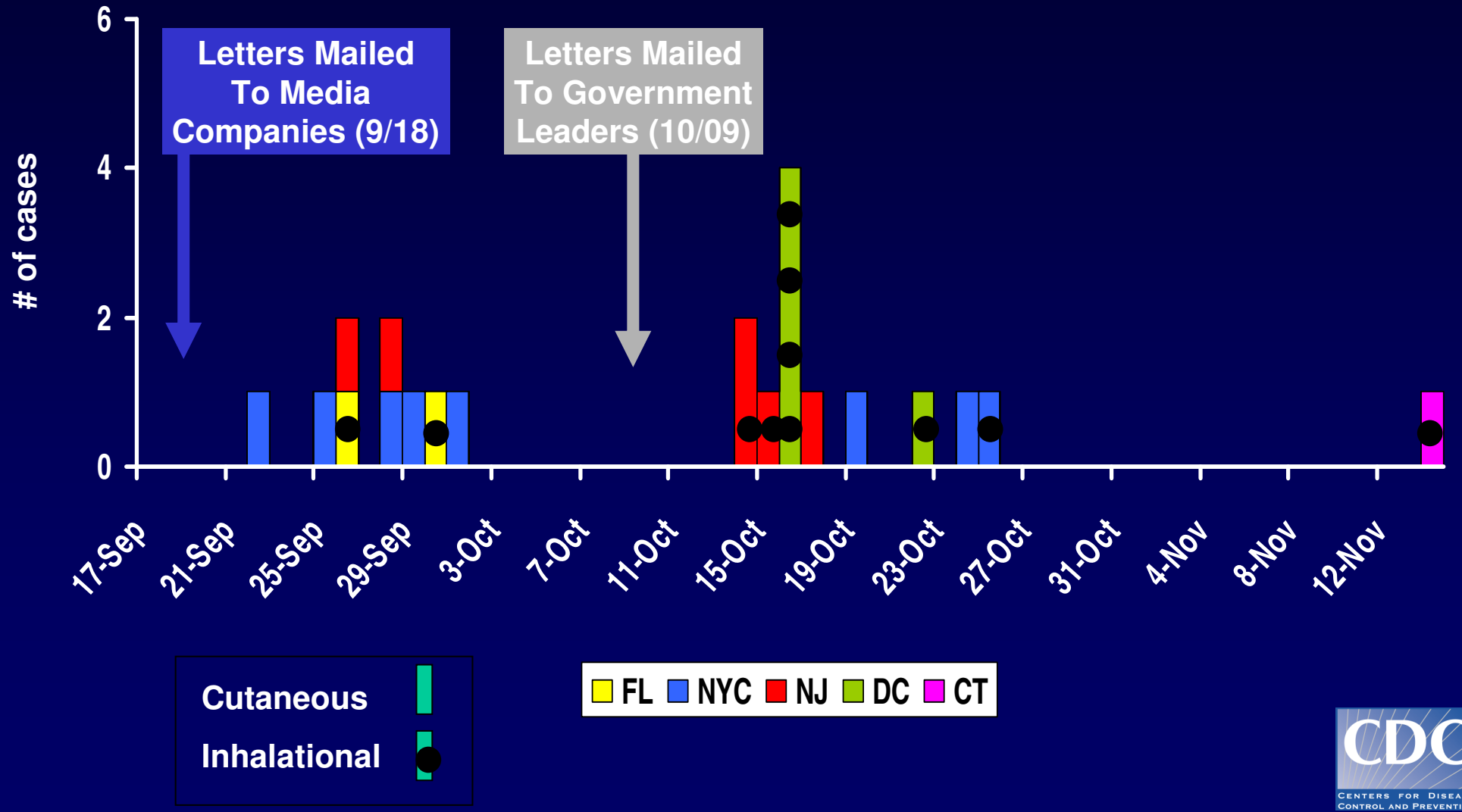
# Epidemic Curve for 22 Cases of Confirmed or Suspect Bioterrorism-Related Anthrax, United States, 2001

