Sandia National Laboratories

Lawrence Livermore National Laboratory

SAND2005-7635C

# Restoration of Major Transportation Facilities Following a Chemical or Biological Agent Release

*Presented by:*

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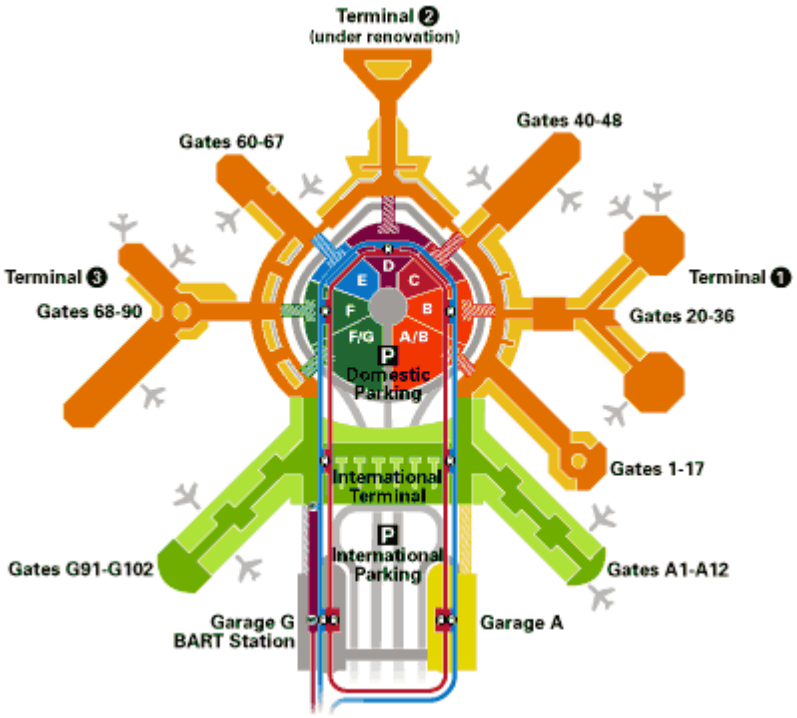
**Sandia National Laboratories**

**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 Objectives
- Project Plan
- Development Activities
- Chemical Restoration Operational Technology Demonstration (OTD)
- Path Forward

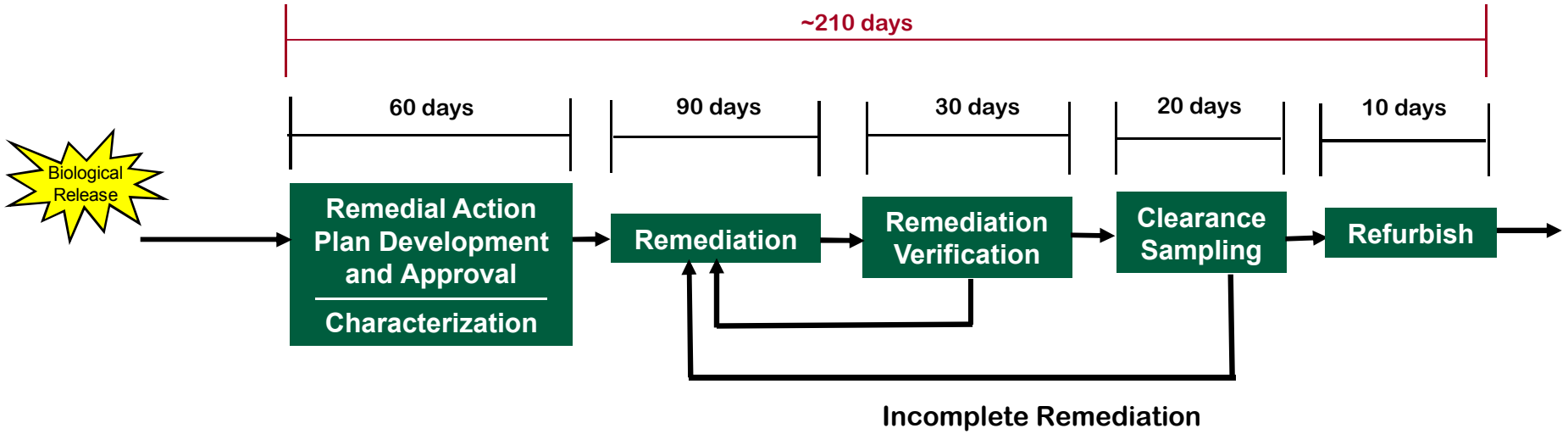


# A biological agent release in key transportation facilities could be devastating

- Severe economic impact if closed for even short periods
- Highly vulnerable to bio-terrorism
- Wide range of decon and restoration challenges
- The Restoration DDAP focuses on critical transportation nodes (airports)

