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Restoration of Major Transportation Facilities Following a Chemical Agent Release: *The Facility Restoration OTD*

Mark D. Tucker, Ph.D.
Sandia National Laboratories

Ellen Raber
Lawrence Livermore National Laboratory

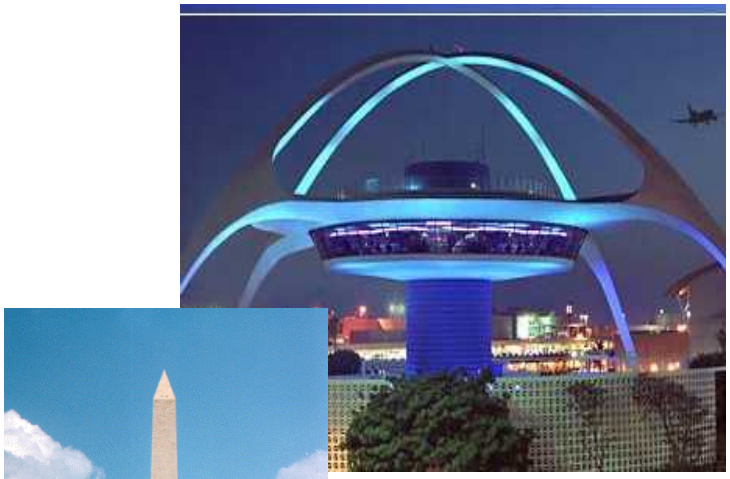
Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy under contract DE-AC04-94AL85000.

Presentation Outline

- Background and Project Overview
- Project Activities
  - **Remediation Plan Development**
  - **Technology Development**
  - **Experimental Studies to Fill Data and Capability Gaps**
  - **Final Demonstration**
- Summary

A chemical agent release in a facility may result in…

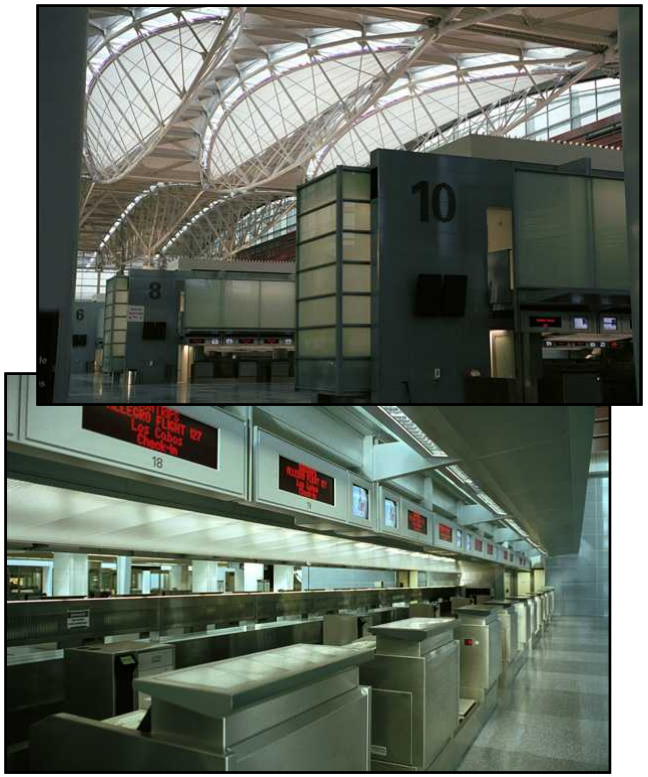
- High Casualties
  - Office Buildings
  - Indoor Stadiums
  - Transportation Hubs
- Loss of National Prestige
  - National Monuments
  - Government Buildings
- Large Economic Impact
  - Transportation Hubs



Economic impact is the most important factor in selecting a facility that needs to be restored quickly and efficiently

A chemical agent release in key transportation facilities could cause severe consequences

- Highly vulnerable to chemical terrorism
- Large economic impact if closed for even short periods
- Wide range of decontamination and remediation challenges
- Lack of understanding among stakeholders on the time, cost, and process to restore facility
- Fundamental technology and capability gaps will make efficient recovery difficult



We are working in close collaboration with a partner airport (LAX) and regulatory agencies

