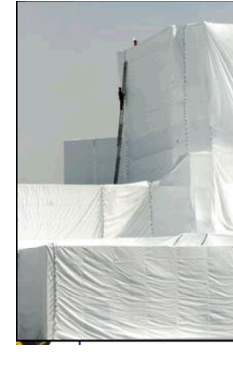
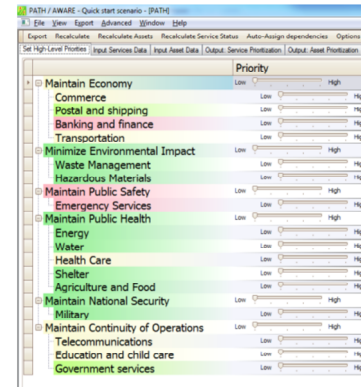




NYC Department of Health and Mental Hygiene & Sandia National Laboratories



Critical Infrastructure Post-Disaster Restoration & Recovery Prioritization Exercise Workshop

May 24, 2017

NYC DOHMH, 42-09 28th St, 14th Fl. (Rm 14-43) Long Island City, NY

Photograph by NICHOLAS KAMM / AFP / Getty

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Agenda

9:00-10:15	Introduction Scenario & Assumptions Prioritization Process Overview Start Exercise: Objective-Level Prioritization
10:15-10:30	Break
10:30-12:00	Function & Service-Level Prioritization (in subgroups) Refinement Concepts Other Considerations Next Steps
12:00-12:30	Lunch - Please fill out feedback forms
12:30-1:00	After-Action Discussion
1:00-2:00	Tools Demonstration (optional)

Goal & Objectives

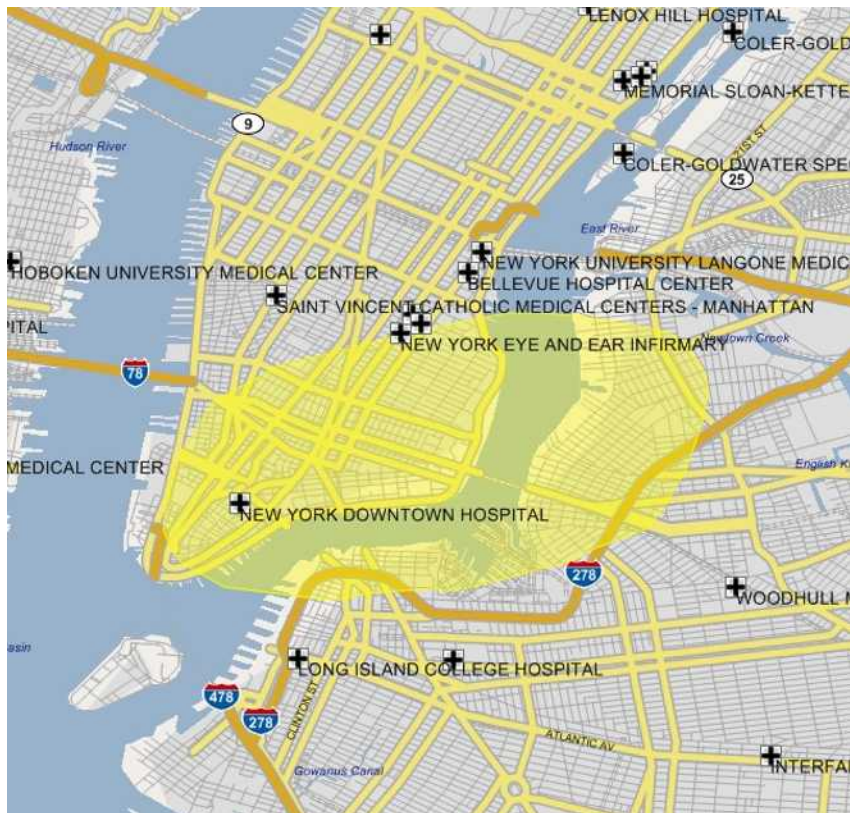
Goal

- Demonstrate and exercise a structured prioritization process using an illustrative example, engaging stakeholders across all sectors

Objectives

- Engage stakeholders to identify CI and dependencies
- Engage stakeholders who would help prioritize CI for remediation
- Familiarize participants with the prioritization process
- Develop draft ranking of remediation objectives

Scenario



(see handout)