**San Francisco International Airport (SFO) is a partner in this effort**

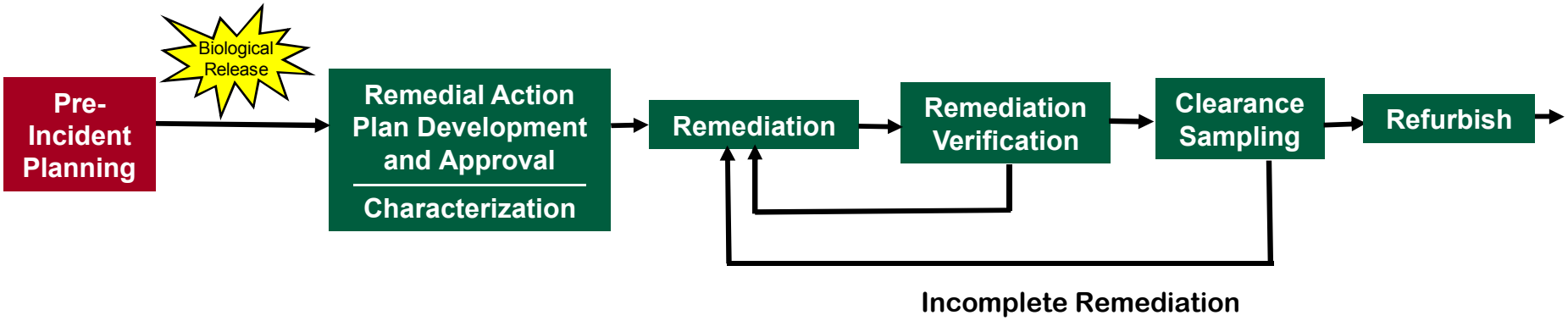
# Previous Restoration Activities




**The time of the overall restoration operation is governed by the length of the combined activities**

# Modified Restoration Activities

**Objective:** Advance the state-of-the-art in building restoration through the development and demonstration of efficient planning, remediation, sampling and analysis tools




**To reduce the time of the overall restoration operation, we are focusing on:**

- reducing the time of each activity
- pre-planning the restoration process

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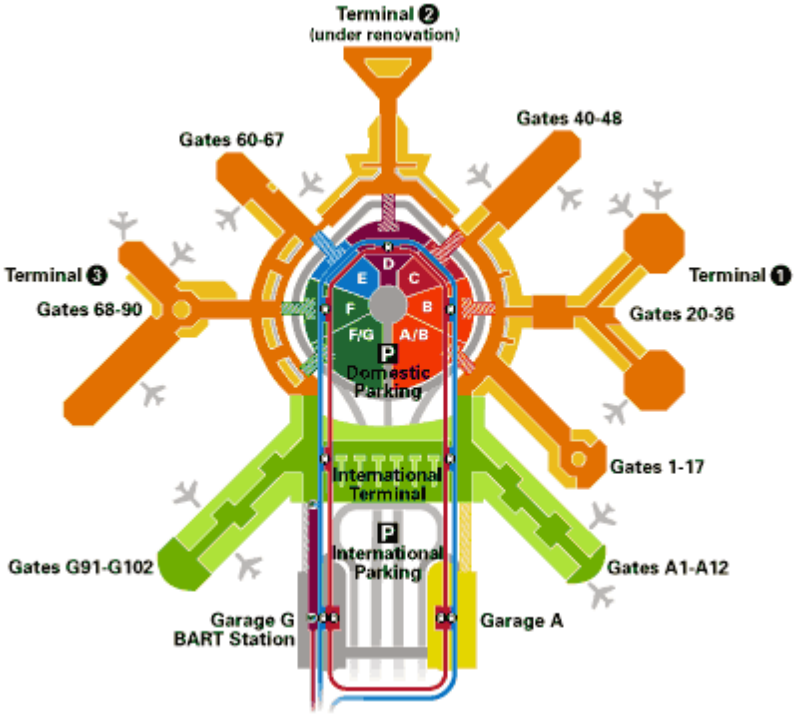
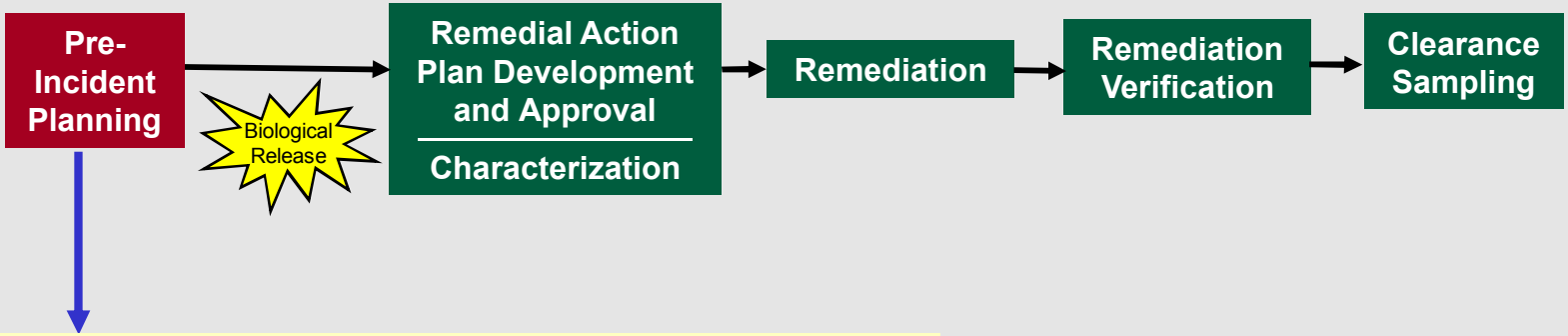


