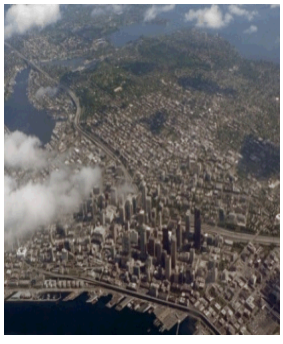
Decontamination Strategy and Technology Selection Tool (DeconST)

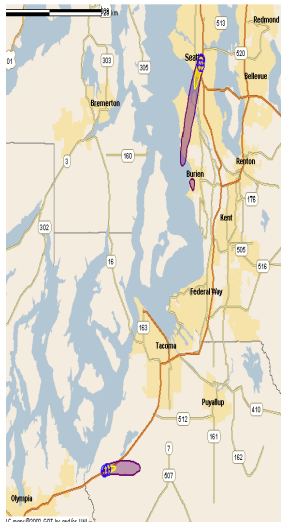
SAND2014-3042P

A flexible, data-rich decision-support tool addressing the complex, multifaceted problem of decontamination technology selection for a specific facility contaminated with *Bacillus anthracis*

SCENARIO:

- Wide-area aerosol release of weaponized *Bacillus anthracis* spores in an urban area (civilian and military targets)
- Resulting contaminated area includes a large, diverse environment with hundreds of facilities requiring decontamination
- Decontamination resources (technologies, equipment and operators) are limited





TOOL OBJECTIVE:
The DeconST summarizes the pertinent information, automating the process of decontamination technology comparison and providing the capability to perform trade-off, cost-benefit analyses

DeconST presents options that provide justification for recommendations, with color-coded estimates of likelihood of success of decontamination, cost implications, and waste estimates.

User Input | Material Inputs | Full Results Summary | Cost Plot | Waste Generation | % Material Decontaminated

DeconST Portlet

Units: ○ U.S. ◉ SI

Facility Information

Name: Walled Office
Type: Walled Office
Size (qualitative): Small
Number of Occupants: 73
Ceiling height (m): 3.0
Floor area (sq. m): 1865.0 ☐ Edit directly
Volume (cu. m): 5595.0

HVAC Information

System type: Unducted

Agent Information

Agent type: Bacillus anthracis

Weather Considerations

Humidity Profile: Relative humidity (%)
HIGH: 50
LOW: 20
Temperature Profile: Temperature (°C)
HIGH: 29.4
LOW: 10.0

Cost-Scaling Factors

Labor & Materials Scaling Factor: 1 (cost multiplier)
Waste-Handling Difficulty: Low

Submit

Inputs include facility, HVAC, agent, weather, and cost-scaling information

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Material Inputs

Facility Materials (default values populated from I-WASTE Tool)	Area* Feet2	Area* Percent	Quantity* Tons	Quantity* Yards3	Material Action: Keep in Place Untreated	Remove for Alternate Decon (e.g., high-value item)	Remove for Waste Treatment & Disposal	Treat in Place
Exterior Structural Materials			1042.3	377.5				
Brick			93.3	57.3				
Concrete			728.1	210.9				
Steel			80.9	23.4				
Wood			116.7	71.6				
Other			23.3	14.3				
Interior/Non-Structural Materials			809.0	234.3				
Total Non-Structural Building Materials								
Floors	20075		6.3	45.7				
Carpet	18032	90%	4.8	41.7				
Marble and Ceramic Tiles	0	0%	0.0	0.0				
Wood Flooring	0	0%	0.0	0.0				
Other Floor Materials	2043	10%	1.5	4.0				
Walls	44962		30.1	86.7				
Curtains and Acoustical Material	0	0%	0.0	0.0				
Drywall	44962	100%	30.1	86.7				
Wood	0	0%	0.0	0.0				
Other Wall Materials								
Ceilings	40265		7.2	77.7				
Ceiling Tiles	40265	100%	7.2	77.7				
Other Ceiling Materials	0	0%						
Other Non-Structural Building Materials			5.9	97.2				
Art and Music Equipment			0.0	0.0				
Bathroom and Kitchen Materials			0.0	0.0				
Dishware			0.0	0.0				
Electronic Equipment			7.3	56.1				
Food			0.0	0.0				
			50.8	526.6				
		30%	15.2	158.6				
		70%	35.6	370.0				
			0.0	0.0				
			0.0	0.0				
			0.0	0.0				
			0.0	0.0				
			41.2	126.4				
			0.0	0.0				
			0.0	0.0				
			0.0	0.0				

Baseline materials quantities are derived from EPA's waste estimator tool

User Input | Material In

Full Results Summary

RESULTS SUMMARY (least desirable → most desirable)

Note: The numbers shown are for comparison purposes only. The values should be considered order-of-magnitude estimates, rather than accurate predictions due to multiple uncertainties.
Note: Rounding of numbers can cause totals to not equal the sum of the component parts.

