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6



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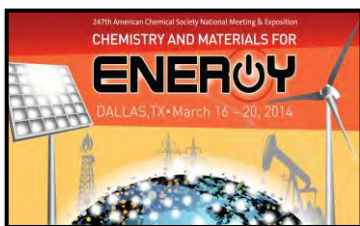
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8

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9

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## *Detecting Bioterrorism: Is Chemistry Enough?*




**Dr. Kristin Omberg**  
Deputy Group Leader  
Los Alamos National Laboratory

**Dr. Darren Griffin**  
Professor of Genetics  
University of Kent

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## Detecting Bioterrorism: Is Chemistry Enough?

Kristin M. Omberg, PhD  
komberg@lanl.gov  
March 13, 2014

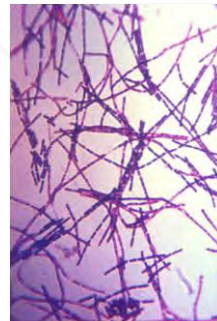


11

October 2, 2001



Bob Stevens. Source: Associated Press



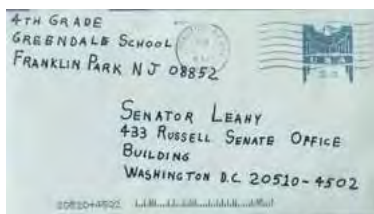
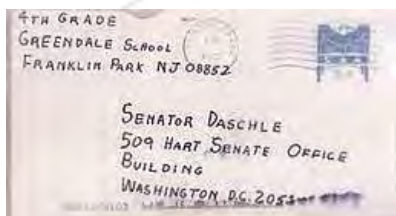

12

## Human anthrax in the US, 1950-2000



| Total | State          | Year (# Cases)                              | Comments                       |
|-------|----------------|---|--------------------------------|
| 14    | New Hampshire  | 1978 (2); 1966 (2);<br>1966 (1); 1957 (9)   | Textile mills                  |
| ≥ 9   | North Carolina | 1987 (1); 1978 (2);<br>1956 (≥ 5); 1953 (1) | Textile mills                  |
| 5     | South Carolina | 1974 (1); 1960 (4)                          | Textile mills                  |
| 5     | Texas          | 1959 (5)                                    | Animal outbreak                |
| 4     | New Jersey     | 1975 (3); 1959 (1)                          | Gelatin plant; animal outbreak |
| 2     | California     | 1976 (1); 1968 (1)                          | Wool; animal outbreak          |
| 2     | Louisiana      | 1971 (2)                                    | 588 animal cases               |
| 2     | Pennsylvania   | 1961 (1); 1957 (1)                          | Textile mill, tannery          |
| 1     | Florida        | 1974 (1)                                    | Imported goatskin              |
| 1     | North Dakota   | 2000 (1)                                    | Animal outbreak                |
| 1     | Ohio           | 1964 (1)                                    | Goat hair                      |
| 1     | Oklahoma       | 1957 (1)                                    | Animal outbreak                |

## “Amerithrax” letters



Each letter contained less than  
a sugar cube of material...



So how do you  
protect against  
a whole bag?



| 15

**Audience Question:**



**When will the next biological attack occur?**

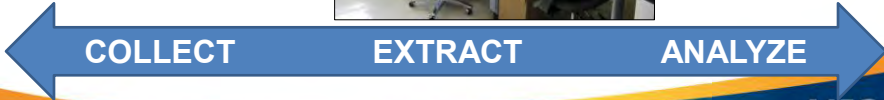
- Within the next 5 years
- Within the next 10 years
- More than 15 years from now
- Never; this is much ado about nothing



| 16



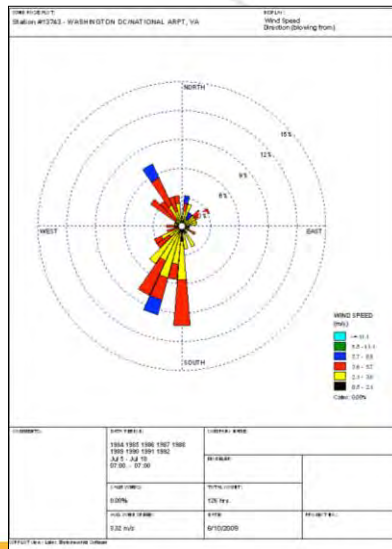
# Environmental Monitoring for Bioaerosols