# The Restoration DDAP Deliverables are addressing all phases of a biological decontamination

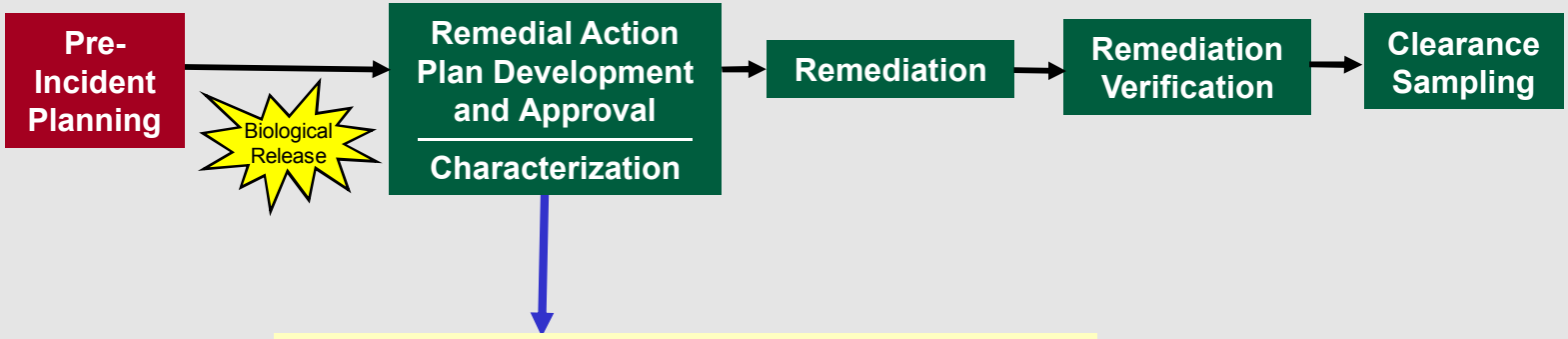



Key Deliverables

1. 'Pre-approved' Restoration Plan
   - Characterization plan,
   - Remedial action plan
   - Clearance plan

2. Software for planning data management and response operations (BROOM – Building Restoration Operations Optimization Model)

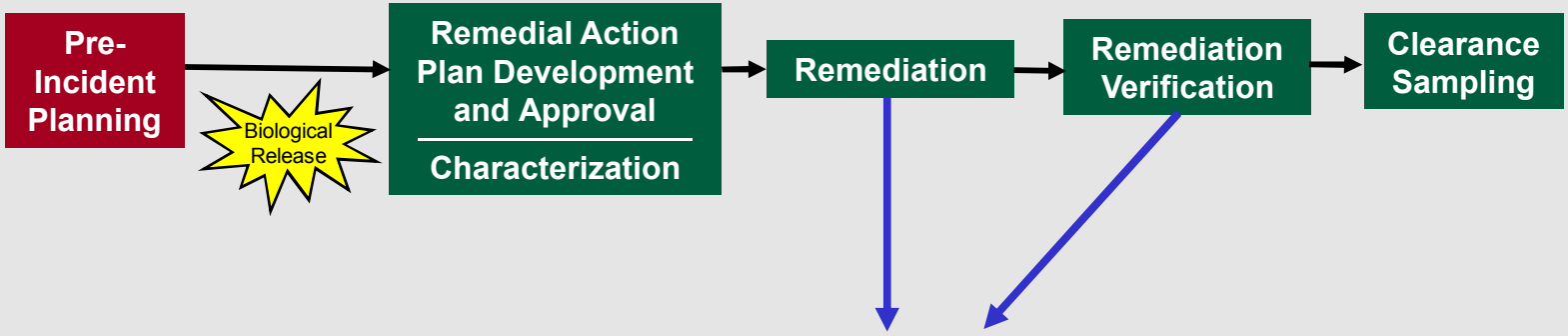
# The Restoration DDAP Deliverables are addressing all phases of a biological decontamination




**Key Deliverables**

1. Demonstrate application of Restoration Plan for specific scenario
2. Demonstrate improved characterization sample collection and analysis with software tools and guidance documents (BROOM)
3. Pre-planned characterization sampling plan