	Volumetric Decontamination (HVAC is decontaminated as part of volumetric decontamination)			Surface Decontamination (Unducted HVAC can be decontaminated as part of the facility decontamination process)								Demolition	
	Chlorine Dioxide Gas	Methyl Bromide	Vaporous Hydrogen Peroxide®	Chlorine Dioxide Liquid	Aqueous Chlorine Dioxide	Bleach Immersion	Bleach Spray	Bleach Wash	Hydrogen Peroxide PAA, Oxonia Active	Hydrogen Peroxide PAA, Minncare	Hydrogen Peroxide PAA, Spor-klenz RTU	Hydrogen Peroxide PAA, Pericox RTU	Demolition w/ Rebuilding	Demolition w/o Rebuilding
	3000 ppmv, 3 hrs, >75% RH, >75 deg F	211 mg/l, 37 degrees C, 75% RH, 18 hour contact time	225 ppmv, 4 hrs		1000 ppm, 1 hr contact time, 3 spray applications	Bleach: Dilute to 0.6% NaOCl by weight. Add acetic acid to pH (6.8). Immersion 30-min. STE neutralized then extracted	Bleach: Dilute to 0.6% NaOCl by weight. Add acetic acid to pH (6.8). Spray 30-min contact. STS contact. Rinse with H2O. STS neutralized at end of contact time. Rinsate had neutralized at end of contact time.	Dilute to 6.0% NaOCl by weight. Add acetic acid to pH (6.8). Spray 10-min contact. Rinse with H2O. STS neutralized at end of contact time. Rinsate had significant level of spores that must be treated.	27.0% H2O2, 5.8% PAA	22% H2O2, 4.5% PAA	1% H2O2, 0.08% PAA, ~10% AA	4% H2O2, 0.32% PAA		
% of Exterior Structural Materials Decontaminated	100%	100%	10%	10%	10%	100%	90%	100%	20%	20%	30%	20%	n/a	n/a
% decontaminated and reusable	90%	100%	10%	0%	0%	90%	80%	90%	0%	0%	10%	0%	n/a	n/a
% decontaminated and destroyed (treated waste)	10%	0%	0%	10%	10%	10%	10%	10%	20%	20%	20%	20%	n/a	n/a
% of Interior Materials Decontaminated	90%	90%	10%	0%	0%	90%	90%	90%	100%	100%	100%	100%	n/a	n/a
% decontaminated and reusable	80%	90%	10%	0%	0%	0%	0%	0%	0%	0%	0%	0%	n/a	n/a
% decontaminated and destroyed (treated waste)	10%	0%	0%	0%	0%	90%	90%	90%	100%	100%	100%	100%	n/a	n/a
% of Contents Decontaminated	60%	60%	60%	40%	40%	40%	40%	60%	60%	40%	40%	40%	n/a	n/a
% decontaminated and reusable	40%	60%	60%	40%	40%	40%	40%	40%	40%	40%	40%	40%	n/a	n/a
% decontaminated and destroyed (treated waste)	20%	0%	10%	10%	10%	10%	10%	20%	20%	10%	10%	10%	n/a	n/a
Total Cost, $M	$2.2	$1.2	$3.0	$4.5	$4.5	$2.8	$3.0	$2.8	$4.5	$4.5	$4.5	$4.5	$3.5	$2.3
Decon Process Cost, $M	$0.8	$0.9	$0.7	$1.1	$1.1	$1.1	$1.1	$1.1	$1.1	$1.1	$1.1	$1.1	$0.2	$0.2
Waste Management Cost, $M	$1.4	$0.3	$2.3	$3.3	$3.4	$1.7	$1.9	$1.7	$3.3	$3.3	$3.0	$3.3	$3.3	$2.1
Material Removal/Replacement Time	21300	15800	55100	59800	59800	26400	51300	25700	57300	58000	53900	58000	68900	40800
Removal Time (person hours)	15300	10300	27500	31700	31700	16200	25500	15500	29200	29900	27200	29900	40800	40800
Replacement Time (person hours)	6000	5500	27600	28100	28100	10220	25700	10200	28100	28100	25700	28100	28100	0
Total Waste Generated (tons)	200	100	1100	1200	1200	200	300	200	1200	1200	1100	1200	1200	1200
Removed for Waste Treatment & Disposal (Materials & contents removed as waste prior to decontamination)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Treated Waste (Materials & contents decontaminated, but damaged by technology)	100	0	0	100	100	100	100	100	300	300	300	300	0	0
Potentially Contaminated Waste (Materials & contents for which decontamination technology fails)	100	100	1000	1100	1000	100	200	100	900	900	800	900	1200	1200

Output compares the relative costs, efficacy and associated destructiveness and waste generated by each of the candidate decontamination technologies

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Project Sponsor: U. S. Department of Defense Threat Reduction Agency & The Department of Homeland Security