The Project supports the DHS S&T Chemical Countermeasures Strategic Objectives

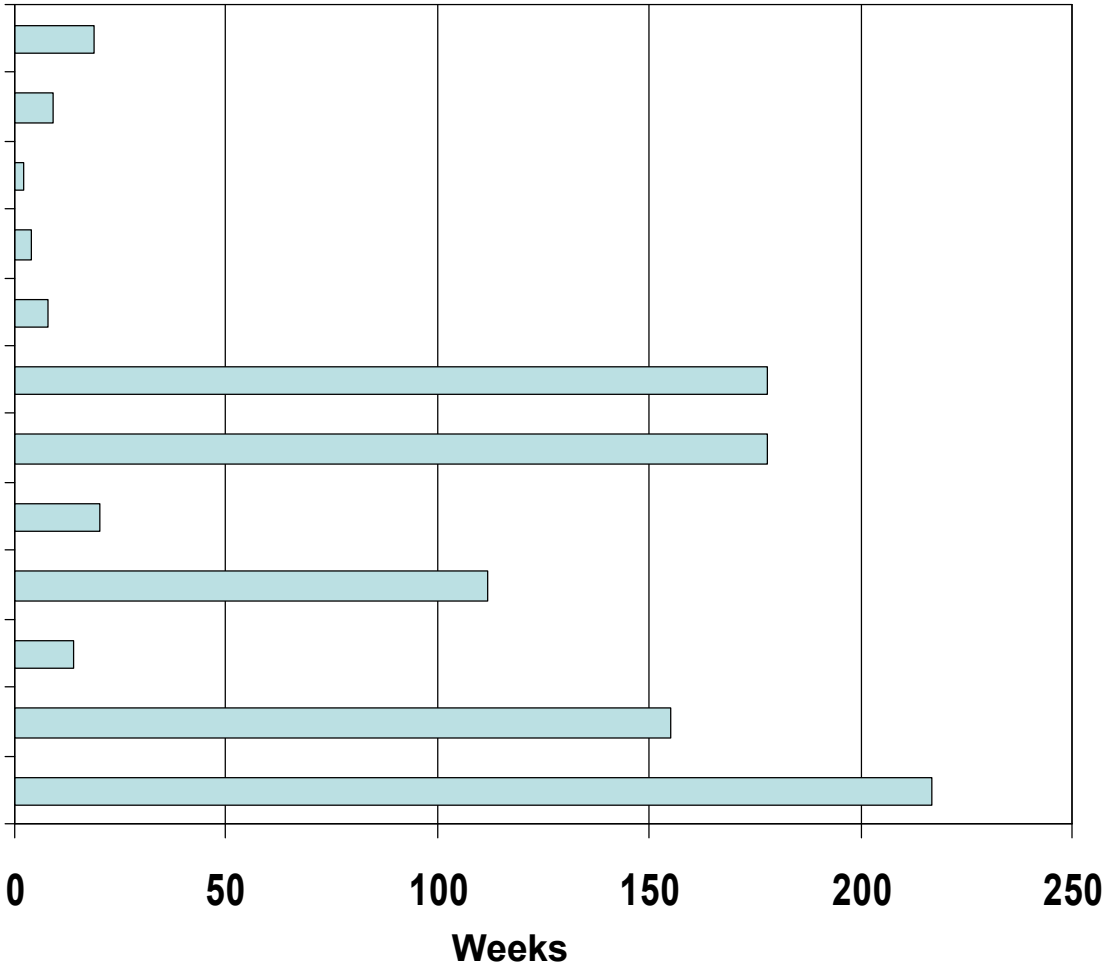
The strategic objectives of DHS S&T's Chemical Countermeasures Program are to:

- Develop a national chemical defense architecture
- Enhance rapid recovery from chemical attacks
- Develop pre-event assessment, discovery, and interdiction capabilities for chemical threats
- Minimize loss of life and economic impact from chemical attack
- Enhance the capability to identify chemical attack source

The Facility Restoration Operational Technology Demonstration (OTD) is addressing these objectives.

Previous recovery activities were very lengthy

State	Facility	Time
NY	Morgan	19 wk
NY	NBC	9 wk
NY	ABC	2 wk
NY	CBS	<4 wk
NY	NY Post	8 wk
NJ	Trenton	178 wk
VA	DOS	178 wk
MD	DOJ Mail Room	20 wk
DC	Brentwood	112 wk
DC	Hart	14 wk
DC	GSA 410	155 wk
FL	AMI	>217 wk



Recovery of facilities following the 2001 anthrax incidents

Implementing a systems approach will decrease the time required for recovery

Response and Recovery Activities					
Crisis Management		**Consequence Management**			
Notification	**First Response**	**Remediation/Cleanup**			**Restoration (Recovery)**
		Characterization	**Decontamination**	**Clearance**	
Receive and assess information Identify suspect release sites Relay key information and potential risks to appropriate agencies	HAZMAT and emergency actions Forensic investigation Public health actions Screening sampling Determination of agent type, concentration, and persistence Risk communication	Detailed characterization of chemical agent Characterization of affected site Site containment Continue risk communication Characterization environmental sampling and analysis Initial risk assessment Clearance goals	Worker health and safety Source reduction Decontamination strategy Remediation Action Plan Site preparation Waste disposal Decontamination of sites, items, or both Verification of decontamination parameters	Clearance sampling and analysis Clearance decision	Renovation Reoccupation decision Long-term environmental and public health monitoring

The systems approach is following the structure developed by an interagency panel of experts

Implementation of the systems approach requires pre-planning and the filling of critical technology, capability, and data gaps

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Crisis Management		**Consequence Management**			
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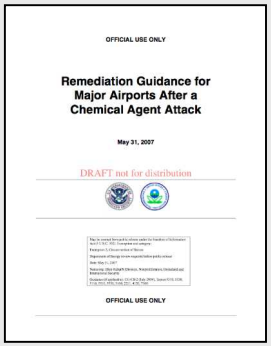
The project is conducting these activities in order to implement the systems approach to recovery

Pre-planning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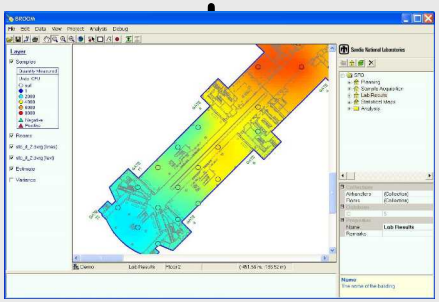
Technology Developmen