# The Restoration DDAP Deliverables are addressing all phases of a biological decontamination

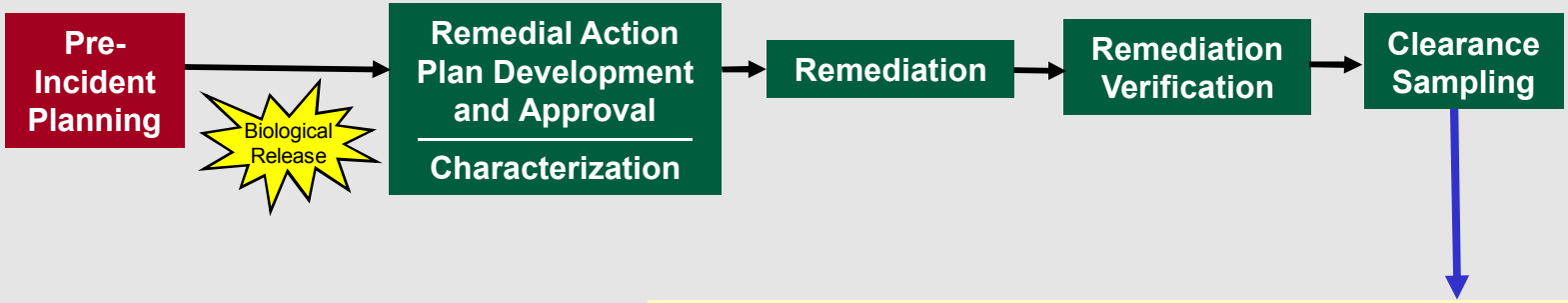



Key Deliverables

1. Demonstration of rapid, high-throughput verification methods
   - Sample placement, tracking (BROOM)
   - Sample processing

2. Tech transfer plan for high through-put techniques

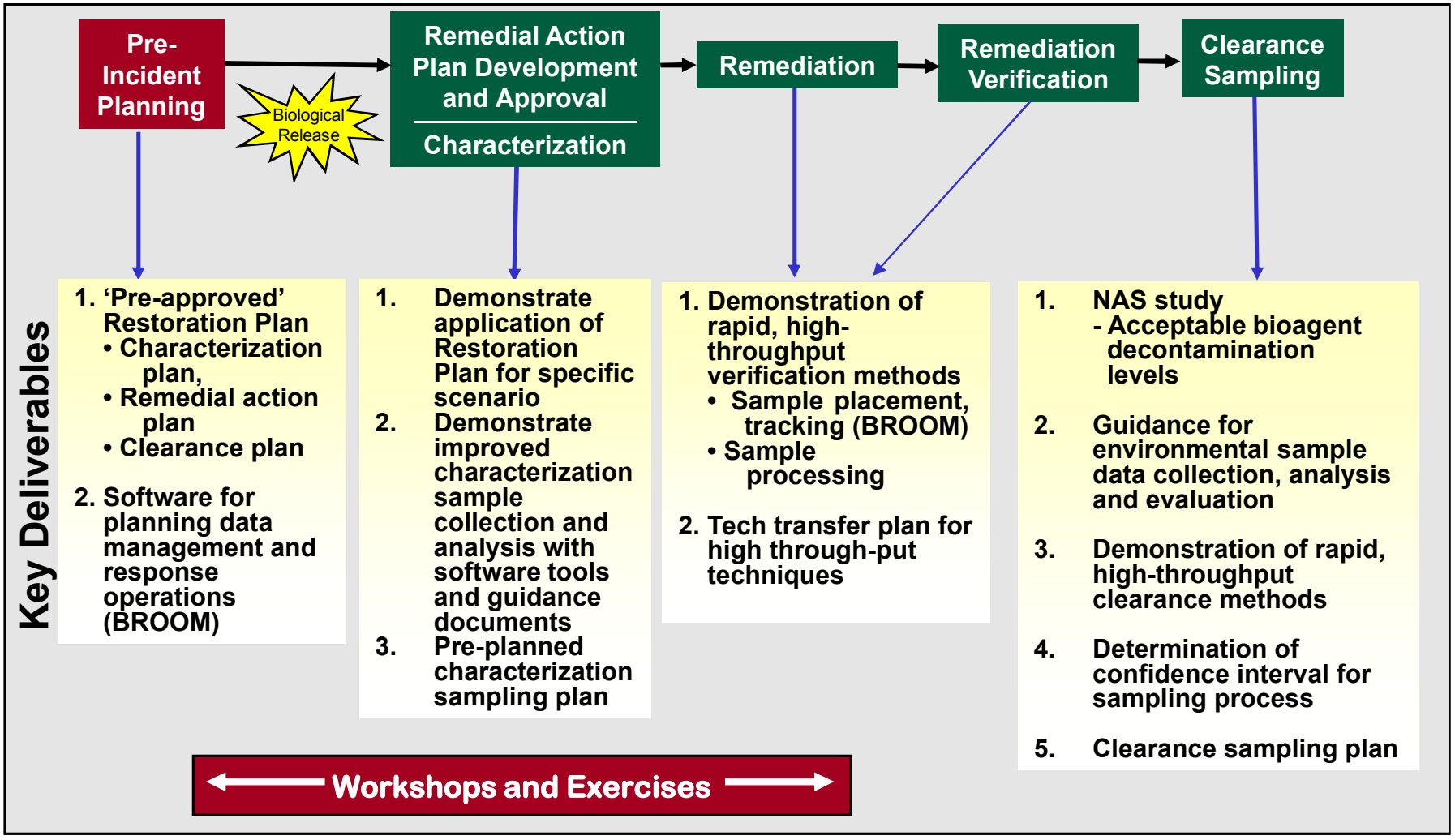
# The Restoration DDAP Deliverables are addressing all phases of a biological decontamination