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# Inhalational & Cutaneous Bioterrorism-Associated Anthrax Cases, United States, 2001

| Characteristic | All Cases (n=22) | Inhalational Cases (n=11) | Cutaneous Cases (n=11) |
|---|---|---|---|
| Median Age in years (range) | 46 (0.6 – 94) | 56 (43 – 94) | 35 (0.6 – 51) |
| Male Sex (%) | 12 (55%) | 7 (64%) | 5 (45%) |
| Occupation<br>Mail Handler<br>Media Employee<br>Other | <br>12 (55%)<br>6 (27%)<br>4 (18%) | <br>8 (73%)<br>1 (9%)<br>2 (18%) | <br>4 (36%)<br>5 (45%)<br>2 (18%) |
| Mean incubation period in days | 6.1 | 6.5 | 5.4 |
| Number of deaths (case-fatality ratio) | 5 (23%) | 5 (45%) | 0 (0%) |

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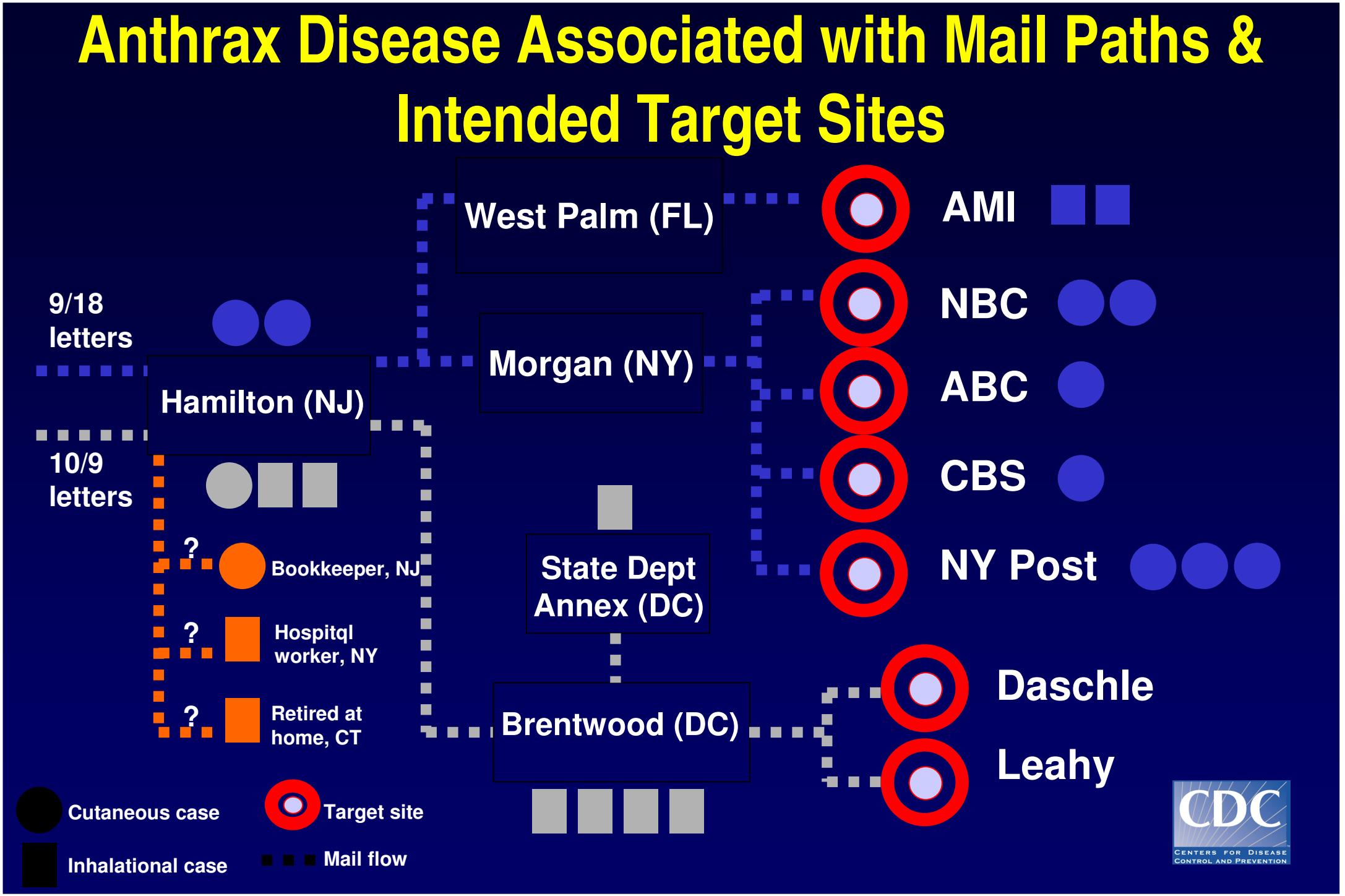
# Anthrax Disease Associated with Mail Paths & Intended Target Sites