- A bioterror attack on Manhattan has contaminated an area of approximately seven square miles with *Bacillus anthracis*, the agent that causes inhalational anthrax
- Hundreds of critical infrastructure assets are in the contaminated zone

Assumptions

- Life-saving response actions have been completed
- Area has been evacuated
- Focus is now on critical infrastructure (CI) facilities
- Initial restoration is by CI asset priority, rather than by geographical zones (i.e., facility-based not block-by-block)
- Cleanup strategies require support from all levels of government including resources such as HAZMAT, laboratory, and decontamination teams and equipment



Photograph by NICHOLAS KAMM / AFP / Getty

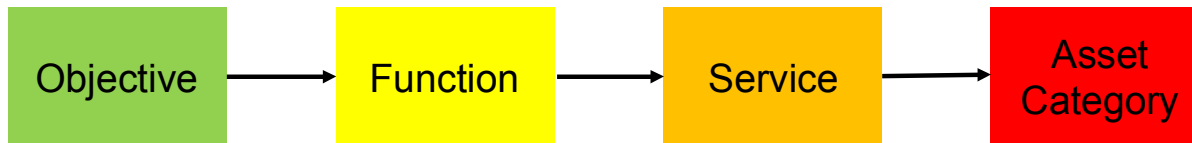


Real-World Prioritization Process

- A multi-agency prioritization committee will be convened by DOHMH to develop prioritization recommendations
 - Committee is separate from Technical Working Group
 - Will include an ethicist
- Recommendations delivered to city-wide Incident/Unified Command, which makes final prioritization decisions also considering:
 - broader context with state and national prioritization requirements
 - other practical & logistical considerations
 - in consultation with elected officials

Prioritization Phases

PHASE 1: Prioritize by Objectives



EXAMPLE: Maintain Public Safety Emergency Services Law Enforcement Police Stations

Weighting & Scoring Mechanism

- Assign weights 1-5 at each level
 - 1 = lowest priority, 5 = highest priority
 - Ties are acceptable
- Objectives are scored more heavily than functions, functions more heavily than services

PHASE 2: Refine Asset Priority List Based on Considerations

Dependencies, Work-arounds, Uniqueness, Symbolic Importance

EXAMPLE: Depends on power, communications, roads, etc. Continuity of operations plan exists.

Objective/Function/Service Mapping

(Example – see handouts for full list)

Objective	Function	Service	Asset Category
Maintain Public Health = restore infrastructure that supports resident population health	Water Systems+	Raw Water Supply, Transmission, and Storage	Raw Water Storage & Distribution System
		Water Treatment	Potable Water Treatment
		Drinking Water	Potable Water Distribution System
	Healthcare and Public Health	Direct Patient Healthcare	Hospitals*
			Primary Care Clinic*
			Misc Care Facility*
		Health Information Technology	Healthcare IT Systems
		Health Plans and Payers	Healthcare Insurance Facilities
		Mass Fatality Management Services	Coronary Facilities
		Medical Materials	Medical Supply Companies
		Laboratories and Supporting Services	Medical Laboratories
		Pharmaceuticals	Pharmacies*
		Public Health	Public Health Clinic*
		Federal Response and Programs	Federal Medical Response
		Other Healthcare and Public Health	Veterinary Care
	Waste Systems	Nuclear Medicine and Associated Waste Products	Nuclear Medicine Facilities
		Wastewater	Waste Water Treatment
	Food and Agriculture	Garbage collection services	Garbage Companies
		Supply	Food Supply Facilities
		Processing, Packaging, and Production	(Commercial - Other*)
		Product Storage, Transportation, and Distribution	Grocery Stores
		Food and Agriculture Supporting Services	Food Supply Support Facilities
		Other Food and Agriculture	Other Food & Ag Facilities

Prioritization Analysis Tool for All-Hazards (PATH)

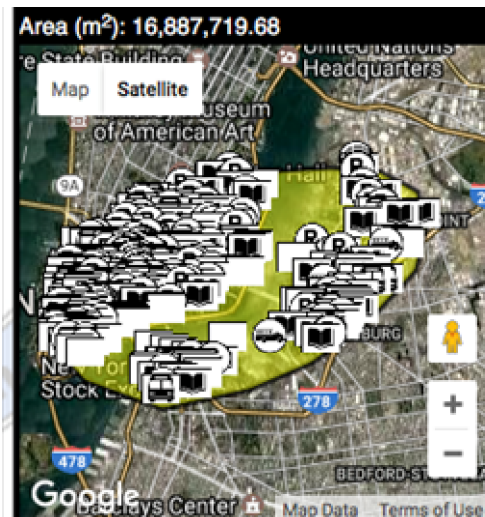
- Facilitates achievement of restoration objectives
- Analysis-based prioritization of critical functions, services, and assets
- Starting point for prioritization decision-making and remediation planning