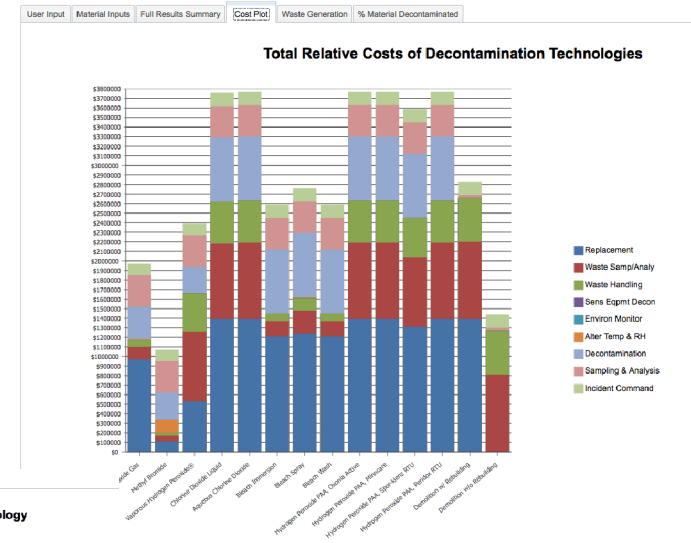
The decontamination strategy and technology selection tool (DeconST) supports decision-making to select decontamination options for specific contaminated buildings following a biological contamination incident.

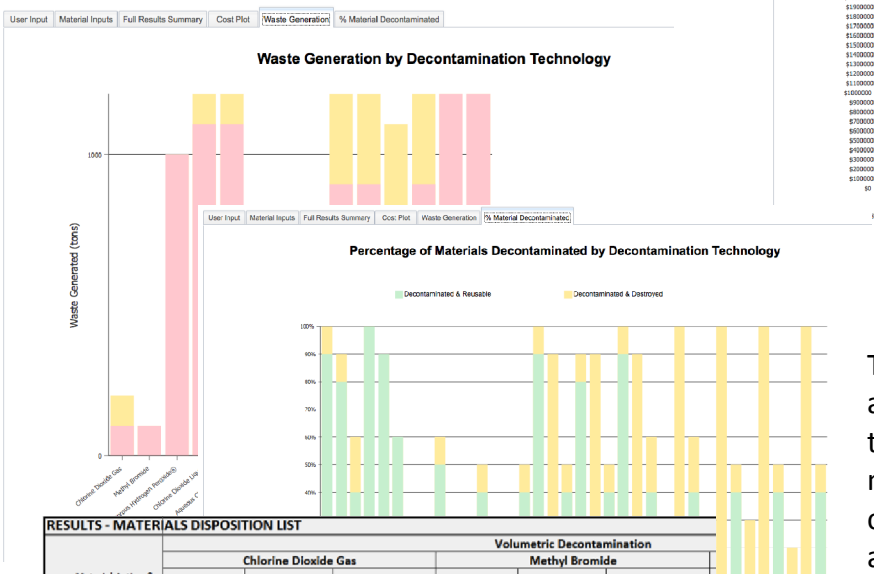
The technologies in the DeconST include currently available biological-agent decontamination technologies with published efficacy data. Building demolition is also included for comparison purposes.

The DeconST takes user input of building type, size, sampling frequency, and information regarding ambient weather conditions, and provides relevant information on facility-specific decontamination methods and associated waste implications.

The DeconST provides a comparison of the relative costs, efficacy and associated destructiveness and waste generated by each of the candidate decontamination technologies.

The cost comparison includes the costs of the decontamination process itself (including incident command, characterization and clearance sampling and analysis, decontamination, and long-term monitoring).





The cost comparison also includes the costs associated with managing the waste generated by the technologies on the structural and interior materials and contents of the facility (including the costs for removing, decontaminating, disposing of, and replacing all materials and contents damaged and/or not decontaminated by the technology).

RESULTS - MATERIALS DISPOSITION LIST

		Volumetric Decontamination					
		Chlorine Dioxide Gas			Methyl Bromide		
Material Action & Result		Exterior Structural Materials	Interior Materials	Contents	Exterior Structural Materials	Interior Materials	Contents
Air Waste	Kept in Place Untreated	Brick, Concrete, Steel, Wood, Other Structural Materials			Brick, Concrete, Steel, Wood, Other Structural Materials		
	Removed for Alternate Decon			Electronic Equipment			Electronic Equipment
	Treated in Place:						
Waste (Included in Dircon % Calculations)	Decontaminated w/o Damage		Drywall, Ceiling Tiles	Non-Porous Furniture		Carpet, Drywall, Ceiling Tiles	Porous Furniture, Non-Porous Furniture
	Decontaminated but Damaged		Carpet	Porous Furniture			
	Potentially Contaminated but Reusable		Other Non-Structural Building Materials				
	Potentially Contaminated and Damaged		Other Floor Materials			Other Floor Materials, Other Non-Structural Building Materials	
	Removed for Waste Treatment & Disposal			Paper and Office Supplies			Paper and Office Supplies
	Waste excluded from Waste Stream Calculations (Aircrete & Caulk)						

The DeconST is intended to be used by a technical working group (TWG) functioning under a Unified Command (UC) to provide and justify recommendations to the Incident Command (IC) on decontamination technologies appropriate to a given building.

The DeconST addresses contamination of a building with *Bacillus anthracis* spores, but is expandable to address other agents. The Tool runs both as a web application and as an MS Excel 2010 spreadsheet.