# *Bacillus anthracis* Activities Summary

- Clinical samples – 1000s
- Environmental samples – 100,000s
- Isolate confirmation and subtyping – 100s
- Phone calls from the public – 1000,000s
- Post-exposure Prophylaxis – app. 10,000
  - Must be followed closely!
- 22 cases of anthrax, 5 deaths

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# Outline

- Investigation – Florida and Washington, D.C
  - What were the gaps in our science base?
  - What were lessons at each step?

- **What were the challenges faced that might guide preparedness and research activities in anticipation of the next attack?**

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# Challenges: Laboratory Diagnostic Methods Utility and Weaknesses

- Microscopy direct from clinical sample – useful (restrictions)
- Culture of *B. anthracis* – need alternatives for treated patient
- Immunohistochemical staining for *B. anthracis* antigens in tissue specimens – extremely useful, but further validation
- Serology for anti-*B. anthracis* antibodies by ELISA – validated during response, timeliness
- Polymerase chain reaction (PCR) for *B. anthracis* DNA in tissue specimens – useful (caveat = DNA prep.)

Lessons

Assays must be evaluated and standardized now

- Other threat agents

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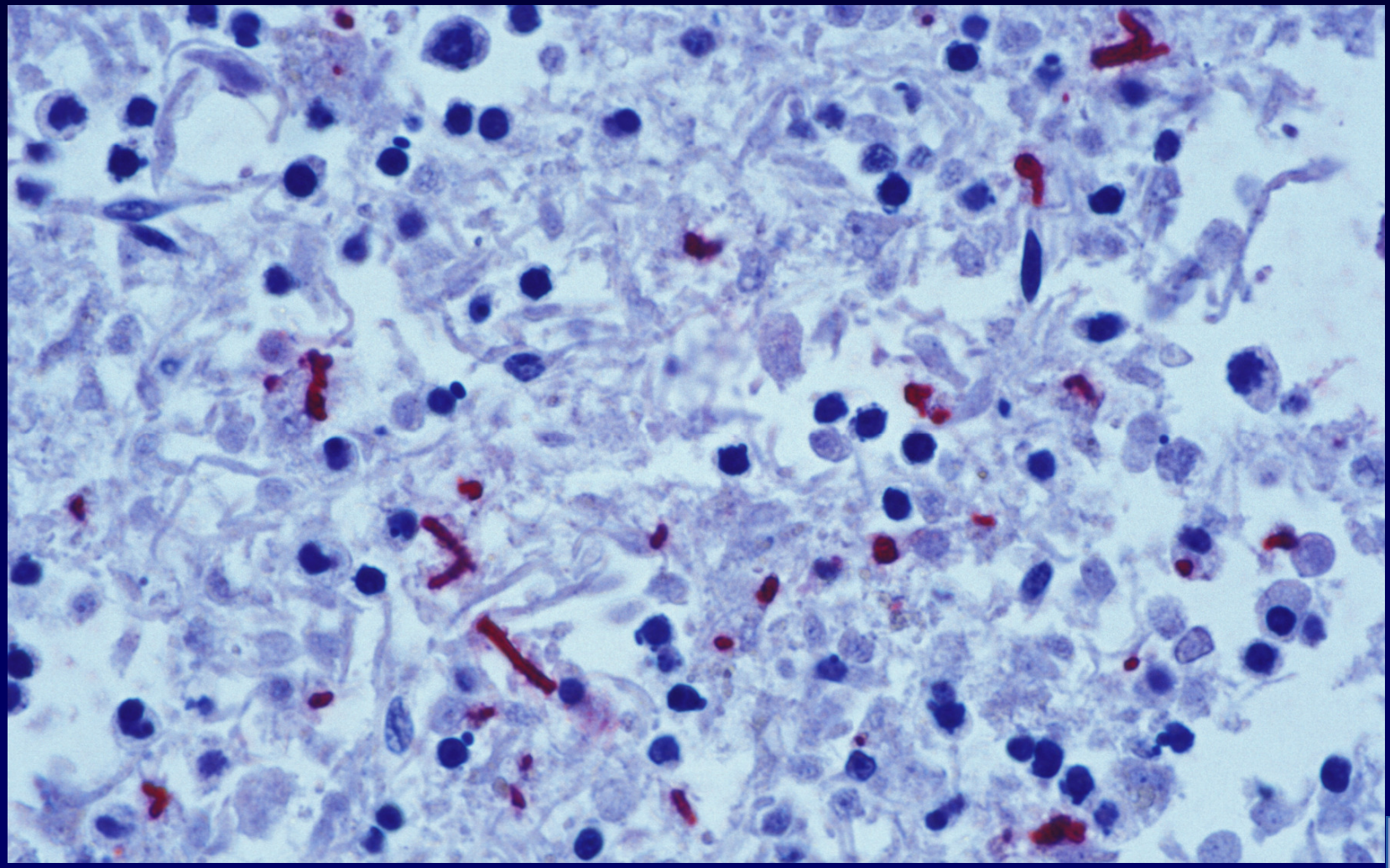
# Challenges: Diagnosis in Treated Patient



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# Challenges: Environmental Assessment

- Environmental assessment for BT event is tremendous
  - Not clearly planned
  - Not standardized or validated
  - Complicated by the many matrices
  - Sample management coordination strategies
  - Leadership is needed

- Sample transportation (and personnel too!)
  - Need for safe, reliable, efficient transport

- How can surface or air sampling after an attack be utilized to gauge risk? Standardized? Validated?

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# Lab Environmental Response to Oct-Dec Anthrax Events