Scenario Priorities

Category Weights

Name	Priority (Low to High)	Value
▶ Maintain Economy	<input type="range"/>	3.0
▶ Maintain Continuity of Operations	<input type="range"/>	5.0
▶ Maintain Public Health	<input type="range"/>	5.0
▶ Maintain National Security	<input type="range"/>	1.0
▶ Maintain Community	<input type="range"/>	1.0
▶ Maintain Public Safety	<input type="range"/>	5.0

Dependencies



Scenario Priorities

Name	Rank	Uq	Ig	AutoRank	Value
EAST RIVER	1			1.0	1.0
HUDSON AVENUE	2			2.0	1.0
NORTH 1ST	3			3.0	1.0
NEW YORK CITY FIRE DEPARTMENT BATTALION 4	4			4.0	1.0
NEW YORK CITY FIRE DEPARTMENT BATTALION 5	5			5.0	1.0
NEW YORK CITY FIRE DEPARTMENT DIVISION 1	6			6.0	1.0
NEW YORK CITY FIRE DEPARTMENT ENGINE 10	7			7.0	1.0
NEW YORK CITY FIRE DEPARTMENT ENGINE 20	8			8.0	1.0
NEW YORK CITY FIRE DEPARTMENT ENGINE 22	9			9.0	1.0
NEW YORK CITY FIRE DEPARTMENT ENGINE 22	10			10.0	1.0
NEW YORK CITY FIRE DEPARTMENT ENGINE 28	11			11.0	1.0
NEW YORK CITY FIRE DEPARTMENT ENGINE 41	12			12.0	1.0
NEW YORK CITY FIRE DEPARTMENT ENGINE 55	13			13.0	1.0
NEW YORK CITY FIRE DEPARTMENT ENGINE 6	14			14.0	1.0

Category Weights

Dependencies

Guiding Ethical Principles

Two Forms of Justice

- Distributive Justice
 - Effort: What you need to put in to clean it
 - Need: How important is this to the functioning
 - Efficiency: The benefit or outcome of cleaning it

- Justice as Fairness: Look at these criteria from two perspectives
 - Department
 - Community

Exercise Prioritization Process

Real-World Prioritization

- Requires group consensus on recommendations
- Will likely include greater influence for certain stakeholders
- Must consider all CI assets

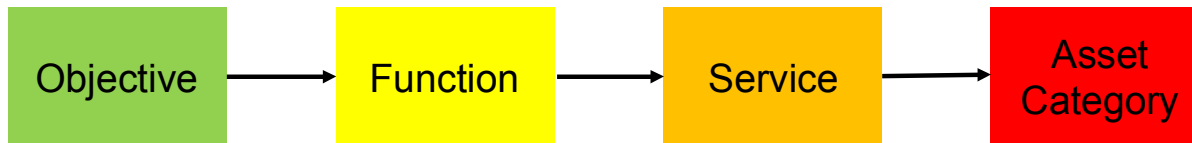
Exercise Artificialities

- Participants will vote on priorities
- Participants will have equal influence
- A subset of assets will be considered

Remember the objective is to demonstrate and exercise the prioritization process and concepts.

Prioritization Exercise

PHASE 1: Prioritize by Objectives



EXAMPLE: Maintain Public Safety Emergency Services Law Enforcement Police Stations

PHASE 2: Refine Asset Priority List Based on Considerations

Dependencies, Work-arounds, Uniqueness, Symbolic Importance

EXAMPLE: Depends on power, communications, roads, etc. Continuity of operations plan exists.