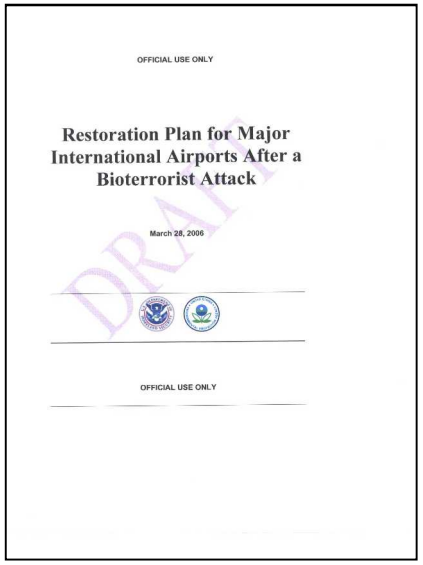


Addressing Critical Data and Capability Gaps

The objective is to recover as quickly and safely as possible to minimize economic damage

The Facility Restoration OTD builds off of the recently completed Biological Restoration DDAP

Biological Restoration DDAP
(BW agent release in an airport)



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Restoration Plan for Major International Airports After a Bioterrorist Attack

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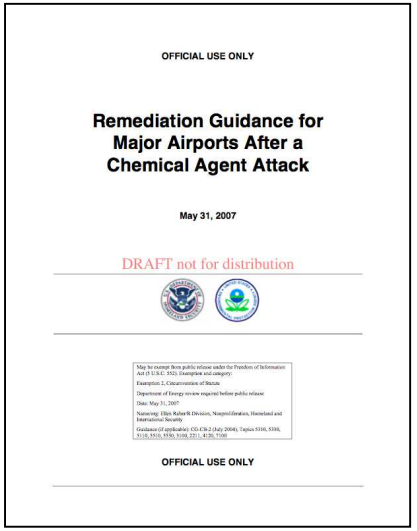
A primary consideration is to utilize many of the fundamental concepts, processes, technical developments, and key relationships established during the ***Biological Restoration DDAP***

Facility Restoration OTD
(CW agent release in an airport)



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The Facility Restoration OTD is utilizing experts from the National Laboratories and other federal agencies

Project Performers

Sandia National Laboratories - PI
Lawrence Livermore National Laboratory – PI
Pacific Northwest National Laboratory
Oak Ridge National Laboratory
Los Alamos National Laboratory

DHS Program Manager

Don Bansleben

External Advisory Panel

Nancy Adams, US EPA
Larry Kaelin, US EPA
Oba Vincent, US EPA
Joe Wood, US EPA

Partner Airport

Los Angeles International (LAX)

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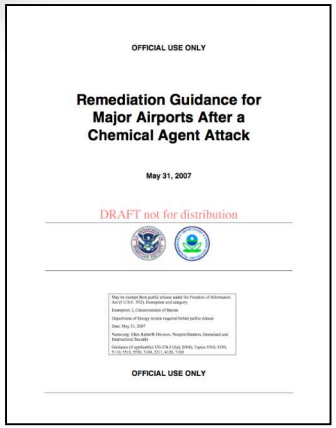
The Facility Restoration OTD is focusing on four tasks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Pre-Planning

Development of a site-specific remediation plan for LAX and a generic remediation plan 'template' for use by other facilities

Technology Development

Development of technologies for remediation including tools to collect, manage, visualize, and analyze the large amount of data generated during an event

Address Data/Capability Gaps

Focused efforts to fill critical data and capability gaps needed to effectively implement the remediation plan to minimize economic damage due to the closure of a facility.

Final Demonstration

Integrate appropriate technologies and methods into a system for chemical remediation of critical facilities. Demonstrate the operation and potential utility of this system.

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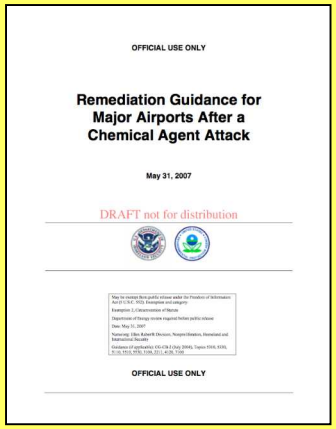
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Pre-planning restoration and recovery operations is essential

Pre-planning to enhance the rapid recovery of critical infrastructure

- Key issues can be addressed before an incident occurs
- Roles and responsibilities can be determined
- Technologies and capabilities can be identified
- Planning templates can speed the process and help all stakeholders better understand the issues
  - Identify necessary resources (personnel, equipment, and consumables)
  - Make key decisions (e.g., decon versus replacement)
  - Determine sampling protocols and methods

A primary deliverable from this project is a remediation plan for LAX and a generic remediation plan template for other facilities to follow

Draft of Remediation Plan completed and undergoing peer review

Draft completed in FY07, to be peer reviewed and revised in FY08

General Restoration Plan

1. Introduction
2. Characterization
3. Remediation
4. Clearance
5. Recommendations for pre-planning

Appendices

A. Notification Phase
B. First Responder Phase
C. Sampling Design
D. Collection and analysis of samples for chemical agents

Appendices (continued)

D. Annex. Review of available instruments
E. Statistical Sampling Approaches
F. Decon Technologies
G. Exposure Estimates
G1. Restoration Guidelines
H. Sample Unit Forms
I. Characterization Template
J. Remediation Action Plan Template
K. Clearance Sampling and Analysis Plan Template
L. Restoration Contact List
M. Waste Management

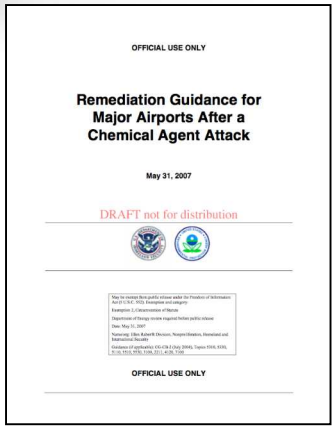
Draft to be completed in FY08

LAX Data Supplements

A. Facility Command Structure
B. Facility Description
C. Facility Ventilation
D. Sampling Units
E. Sampling Zones
F. Remediation Pre-planning