# How do you site bioaerosol collectors?



*QUIC: Quick Urban & Industrial Complex Model*



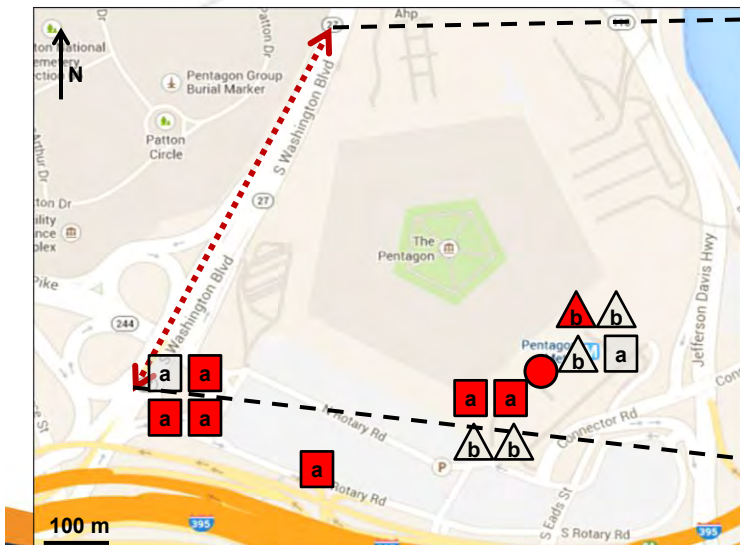
# 2005 Collector Siting



- = air sampler
- a = above-ground surface sample
- △ b = below-ground surface sample



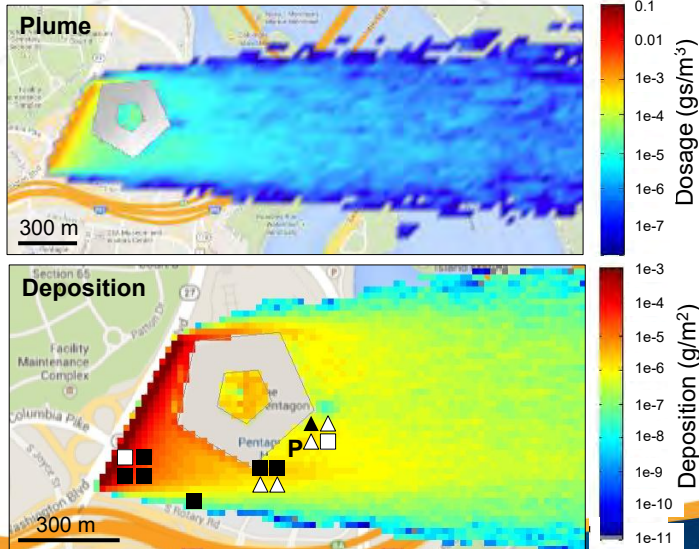
# 2005 Results Red = PCR-positive



- = air sampler
- a = above-ground surface sample
- △ b = below-ground surface sample