1. Prioritize by Objectives (all)
2. Prioritize by Functions & Services (in subgroups)
3. Refine (all)

Vote on Objective Weightings

20 votes per person, include Org. Initials on sticky dots



Objective	Total Votes	PATH Input Weighting
Maintain Economy = restore infrastructure critical to national/local economy		
Maintain Continuity of Operations = maintain government continuity and restore local & regional lifelines		
Maintain Public Safety = restore local/regional emergency services		
Maintain Public Health = restore infrastructure that supports resident population health		
Maintain Federal Capabilities & National Security = restore infrastructure that supports critical federal capabilities & national security		
Maintain Community = restore infrastructure that provides a coherent sense of community		

Vote on Objective Weightings

- Perspective of NYC stakeholders considering what is in the overall best interest of our city
- Weigh objectives in terms of criticality (not a zero-sum game or weighing objectives one against another)
- Considerations
 - Scenario-specific options & trade-offs
 - Lifelines
 - No national security assets
 - Ethical considerations
- Discuss
- Vote on objectives

Subgroup Ranking: Functions & Services

(see handout)

- Weight each Function
 - 1 = lowest priority, 5 = highest priority
 - Ties are acceptable
- Weight each Service
 - 1 = lowest priority, 5 = highest priority
 - Ties are acceptable
- Mark rankings on Objective/Function/Service Charts
 - finish by 10:55
- Assign spokesperson to present results to group

Objective/Function/Service Mapping

(Example – see handouts for full list)

Objective	Function	Service	Asset Category
Maintain Public Health = restore infrastructure that supports resident population health	Water Systems+	Raw Water Supply, Transmission, and Storage	Raw Water Storage & Distribution System
		Water Treatment	Potable Water Treatment
		Drinking Water	Potable Water Distribution System
	Healthcare and Public Health	Direct Patient Healthcare	Hospitals*
			Primary Care Clinic*
			Misc Care Facility*
		Health Information Technology	Healthcare IT Systems
		Health Plans and Payers	Healthcare Insurance Facilities
		Mass Fatality Management Services	Coronary Facilities
		Medical Materials	Medical Supply Companies
		Laboratories and Supporting Services	Medical Laboratories
		Pharmaceuticals	Pharmacies*
		Public Health	Public Health Clinic*
		Federal Response and Programs	Federal Medical Response
		Other Healthcare and Public Health	Veterinary Care
		Nuclear Medicine and Associated Waste Products	Nuclear Medicine Facilities
	Waste Systems	Wastewater	Waste Water Treatment
		Garbage collection services	Garbage Companies
	Food and Agriculture	Supply	Food Supply Facilities
		Processing, Packaging, and Production	(Commercial - Other*)
		Product Storage, Transportation, and Distribution	Grocery Stores
		Food and Agriculture Supporting Services	Food Supply Support Facilities
		Other Food and Agriculture	Other Food & Ag Facilities

Resultant Ranking (Phase 1)

- Review Service-level rankings in spreadsheet
- Review Asset-level rankings in PATH Tool

Service-Level Ranking

(view in spreadsheet)



Objective	Function	Service	Objective Weight	Function Weight	Service Weight	Resultant Ranking
Maintain Continuity of Operations	Energy+	Electricity	5	5	5	1.00
Maintain Continuity of Operations	Service-Based Govt Facilities	Service-Oriented Government Facility	5	5	5	1.00
Maintain Public Health	Food and Agriculture	Processing, Packaging, and Production	5	5	5	1.00
Maintain Public Safety	Emergency Services	Fire and Emergency Services	5	5	5	1.00
Maintain Public Safety	Emergency Services	Law Enforcement	5	5	5	1.00
Maintain Continuity of Operations	Communications+	Wireless Communication	5	4	4	0.96
Maintain Public Health	Healthcare and Public Health	Direct Patient Healthcare	5	3	5	0.94
Maintain Continuity of Operations	Transportation+	Highway and Motor Carrier	5	3	4	0.93
Maintain Continuity of Operations	Transportation+	Mass Transit and Passenger Rail	5	3	4	0.93
Maintain Public Health	Healthcare and Public Health	Public Health	5	3	4	0.93
Maintain Continuity of Operations	Transportation+	Aviation	5	3	3	0.92
Maintain Public Health	Healthcare and Public Health	Pharmaceuticals	5	3	3	0.92
Maintain Continuity of Operations	Transportation+	Maritime Transportation Systems	5	3	2	0.92
Maintain Economy	Financial Services	Securities, Commodities, Financial	3	4	5	0.65
Maintain Economy	Financial Services	Banking and Credit	3	4	4	0.64
Maintain Economy	Commercial Facilities	Other Commercial Facilities	3	3	1	0.59
Maintain Community	Coherent Sense of Community	Housing	1	4	4	0.32
Maintain Community	Coherent Sense of Community	Education Facility	1	4	3	0.31
Maintain Federal Capabilities & National Security	Government Facilities	Other Government Facility	1	2	1	0.23