Peer review by USEPA, USDOD and other subject matter experts

The Facility Restoration OTD is focusing on four tasks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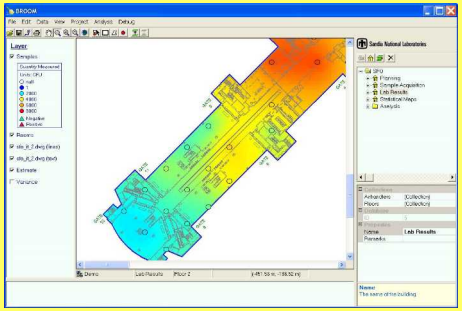

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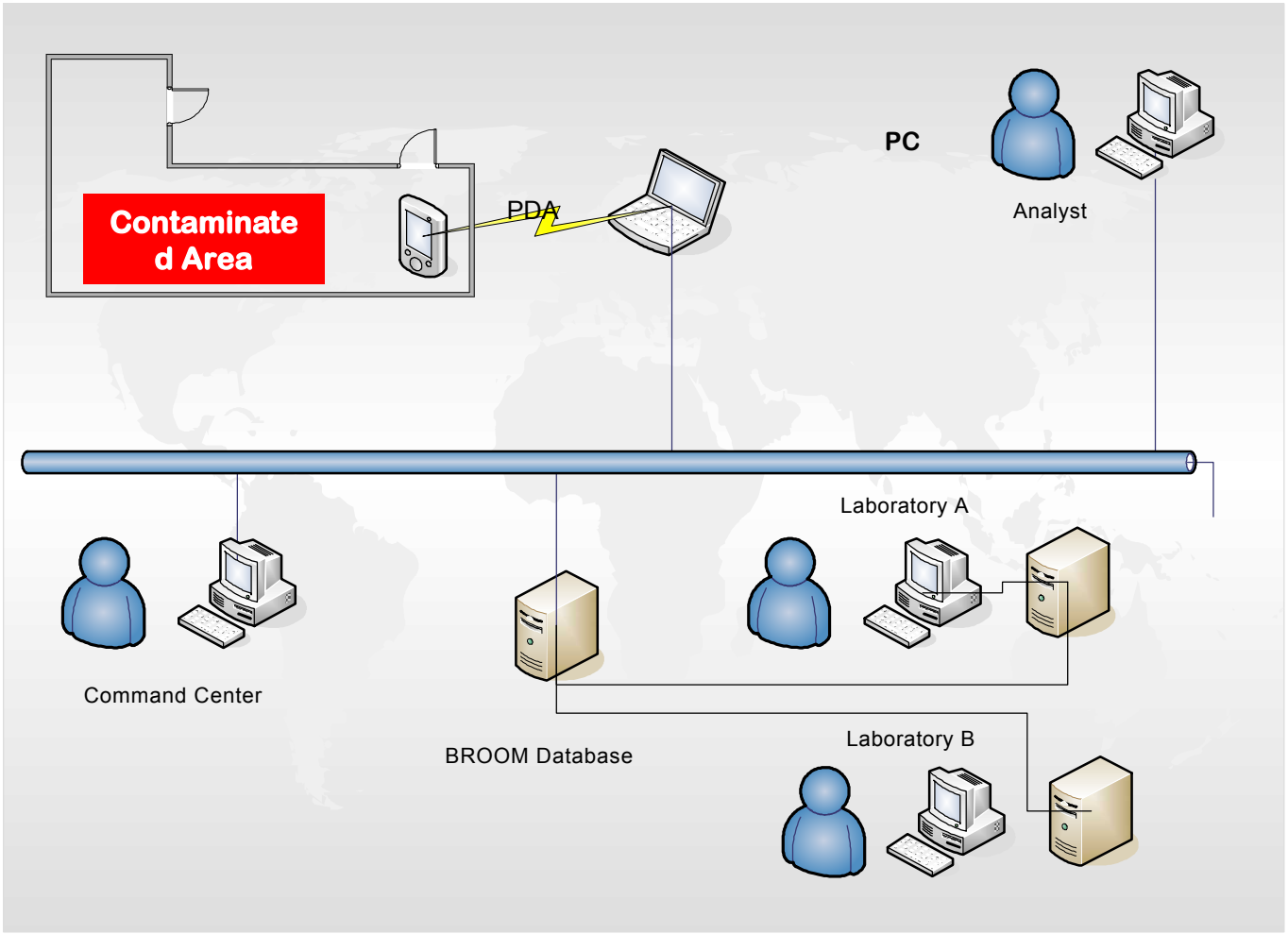
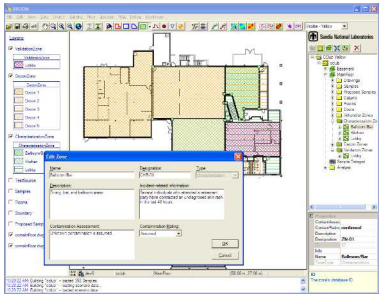
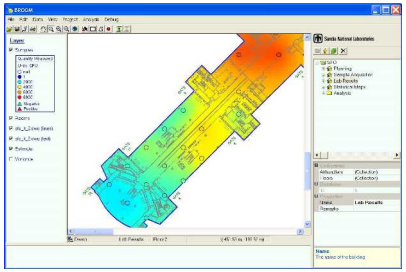
The project is adapting the BROOM decision support tool for chemical use

