SAND2015-3047C

RESTORe: A Software Tool for Estimating and Optimizing Time, Resources, and Cost for Site-Specific Remediation and Recovery Following a CBW Agent Release

Sandia National Laboratories, Albuquerque, NM USA
Mark D. Tucker, Ph.D., P.E.

Problem:

The remediation of a facility following the release of a chemical or biological agent is a complex process…

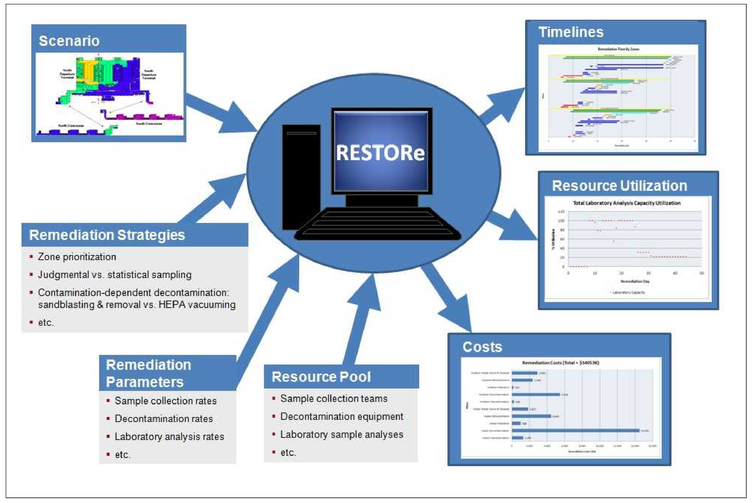
Photo courtesy of US EPA

Critical infrastructure are typically very complex facilities and offer many remediation challenges.

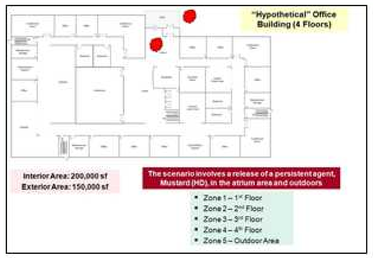
Complex deployment system for chlorine dioxide gas inside of a contaminated facility following the 2001 anthrax attacks.

Due to this complexity, planning for remediation will be difficult and must include both technical and project management issues.

Methodology:



Scenario:



Floor plan for a hypothetical office building.

Scenario information and a remediation strategy was entered into RESTORe.

Building Characteristics

Zone	Volume (cf)	Floor/Ground (sf)	Vertical (sf)	Ceiling/Roof (sf)
1	600,000	50,000	30,000	50,000
2	600,000	50,000	30,000	50,000
3	600,000	50,000	30,000	50,000
4	600,000	50,000	30,000	50,000
5	-	150,000	53,000	-

Zone	Floor/Ground	Walls	Ceiling
1	Tile, Carpet	Wallboard, Glass	Ceiling Tile
2	Tile, Carpet	Wallboard, Glass	Ceiling Tile
3	Tile, Carpet	Wallboard, Glass	Ceiling Tile
4	Tile, Carpet	Wallboard, Glass	Ceiling Tile
5	Asphalt, Soil	Concrete, Glass	-

Remediation Strategy

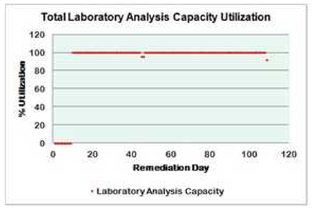
- Remediation begins on Day 6 (after First Response and a Forensics Investigation)
- Conduct hot-spot decon of surfaces in release area as rapidly as possible
- Conduct gas phase decon in all interior areas
- Waste decon off of the critical path
- Priority of Zones
  - 1st Floor (Priority 1)
  - 2nd Floor (Priority 2)
  - 3rd Floor (Priority 2)
  - 4th Floor (Priority 2)
  - Exterior (Priority 1)

Impact:

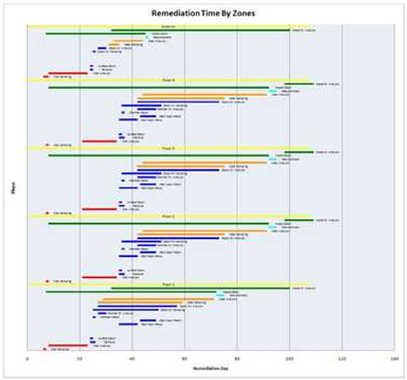
A key Homeland Security need is to develop the capability to rapidly recover from an attack utilizing chemical or biological warfare agents. This tool provides the capability to rapidly assess various remediation strategies to determine the time and cost for recovery as well as resource requirements. This will enable more-informed decision-making for decontamination of critical infrastructure facilities in order to return them to normal operations as quickly as possible which will minimize economic damage.

Remediation of complex scenarios (i.e., subway systems and major airports) have also been modeled with RESTORe – including the impact of composite sampling.

Results:



Outputs from RESTORe include time and cost estimates as well as resource allocation plots.



Comparison of the baseline and alternative remediation strategies demonstrates the impact of additional laboratory analysis capability.

Zone	Baseline (Completion Day)	Alternative (Completion Day)
Zone 1 (1st Floor)	Day 75	Day 48
Zone 2 (2nd Floor)	Day 95	Day 53
Zone 3 (3rd Floor)	Day 95	Day 53
Zone 4 (4th Floor)	Day 95	Day 53
Zone 5 (Exterior)	Day 46	Day 30
Reduction (days)	-	- 42 days
Reduction (%)	-	- 48%

Many strategies can be evaluated including technology insertions (e.g., real-time sampling & and analysis), resource insertions (e.g., more sampling teams), and changing priorities of zones and processes.

Analysis:

RESTORe was used to analyze both a baseline and alternative remediation strategy.

Baseline Strategy

Lab capacity: analysis of 500 samples per week (GC/MS)

Alternative Strategy

Decision: Should a mobile laboratory be deployed?

Additional lab capacity: 700 samples per week (GC/MS)

Capability Insertion:

HOMELAND SECURITY

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