Key Deliverables

1. NAS study
   - Acceptable bioagent decontamination levels
2. Guidance for environmental sample data collection, analysis and evaluation
3. Demonstration of rapid, high-throughput clearance methods
4. Determination of confidence interval for sampling process
5. Pre-planned Clearance sampling plan

# The Restoration DDAP Deliverables are addressing all phases of a biological decontamination




**Our goal is to compress the time necessary to restore airport operations**

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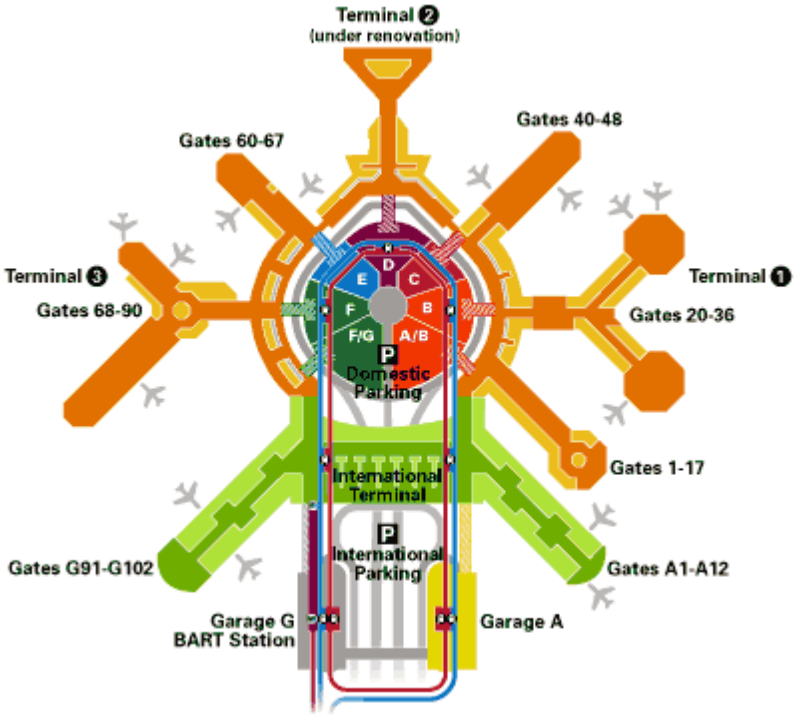
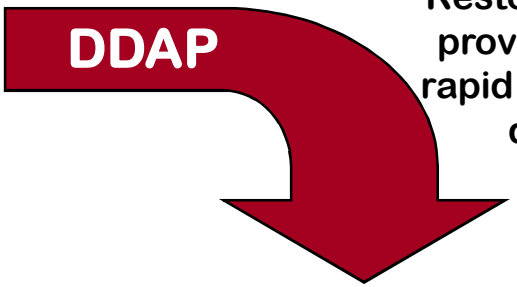


# One of the major delays in restoration projects has been the development/approval of remediation action plans

- An EPA "crisis exemption" is required to utilize fumigants for restoration
  - All phases of the operation are examined
  - Approval process can take months
- Key issues can be addressed before an incident occurs
- 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
  - Get "buy-in" from stakeholders




Restoration templates provide guidance for rapid remediation plan development

- Assembled a Restoration Plan Team
  - HVAC/facility engineers, Environmental Scientists, Microbiologists, Statisticians, Industrial Hygienists
- Identified Data Needs
- Identified Roles and Responsibilities
- Evaluated Contamination Scenarios
- Developed a Restoration Plan Template
- Plan is now being vetted by various federal agencies
- Developing a specific Restoration Plan for SFO

**A Restoration Plan must to able to handle multiple contamination scenarios**

# Restoration Plan Elements

## 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 and Analysis Methods
D. General Sampling Design
E. Probability-based Sampling Design
F. Decon Technology
G. Handling Decon Waste
H. Sample Unit Forms
I. Characterization Template
J. Remedial Action Plan Template
K. Clearance Plan Template