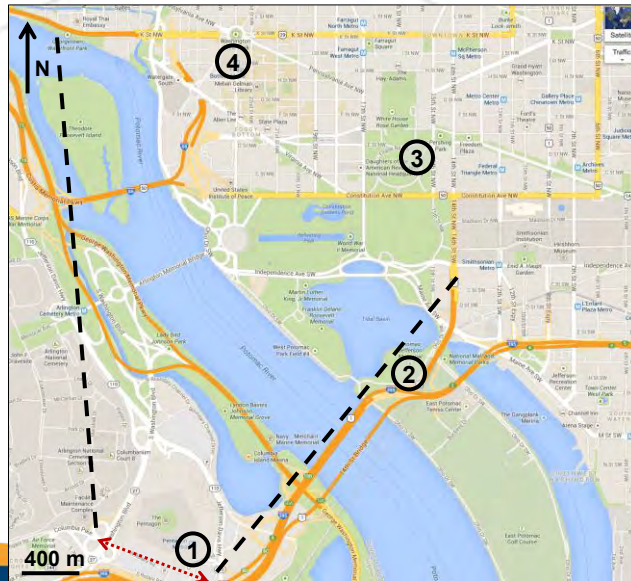


## 2005 Modeled Plume & Deposition

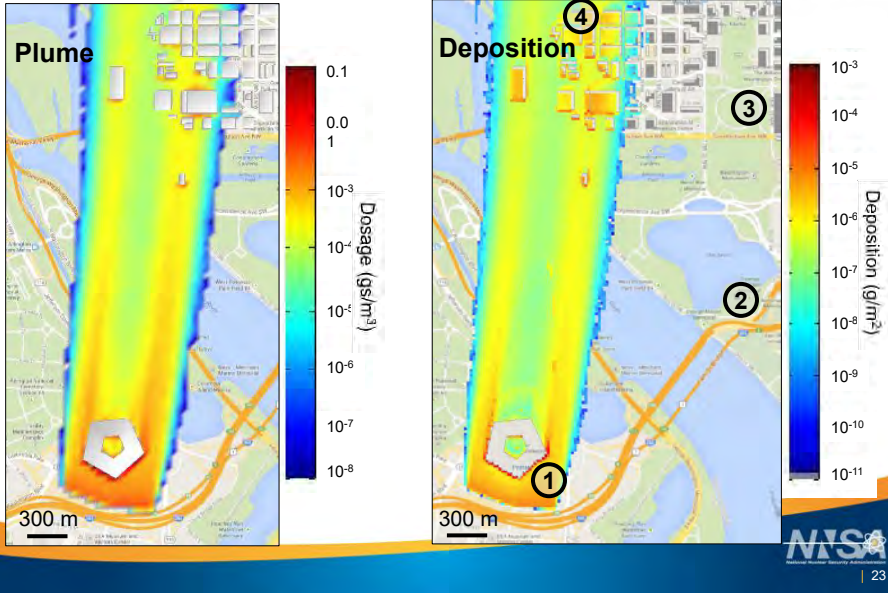


## 2009 Collector Siting

Circle = air sampler; surface samples collected in vicinity

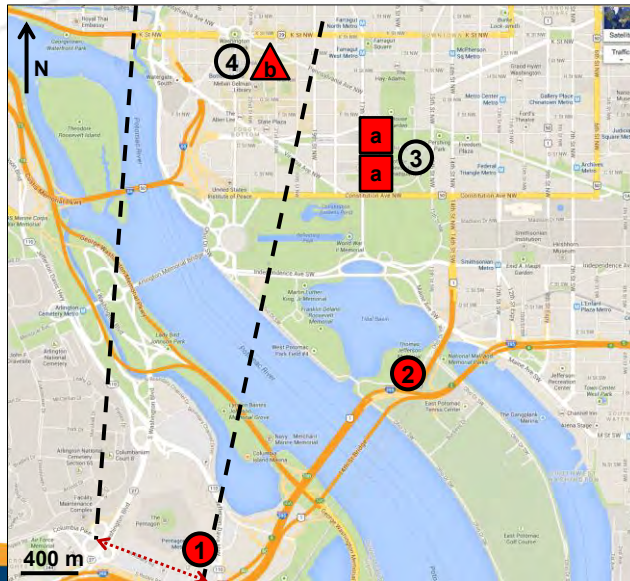


# 2009 Modeled Plume & Deposition



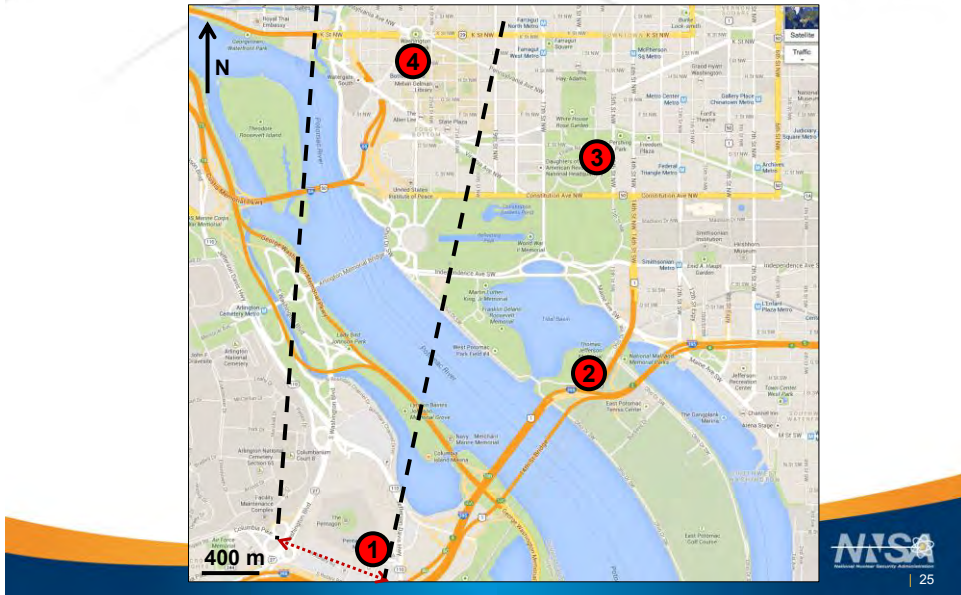
# 2009 results: 12 hours post-release

Circle = air sampler; square = surface samples



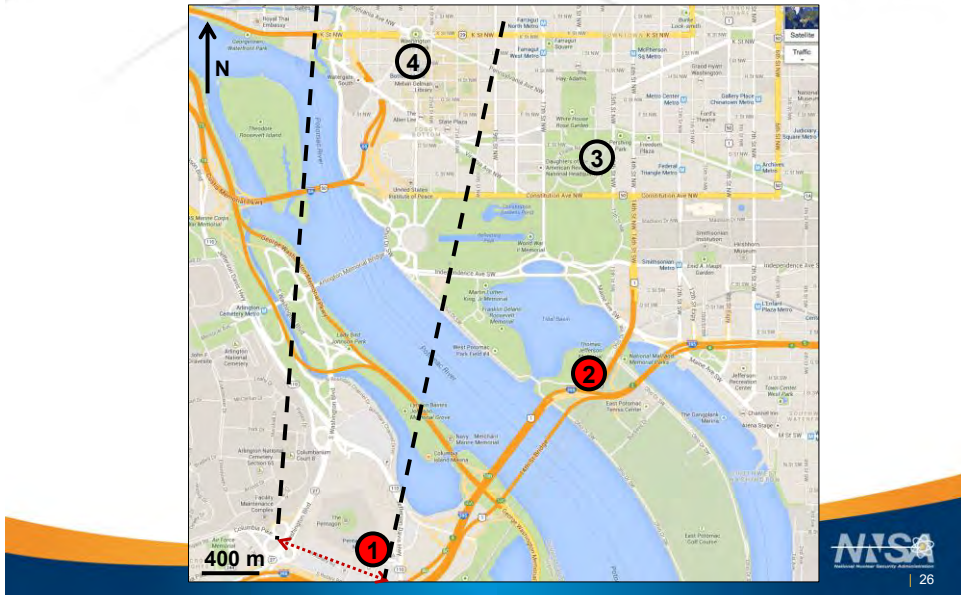
## 2009 results: 24 hours post-release

Circle = air sampler; no surface samples collected



## 2009 results: 48 hours post-release

Circle = air sampler; no surface samples collected



## 2009 results: 72 hours post-release

Circle = air sampler; no surface samples collected



### Audience Question:



Do biological agents in the environment behave like other particles?

- Yes; one soil-bound particle is like any other
- No; bioagents behave differently

## Summary



- Aerosol collectors in the US continuously monitor for threat agents to protect against a large-scale aerosolized biological attack
- Collectors are typically sited using transport and dispersion modeling and historic wind data
- Samples are analyzed using PCR