**DoD inclusive (25%)**
**30,200 environmental tests performed**

**+ CDC inclusive (6%)**
**7,500 environmental tests**

**PHL inclusive (69%)**
**+ 84,010 environmental tests**

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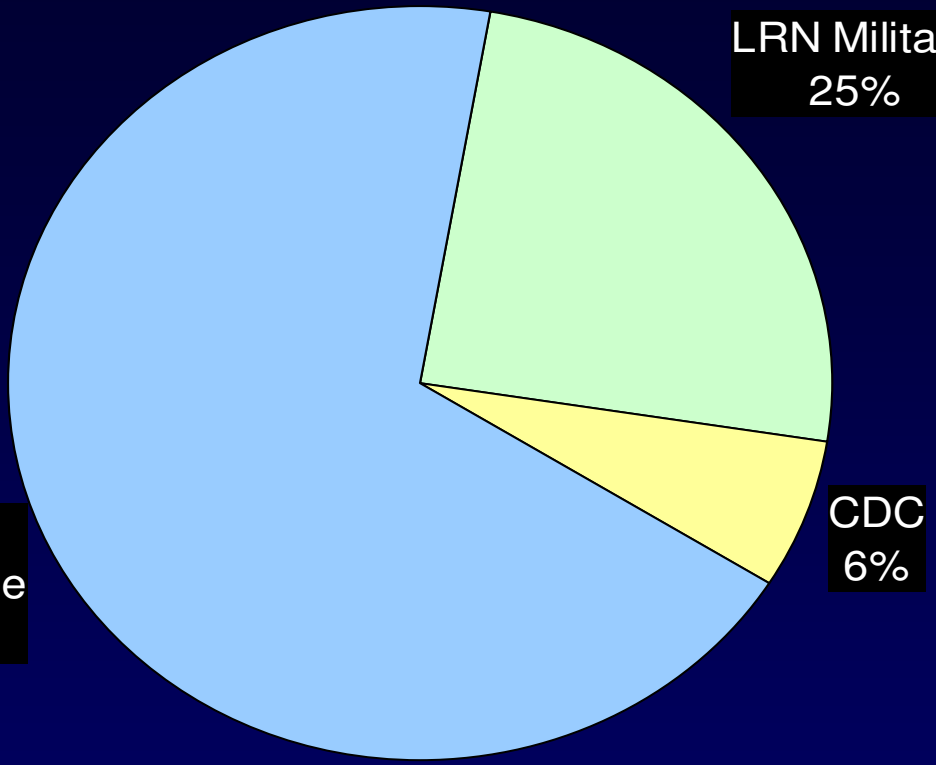
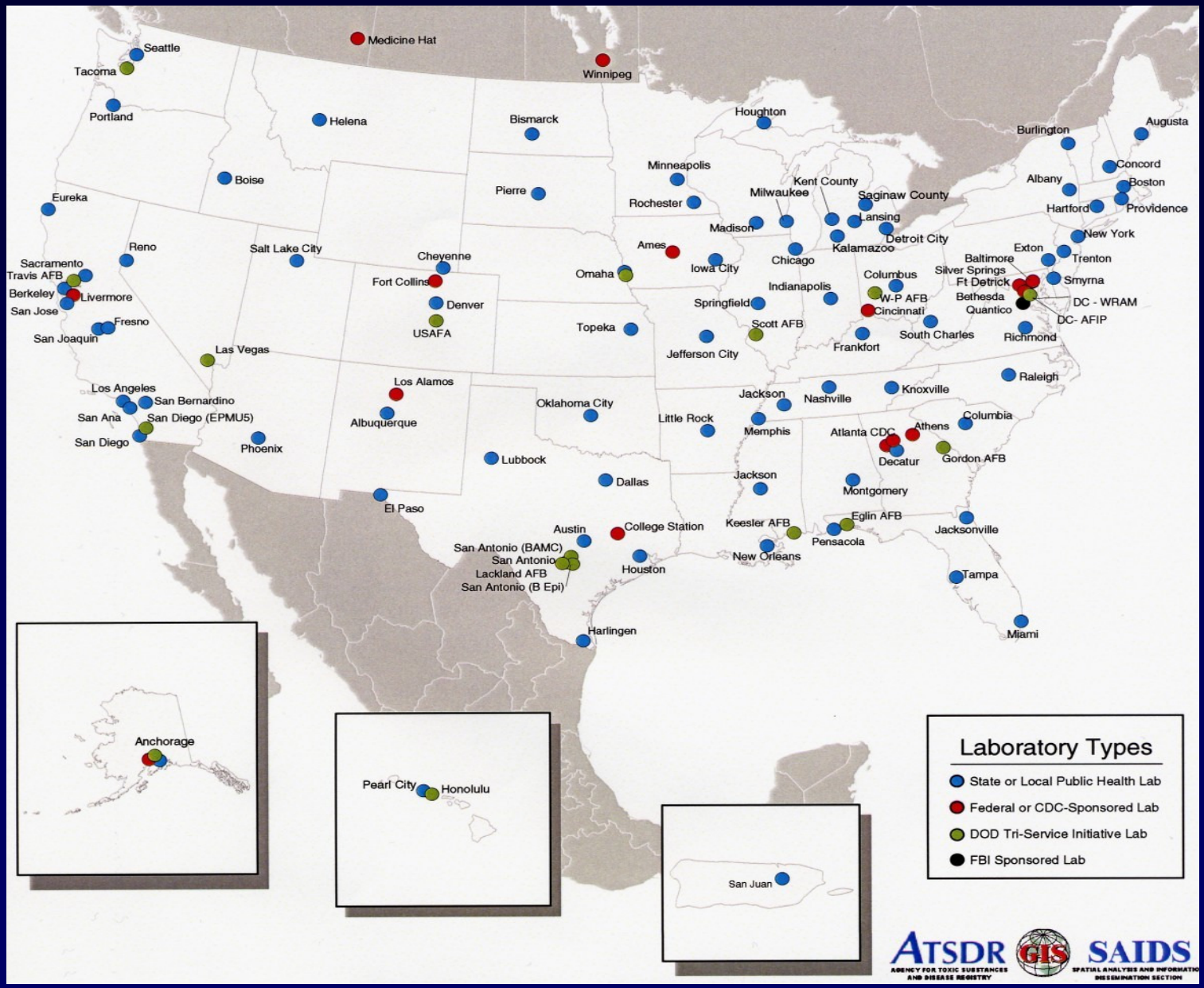
**Total:**
**121,710 environmental tests**