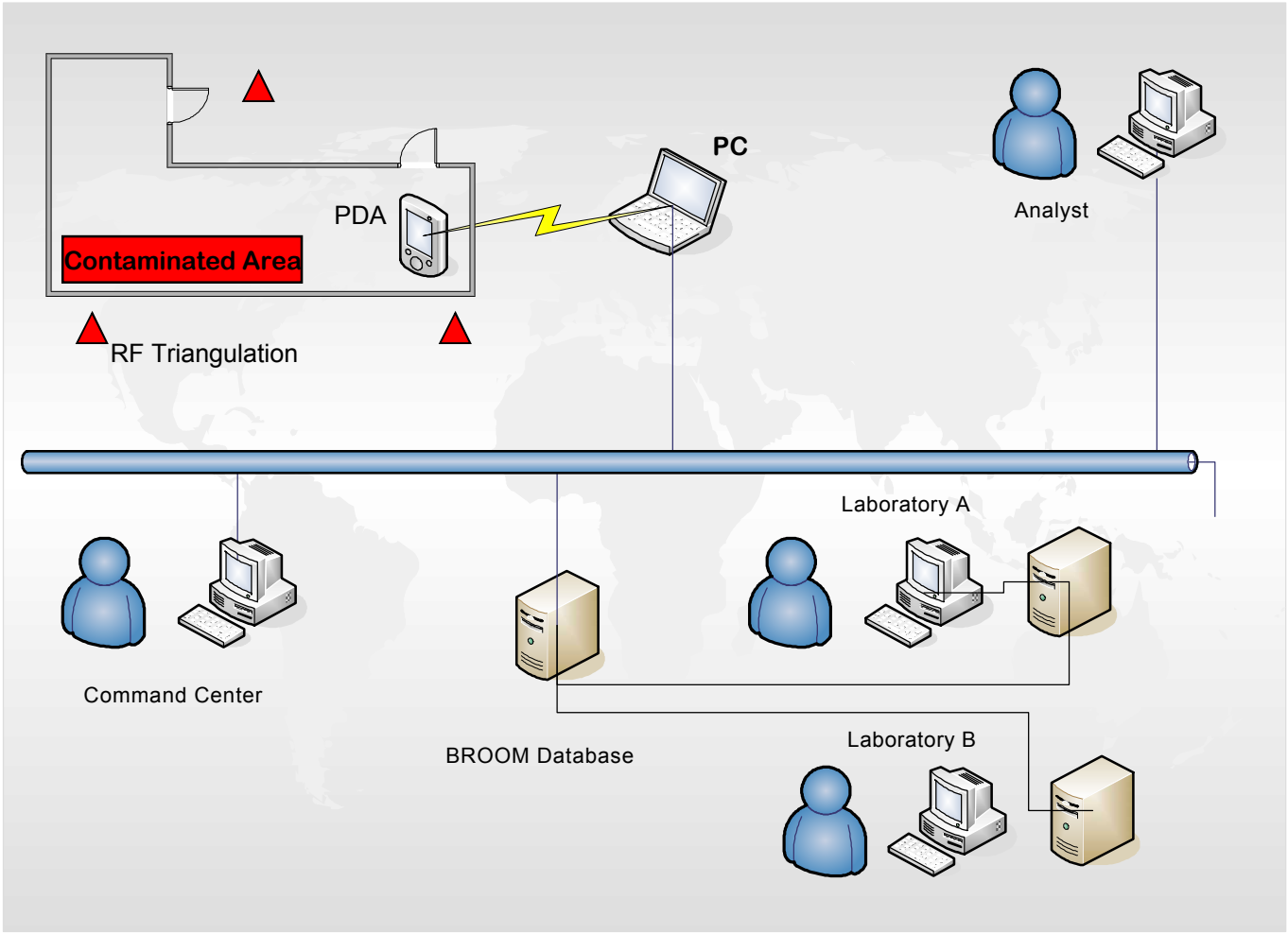
## Facility Specific Data Supplement

A. Facility Command Structure
B. Facility Description
C. Facility Ventilation
D. Facility Decon Capabilities

**The Planning Template is currently under peer review which will be followed by the development of a site-specific plan for SFO**

# Building Restoration Operations Optimization Model (BROOM)

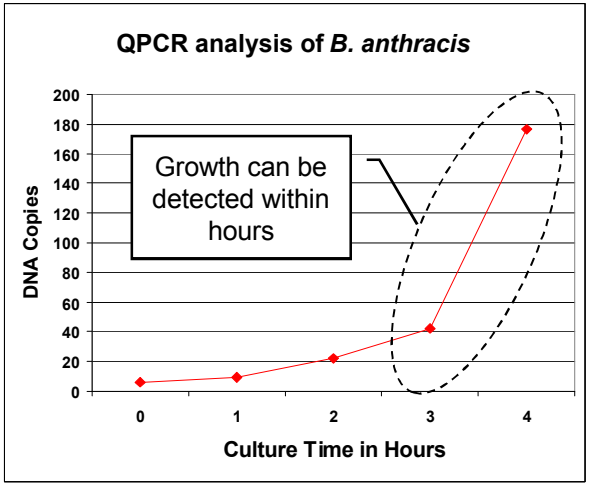
**BROOM can be used for pre-event planning and post-event operations**




**BROOM: Data collection, data management, and data analysis**

# The Rapid Viability Test Protocol (RVTP) reduces the "culture time" to less than a day

- The protocol is based on technology and assays that can be transferred LRN labs
- High-throughput technology allows processing of 1000's of samples per day
- Protocols developed for:
  - environmental samples (e.g., swipes, swabs, and aerosol filters)
  - biological indicators (BIs)