- Experiments and modeling have shown these systems are effective at detecting the presence of DNA
- Systems can warn public health in time to mount an effective response



## But does DNA in the air mean people are infected?



- It only means there's DNA in the air
- Current systems often can't confirm viability
- No rapid techniques to confirm human exposure
  
- A recent USGS study found *B. anthracis* in 5% of soil samples collected on a north-south transect between Manitoba, Canada and Texas



## Audience Question:



If you were a public health official and *B. anthracis* DNA was found in the air in your city, what would you do?

- Nothing; it was probably from naturally occurring bacteria
- Wait for more information; if it's really a problem, someone will show up sick soon
- Panic! Evacuate and/or begin mass prophylaxis with antibiotics or vaccines



31

## References



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32



## Detecting Bioterrorism: Is Chemistry Enough?



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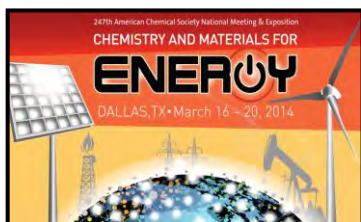
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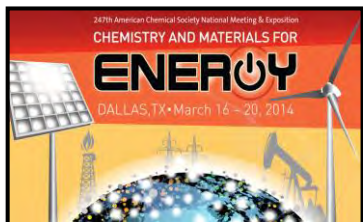
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