**Laboratory Response Network for Bioterrorism, BPRP/NCID/CDC**

# Laboratory Response Network




LRN
LABORATORY RESPONSE NETWORK

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# Challenges: Guidance on the efficacy of antibiotic prophylaxis for public health recommendations

- Animal Studies
  - Henderson DW, Peacock S, Belton FC. 1956. Observations on the prophylaxis of experimental pulmonary anthrax in the monkey. *J Hygiene 54*: 28-36.
  - Friedlander AM, Welkos SL, Pitt ML, et al. 1993. Postexposure prophylaxis against experimental inhalational anthrax. *JID 167*: 1239-42.
- Questions
  - Length of treatment with or without vaccine?
  - New antibiotics?
  - Adjunct therapies?

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# Challenges: Post-exposure Prophylaxis Delivery
# National Pharmaceutical Stockpile


**Oct 8-January 11**

**143 sorties to 9 states**

**Delivered 3.75 million antibiotic tablets**

National to local a success

Local planning is critical

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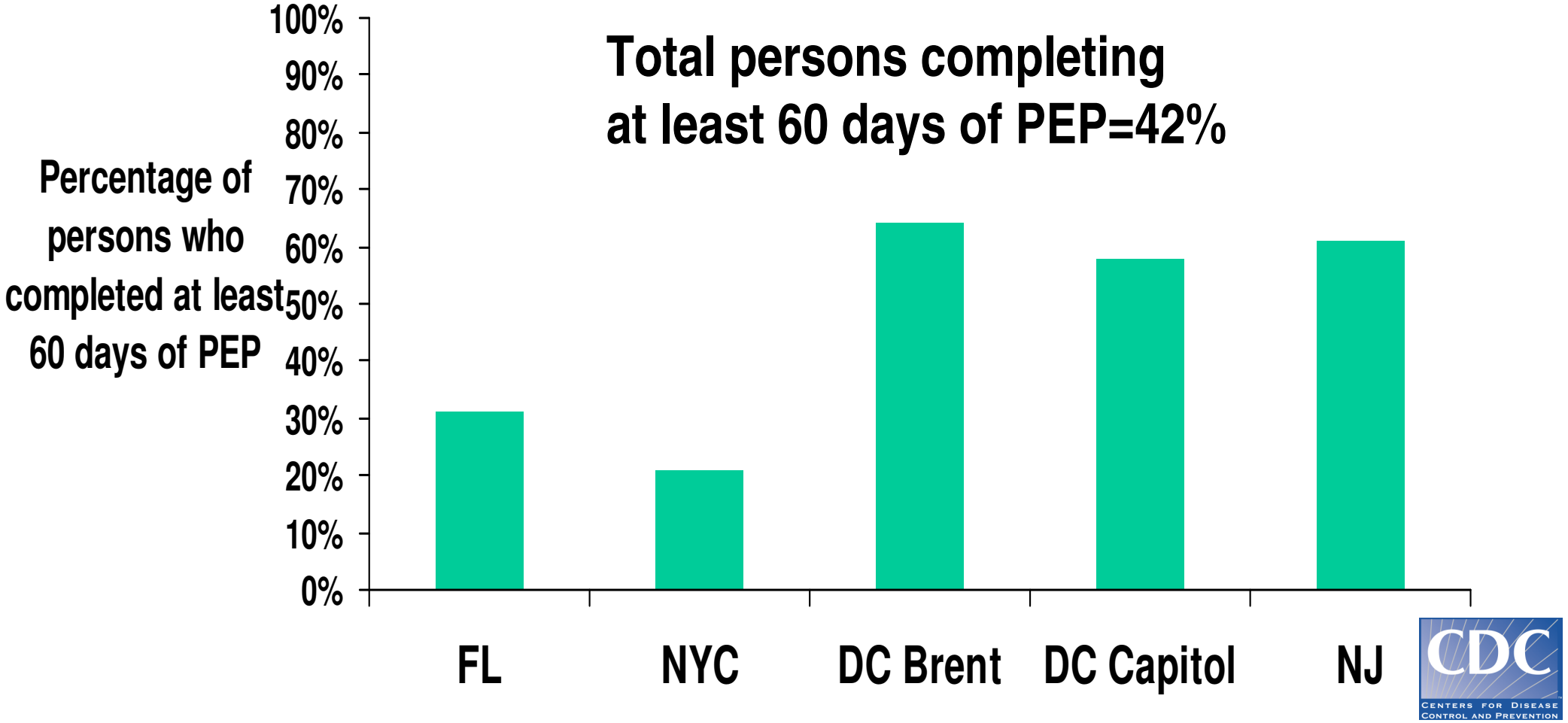
# Challenges: Post-exposure Prophylaxis Adherence

## Persons completing at least 60 days of PEP, by site



# Challenges: Anthrax Vaccine

**The anthrax vaccine used in the post-exposure program is considered investigational because:**

1. The vaccine is not approved for post-exposure prophylaxis;
2. The vaccine is not approved for a 3-dose regimen; and
3. The lot of vaccine to be used in this program is not approved for commercial use.

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# Challenges: The Science of Re-suspension?

- Re-suspension was considered unlikely
- Re-suspension was detected in every indoor environment tested
- The degree and risk associated is poorly understood
  - product dependent
- Anticipate exposures to secondary aerosols
  - in laboratory and remediation and immunize now

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# Consultation: "*Bacillus anthracis* Bioterrorism Research Priorities for Public Health Response"

- December 10-11, 2001, CDC, Atlanta, GA
- 132 Participants: CDC, FDA, NIH, EPA, DoD, DoE, USPD, DRES, State Health Depts., & Universities
- Working Grps: Powder Eval., Epidemiologic Investigation, Environ. assessment, Surveillance, Diagnosis, Treatment, PEP, & Remediation

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# Summary Observations

- Unprecedented bioterrorism attack
- Letter transit paths associated with more morbidity & mortality than targets
- Clinical diagnosis is complicated by antibiotic treatment
- Environmental contamination and assessment presented unexpected challenges
- Disease clearly averted in some circumstances
- Preparedness worked: especially LRN and NPS
- Numerous knowledge gaps for public health response
- Clinical labs remain our front line, and we must focus support efforts for those individuals