BROOM can be used for pre-event planning and post-event operations

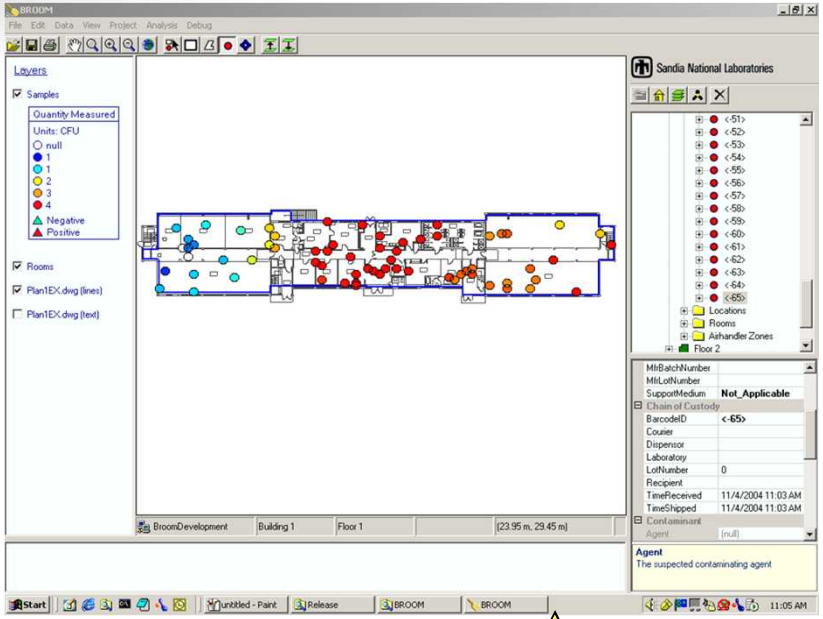






BROOM: Data collection, management, visualization, and analysis

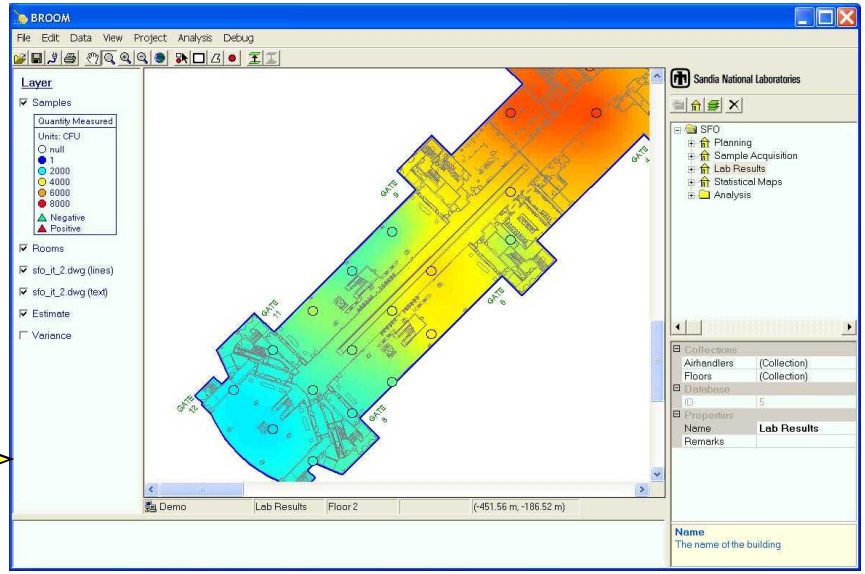
BROOM can collect, manage, visualize, and analyze the large amounts of data associated with a chemical agent release



- **Data Collection, Management, and Visualization**
  - Sample locations
  - Sample results
- **Data Analysis**
  - Map Contamination
  - Map Uncertainty
  - Optimize subsequent sampling to reduce uncertainty in magnitude and extent