**Tests demonstrate RVTP capability to detect a few viable spores in background of many killed spores**

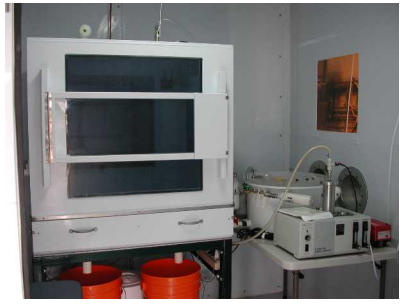
Kill biological indicator (BI) spiked with live spores

| Number of Spores | | RVTP | RVTP |
|---|---|---|---|
| Killed | Live | positive at 14 hr | Percent at 14 hr |
| 10^6 | 0 | 0/78 | 0 |
| 10^6 | 10 | 100/100 | 100 |
| 0 | 10 | 50/50 | 100 |
| 10^6 | 100 | 100/100 | 100 |
| 0 | 100 | 50/50 | 100 |

**RVTP gave results at 14 hr (specific to target organism) that required 48 hr of culturing (non-specific detection)**

# Evaluation of Surface Sample Collection Methods for *Bacillus* Spores

- Surface sample collection methods
  - Swab, wet, synthetic
  - Wipe, wet, synthetic
  - Vacuum, HEPA filter sock, synthetic
- Surfaces
  - 2 Non-porous (stainless steel and painted wallboard)
  - 2 Porous (carpet and bare concrete)
- Unique experimental method
  - Dry deposition surface seeding
  - Co-located reference coupons (99.97% recovery of spores)
  - 1 $m^3$ chamber
- Sonication extraction method
- Culture based analysis
- Statistically valid sample size
  - 24 samples / surface loading
  - 3 surface loadings / surface (1 log, 2 log, and 4 log per sq cm)



| Collection Method | Surface | Mean Recovery Efficiency (n=24) | Median Recovery Efficiency (n=24) |
|---|---|---|---|
| Swab | Stainless Steel | 0.461 ±0.154 | 0.455 |
| | Painted Wallboard | 0.483 ±0.224 | 0.442 |
| Wipe | Stainless Steel | 0.590 ±0.173 | 0.573 |
| | Painted Wallboard | 0.460 ±0.291 | 0.377 |
| Vacuum | Stainless Steel | 0.174 ±0.138 | 0.118 |
| | Painted Wallboard | 0.268 ±0.030 | 0.022 |
| | Carpet | 0.253 ±0.068 | 0.248 |
| | Bare Concrete | 0.181 ±0.072 | 0.173 |

$$\eta_r = \eta_c \times \eta_e$$

# Workshops and Tabletop Exercises

**Restoration operations will involve a wide range of stakeholders:**

- Facility owners/operators
- Federal, state and local agencies
  - CDC/NIOSH
  - US EPA
  - Department of Homeland Security (including TSA)
  - State EPA
  - Law enforcement (federal and local)
  - Department of Transportation
  - Loca[illegible]ies

**A series of workshops/tabletop exercises have been developed to engage these stakeholders and to better understand the restoration process**

- Initial Workshop (LLNL – 9/03)
  - Involved key personnel at operational and/or decision-making level
  - Based on a draft SFO Restoration Plan
  - Identified critical gaps and issues
- Tabletop Exercise (SFO – 4/04)
  - Scenario driven
  - Formation of Unified Command, Technical Working Group, and Clearance Committee to work through entire restoration process
- Airport Preparedness Workshop (San Ramon – 6/05)
  - Focused on Planning for response and recovery
  - Involved SFA, LAX, and SEA with a large number of stakeholders
- Final Demonstration (SFO – 1/06)

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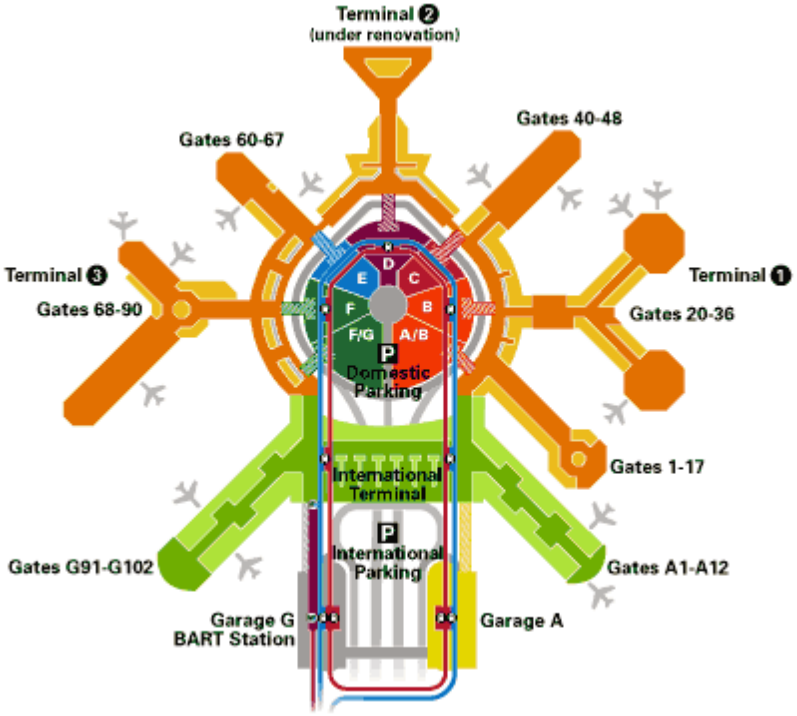