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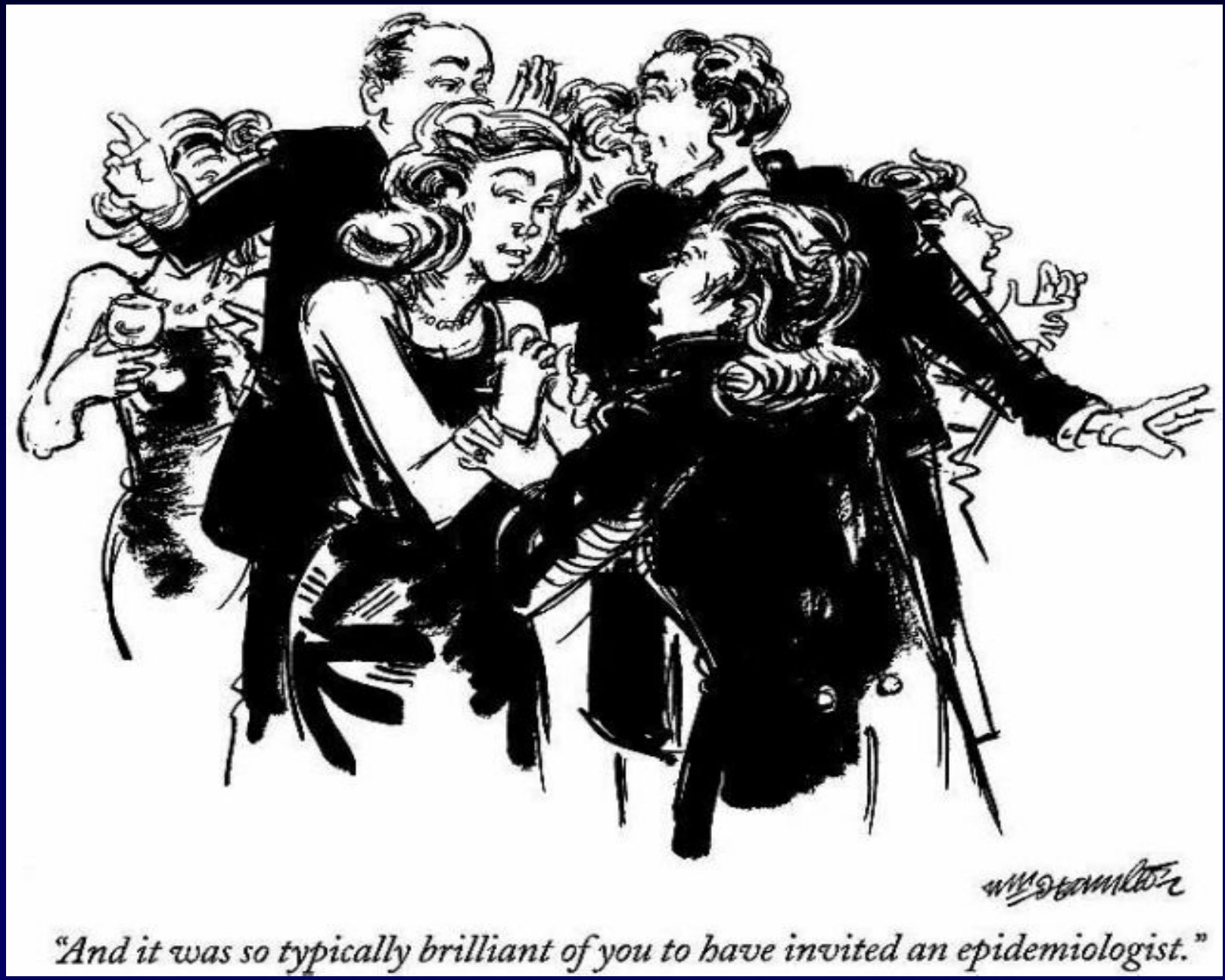

*"And it was so typically brilliant of you to have invited an epidemiologist."*

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