Data Management and Visualization

Data Analysis



The OTD is also integrating BROOM with the Visual Sampling Plan (VSP) tool

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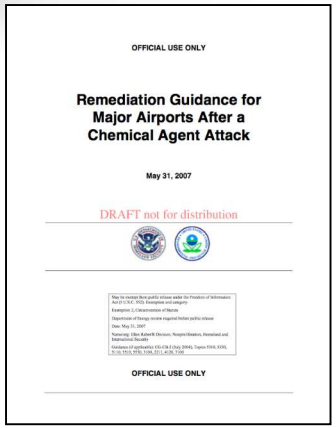
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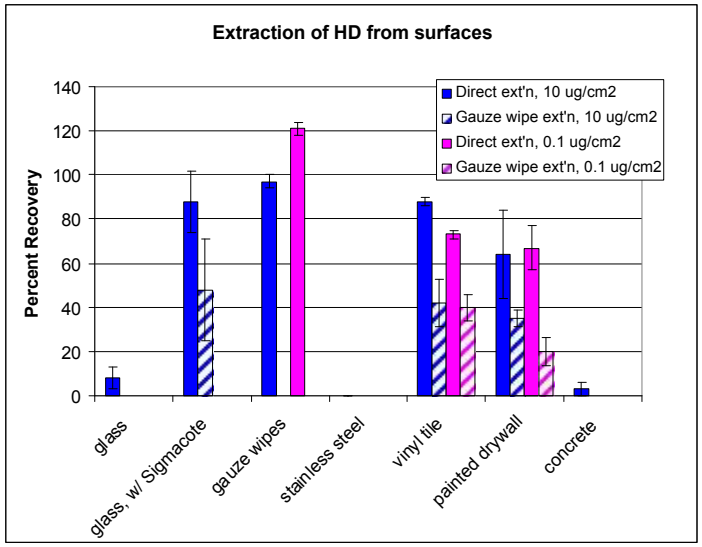
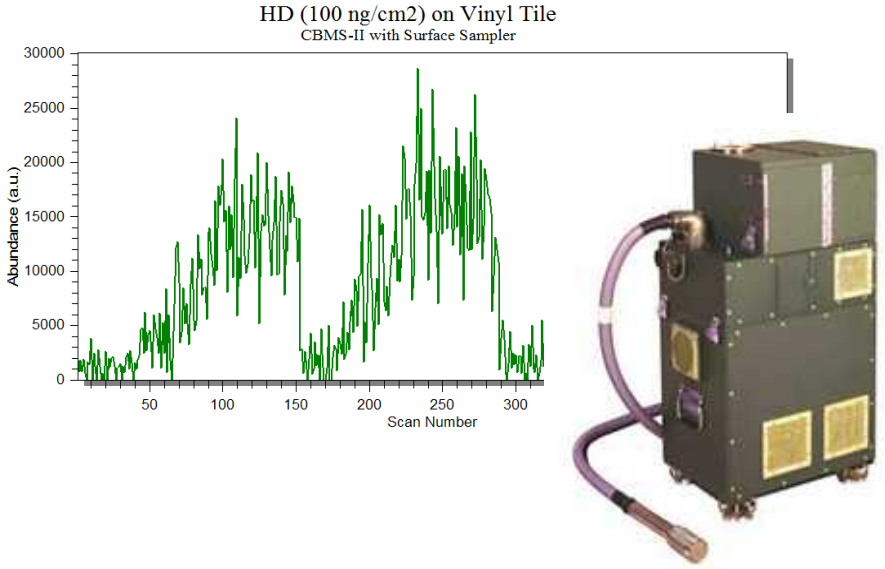
Integrate appropriate technologies and methods into a system for chemical remediation of critical facilities. Demonstrate the operation and potential utility of this system.

The Project is also addressing critical data and capability gaps

- Surface Sample Collection Efficiency and Detection Limits for CW Agents
  - Objective: To determine the collection efficiency and detection limits of the surface sampling methods on porous and non-porous surfaces that would be typically found in the interior of a transportation facility.
- Interaction of Chemical Agents on Interior Surfaces and Natural Attenuation/Decay Rates
  - Objective: To determine adsorption/desorption and decay rates for chemical agents on interior surfaces.
- Gas/Vapor Decontamination Method Scale-up Evaluation
  - Objective: To evaluate potential gas/vapor technologies that can be quickly implemented for use against the lower persistency agents.
- Statistical Sampling Algorithm Validation
  - Objective: To validate potential statistical sampling algorithms against data from actual release sites. In addition, we will integrate the validated methods into BROOM/VSP.

Demonstrate that existing technologies and methods can detect CWAs at concentrations protective of human health



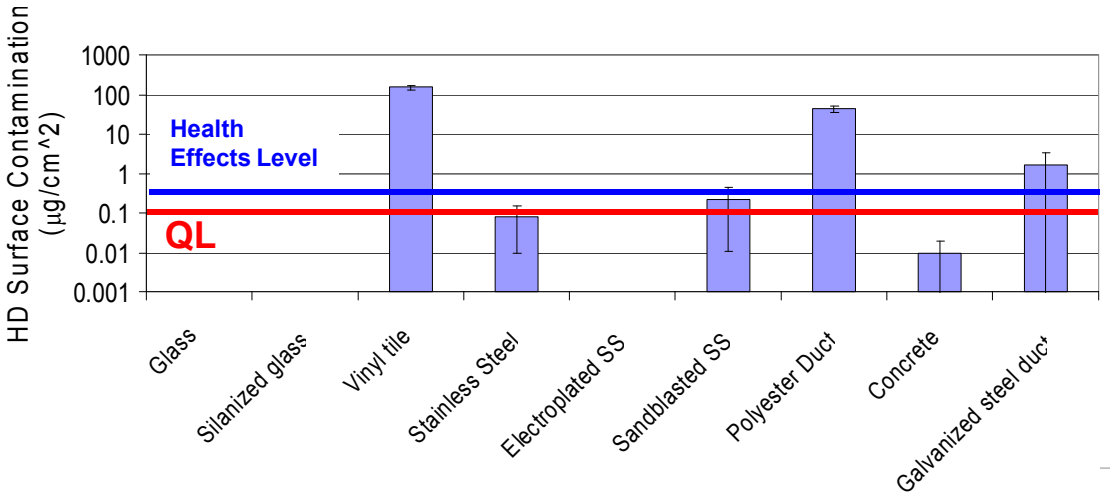


Conventional sampling and gas chromatographic/mass spectrometric analysis can easily detect CWA on surfaces at levels relevant to the protection of public health

Real-time mass spectrometric techniques, such as the CBMS II, show promise for rapid detection of CWAs at low concentrations

Interaction of Chemical Agents on Interior Surfaces

- **Need to understand adsorption, desorption, and natural decay on indoor materials at high vs. low concentrations**
  - **Dynamics, affinity, and reactivity control CWA persistence**
  - **Current knowledge primarily on vapor hazards**
- **Quantitative measurements needed to justify ventilation as a decon option for non-persistent and volatile agents.**
- **Live agent work at LLNL and simulant work at Sandia for protocol development and to group like materials into classes.**
  - **3 agents (HD, GB, VX)**
  - **8 surfaces (glass, stainless steel, vinyl floor tile, latex painted wallboard, concrete, escalator handrail, polyester flexible HVAC duct, galvanized steel HVAC duct)**