# Chemical Restoration OTD

- This DHS-funded project focuses on restoration of a major airport following a chemical agent release
- The focus is on major airports but the same concepts can be utilized for other type of facilities (indoor stadium, subway systems, high valued facilities, etc.)
- Many of the concepts will be similar to the Biological Restoration DDAP, except..
  - **Agent decay**
  - **Surface interactions**
  - **More rapid sampling and analysis techniques**
  - **Multiple decon formulations**
  - **Long term monitoring may be required**

**We are collaborating with the Los Angeles International Airport (LAX) for this project.**

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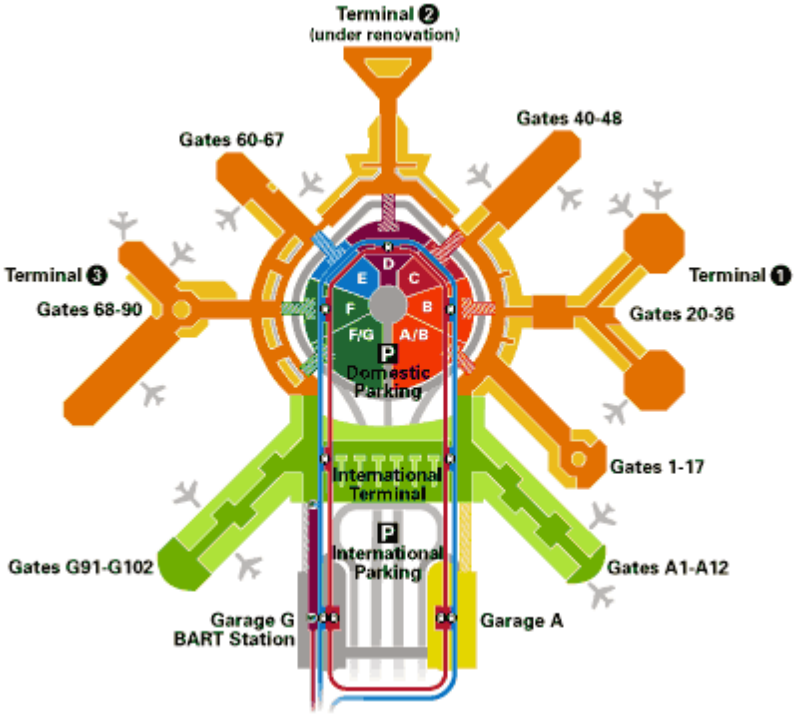
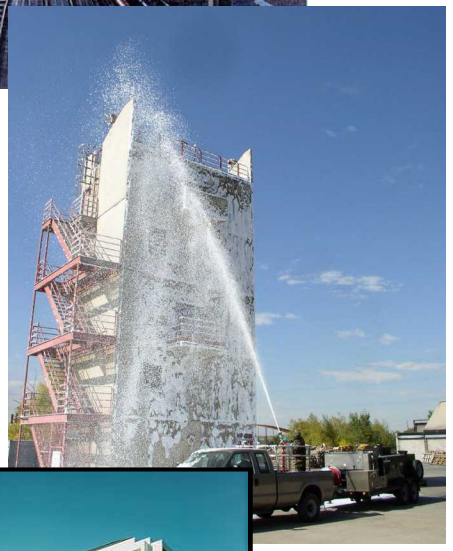


# We have focused on the development of a process that can also be applied to…

- Other transportations nodes and facilities
  - Other airports
  - Subway systems, train stations, etc.
  - National monuments, office buildings, etc.
  - Military bases
- Other types of agents
  - Other bio agents (i.e., plague, smallpox)
  - Release of a chemical agent
  - Release of a toxic industrial chemical
- Other terrorist and natural events
  - Wide area bio agent release
  - Natural disasters
  - Naturally occurring disease outbreaks



# Project Team

## LLNL

- Ellen Raber – LLNL Lead
- Tina Carlsen – Restoration Plan
- Lindee Berg – Restoration Plan
- Sav Mancieri – Tabletop Exercises
- Paula Krauter – Demonstration
- Staci Kane – Rapid Viability
- Don McQueen – Statistical Methods

## SNL

- Mark Tucker – SNL Lead
- Jim Ramsey – BROOM
- Richard Griffith – BROOM
- Brad Melton – BROOM
- Pat Finley - BROOM
- Sean McKenna – Statistical Methods
- Gary Brown – Sampling and Rapid Viability
- Caroline Souza – Sampling and Rapid Viability
- Wayne Einfeld – Demonstration
- Pauline Ho - Demonstration

**DHS Program Managers: Kimothy Smith and Dawn Myscofski**