



JUDGING THE EFFICACY OF ANTHRAX FUMIGATIONS

Joint Services Scientific Conference
Towson, MD
November 20, 2003

Dorothy A. Canter, PhD.
US EPA



Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE 19 NOV 2003		2. REPORT TYPE N/A		3. DATES COVERED -	
4. TITLE AND SUBTITLE Judging The Efficacy Of Anthrax Fumigations				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) US Environmental Protecion Agency				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release, distribution unlimited					
13. SUPPLEMENTARY NOTES See also ADM001851, Proceedings of the 2003 Joint Service Scientific Conference on Chemical & Biological Defense Research, 17-20 November 2003. , The original document contains color images.					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT UU	18. NUMBER OF PAGES 15	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

ANTHRAX REMEDIATION PROCESSES

- Site assessment/environmental sampling
- Isolation of contaminated areas
- Artifact/critical item removal
- Source reduction/waste removal
- Decontamination of contaminated areas (e.g., fumigation)
- Post-remediation environmental sampling
- Further remediation/sampling (if needed)
- Disposal of PPE, waste water, debris





ANTHRAX-CONTAMINATED SITES WITH FUMIGATION REMEDIES

Sites	Nature of Contamination	Fumigant	Volume Fumigated	Fumigation Approach
Hart Bldg	Aerosolized	Chlorine dioxide (ClO ₂)	90,000 ft ³ 2 floors	All at once
DOJ mail facility	Secondary	Formaldehyde	4,000 ft ³	Machines tented
GSA Bldg 410	Secondary	Vaporized hydrogen peroxide (VHP)	1.6 x 10 ⁶ ft ³	9 zones
Brentwood	Aerosolized	ClO ₂	14.5 x 10 ⁶ ft ³ 2 floors	All at once
SA-32	Aerosolized	VHP	1.4 x 10 ⁶ ft ³	10 zones
Trenton	Aerosolized	ClO ₂	6.1 x 10 ⁶ ft ³	All at once



FUMIGATION

- Definition: the process of applying smoke, vapor or a gas to a facility or room for the purpose of disinfecting or destroying pests*

* Webster's Dictionary





HISTORICAL ANTHRAX FUMIGATIONS WITH FORMALDEHYDE

- Biosafety hoods and laboratories in research and clinical settings
 - NIH recommendations
 - NSF/ANSI standard for Class II biosafety cabinets
- Containment areas (animal rooms and office areas), equipment/materials, and buildings at US Army Medical Research Institute of Infectious Diseases (USAMRIID)
 - Regulations for conducting fumigations



FUMIGATIONS IN RESPONSE TO 2001 ANTHRAX ATTACKS

- Most fumigations modeled after biomedical sterilization processes, with established ranges for process variables for all four process phases and use of biological indicators as measures of efficacy of process
 - Phases:
humidification (dehumidification);
conditioning; decontamination; aeration





PROCESS VARIABLE GOALS/REQUIREMENTS

Fumigant/ Facility	Process Variables			
	Temperature	Relative Humidity	Concentration	Duration of Treatment
ClO₂				
Hart Bldg	70-80° F	65-75%	750 ppm	≥12 hrs.
Brentwood	≥75° F	≥75%	750 ppm	≥12 hrs.
Trenton	≥75° F	≥75%	750 ppm	≥12 hrs.
VHP				
Bldg 410	not specified	≤40%	108 ppm	3 hrs
SA-32	70° F	≤40%	≥216 ppm	≥4 hrs.





BIOLOGICAL INDICATOR GOALS/REQUIREMENTS

Fumigant/ Facility	Biological Indicator Parameters			
	Surrogate species	Number used	Placement Strategy	Consequences of Positive Results
ClO ₂				
Hart Bldg	Multiple species	>>1/100 ft ²	Random	None
Brentwood	<i>B. subtilis var. niger</i>	≥1/100 ft ²	Random, biased, focused locations	None
Trenton	<i>B. subtilis var niger</i>	≥1/100 ft ²	Random stratified + hard to reach/ contaminated locations	Additional environmental sampling





BIOLOGICAL INDICATOR GOALS/REQUIREMENTS

Fumigant/ Facility	Biological Indicator (BI) Parameters			
	Surrogate species	Number used	Placement Strategy	Consequences of Positive Results
VHP				
Bldg 410	<i>B. subtilis var. niger</i>	>1/100 ft ²	Hard to reach/ contaminated locations	Re-fumigation if ≥1 +BI
SA-32	<i>B. stearo- thermophilus</i>	>1/100 ft ²	Hard to reach/ contaminated locations	Re-fumigation if ≥1 +BI





SA-32: SITE WITH MOST STRINGENT REQUIREMENTS

- All process conditions achieved throughout all four phases of fumigation cycle at all real-time monitoring points
- All chemical indicators (CIs) exhibit color change following exposure to VHP
- All BIs recovered aseptically negative for growth of *B. stearoothermophilus*
- Positive control BIs (5% of BIs) demonstrate growth
- Negative control BIs (5%) exhibit no growth





SA-32: SITE WITH MOST STRINGENT REQUIREMENTS

- If any of above requirements not met, zone had to be refumigated
 - One of 10 zones was re-fumigated; second fumigation met all requirements



HISTORICAL CRITERIA FOR SUCCESSFUL TREATMENT

- Biomedical sterilizations
 - FDA regulation: Subsequent growth or failure of BI microorganism to grow under suitable conditions indicates adequacy of sterilization
- USAMRIID fumigations
 - All BIs negative for growth of indicator spores, or fumigation repeated





CRITERIA FOR SUCCESSFUL FUMIGATIONS

- All process variables within prescribed ranges for all four phases of fumigation at all monitoring points
- All aseptically removed BIs negative for growth of indicator organism

If criteria not met, further treatment or additional environmental sampling, depending upon site-specific results





BUT

Extensive post-remediation
environmental sampling
required even if fumigation(s)
successful





ULTIMATE CRITERION FOR EFFECTIVE REMEDIATION

- No growth of *Bacillus anthracis* spores from all post-remediation environmental samples