Decontamination of complex infrastructure will require a set of technologies

Gas, Vapor and Aerosol Technologies

Volumetric

Surface

Liquids, foams, and gels

Decontamination Technologies

Waste

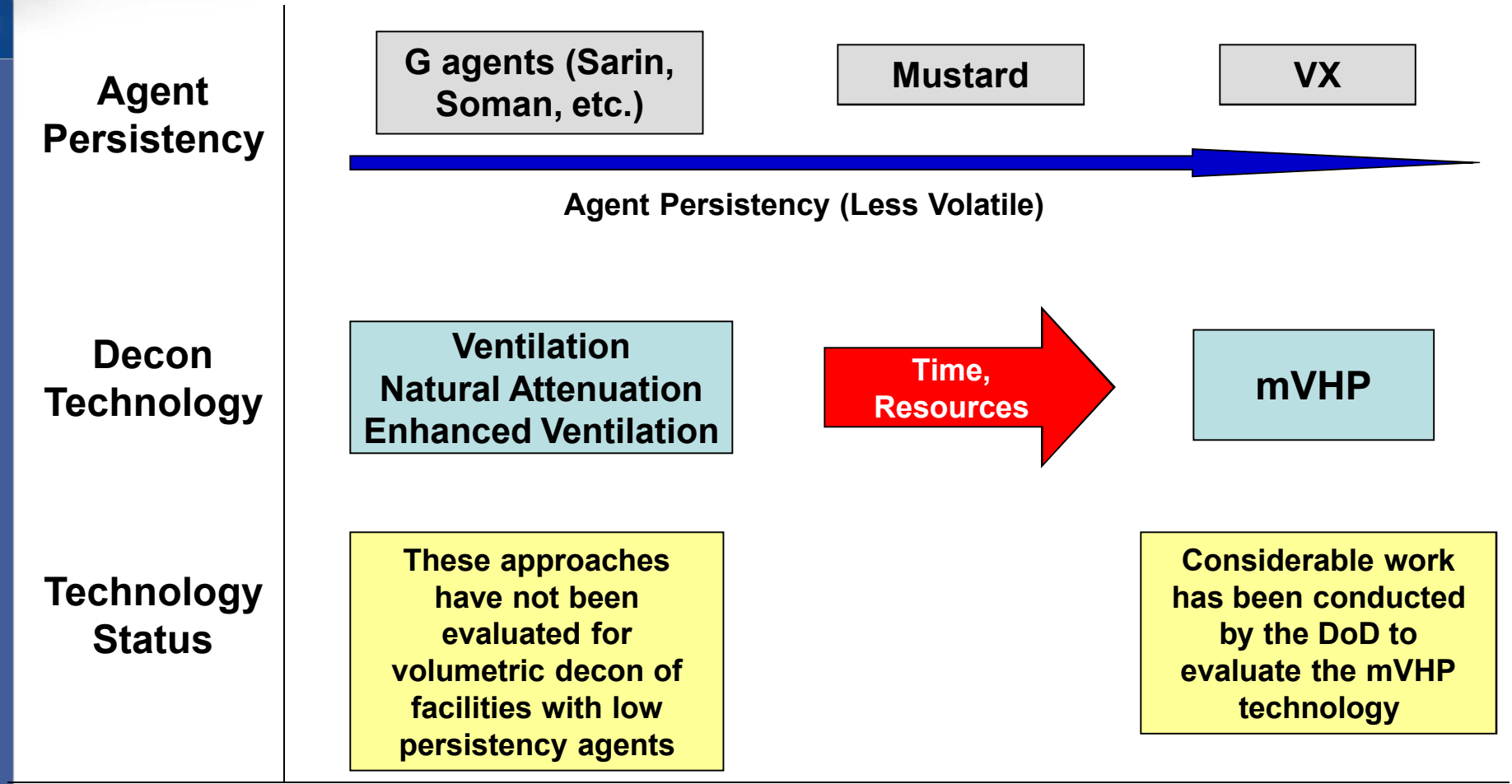
Liquids, foams, and gels

Sensitive Equipment

Gas, Vapor, Aerosol, and Solvent Extraction Technologies

Potential decontamination technologies exist for each of these areas

Volumetric decontamination technologies will be selected based on the persistency of the agent



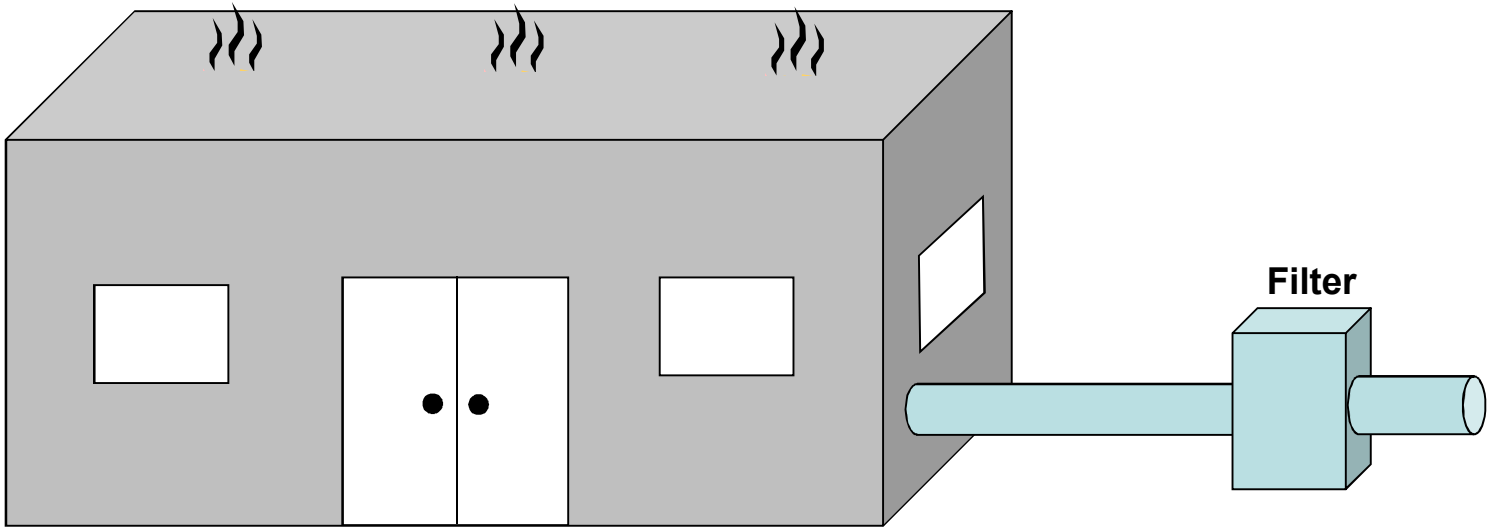
Objective: Reduce the time for decontamination and eliminate the need to use more time-consuming processes (i.e., mVHP)

The project is evaluating enhanced ventilation as a rapid method to remediate facilities contaminated with non-persistent agents

1. Use Hot Air Decontamination Evaluation Screening (HADES) tool to determine heating parameters

2. Heat interior of entire facility to desorb agents from surfaces

3. Filter and remove agent from air



To evaluate enhanced ventilation as a decon method, two issues are being investigated: (1) The temperatures and time required to desorb chemical agents from materials, and (2) The methods and processes required to heat a facility to the required temperature.

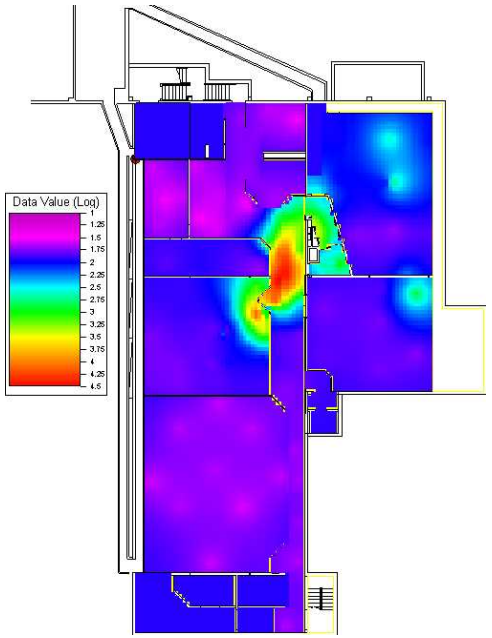
The project is also evaluating and validating statistical sampling approaches

Objectives:

- Validate potential statistical sampling algorithms against data from actual release sites
- Integrate the validated methods into VSP and BROOM

Progress to date:

- Quality Assurance guidelines developed for validation testing
- Three comprehensive baseline data sets have been developed for the validation testing
- Several traditional statistical methods (e.g., hot spot delineation) have been analyzed with a probabilistic methodology, with good success
- Geostatistical methods in the process of undergoing validation testing, with good preliminary results



This work is addressing the sampling validation issues raised by the GAO (2005)

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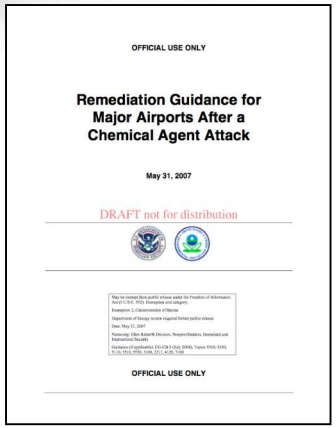
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Final Demonstration

Integrate appropriate technologies and methods into a system for chemical remediation of critical facilities. Demonstrate the operation and potential utility of this system.

The project will conclude with a final demonstration tentatively scheduled at an Ontario, CA airport terminal in FY09

The event will incorporate a variety of presentation formats including platform presentations, video presentations, panel discussions, and live demonstrations.

Presentation Outline

- Background and Project Overview
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We are developing a systems approach for chemical remediation and recovery

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The OTD is part of a larger strategy to enhance our ability to rapidly recover from the release of a chemical or biological agent in critical facilities or areas

2001

- No pre-planning for recovery
- Lack of knowledge in many areas of the recovery process
- Large capability gaps

Present

(DHS funded Restoration Demonstration Projects)

- Development of Site-specific recovery plans for SFO, LAX and template for other facilities
- Improved knowledge of the recovery process
- Specific capabilities (BROOM, sample collection efficiency, rapid viability analysis, decon)
- Workshops and exercises to transfer processes to other facilities

Future

- Remediation plans for other airports and facilities based on DHS templates
- Recovery process improvements and enabling technologies provided to other agencies
- **Other applications (additional contaminants, other types of facilities, wide area releases)**

Transition to other airports, facilities, and applications through a remediation plan template, demonstrations, exercises, and products.