Asset-Level Ranking (Phase 1)

(view in PATH)



Name	Rank	Phase 1 Rank	Normalized Score
EAST RIVER	1	1	1
HUDSON AVENUE	2	2	1
NORTH NEW YORK CITY FIRE DEPARTMENT	Placeholder – replace w/ ranking based on defaults		
ENGINE 28 LADDER 11	4	11	1
NEW YORK CITY FIRE DEPARTMENT BATTALION 1 ENGINE 7 LADDER 1	5	4	1
NEW YORK CITY FIRE DEPARTMENT BATTALION 4 ENGINE 15 LADDER 18	6	5	1
NEW YORK CITY FIRE DEPARTMENT DIVISION 1 LADDER 20 UNIT 1	7	6	1
NEW YORK CITY FIRE DEPARTMENT ENGINE 10 LADDER 10	8	7	1
NEW YORK CITY FIRE DEPARTMENT ENGINE 205 LADDER 118	9	8	1
NEW YORK CITY FIRE DEPARTMENT ENGINE 221 LADDER 104	10	9	1
NEW YORK CITY FIRE DEPARTMENT ENGINE 229 LADDER 146	11	10	1
NEW YORK CITY FIRE DEPARTMENT ENGINE 4 LADDER 15 - DECON UNIT	12	12	1
NEW YORK CITY FIRE DEPARTMENT	13	13	1
NEW YORK CITY FIRE DEPARTMENT	14	14	1
NEW YORK CITY FIRE DEPARTMENT ENGINE 9 LADDER 6 SATELLITE 1	15	15	1
NEW YORK CITY FIRE DEPARTMENT	16	16	1
NEW YORK CITY FIRE DEPARTMENT MARINE BATTALION MARINE 6	17	17	1

Phase 2 Refinement Concepts

(Examples – manually adjust in PATH)

- Dependencies – e.g., NYPD & FDNY need Brooklyn Bridge
- From advance work:
 - Workarounds – e.g., ConEd E 16th St and HeadQuarters both have workarounds = ignore
 - Gas stations – can get gas from outside of contaminated area
 - Unique w/in a category – e.g., NYPD Headquarters
 - Symbolic – e.g., Statue of Liberty
- Other – Service not disrupted – e.g., Cell Towers = ignore

Completed Asset-Level Ranking

(based on default weightings + refinements)



Name	Rank	Phase 1 Rank	Normalized Score	
EAST RIVER	1	1	1	
HUDSON AVENUE	2	2	1	
NORTH	Placeholder – replace w/ ranking based on defaults + refinements			1
NEW YORK CITY FIRE DEPARTMENT ENGINE 10 LADDER 10				1
NEW YORK CITY FIRE DEPARTMENT BATTALION 1 ENGINE 7 LADDER 1	5	4	1	
NEW YORK CITY FIRE DEPARTMENT BATTALION 4 ENGINE 15 LADDER 18	6	5	1	
NEW YORK CITY FIRE DEPARTMENT DIVISION 1 LADDER 20 UNIT 1	7	6	1	
NEW YORK CITY FIRE DEPARTMENT ENGINE 10 LADDER 10	8	7	1	
NEW YORK CITY FIRE DEPARTMENT ENGINE 205 LADDER 118	9	8	1	
NEW YORK CITY FIRE DEPARTMENT ENGINE 221 LADDER 104	10	9	1	
NEW YORK CITY FIRE DEPARTMENT ENGINE 229 LADDER 146	11	10	1	
NEW YORK CITY FIRE DEPARTMENT ENGINE 4 LADDER 15 - DECON UNIT	12	12	1	
NEW YORK CITY FIRE DEPARTMENT	13	13	1	
NEW YORK CITY FIRE DEPARTMENT	14	14	1	
NEW YORK CITY FIRE DEPARTMENT ENGINE 9 LADDER 6 SATELLITE 1	15	15	1	
NEW YORK CITY FIRE DEPARTMENT	16	16	1	
NEW YORK CITY FIRE DEPARTMENT MARINE BATTALION MARINE 6	17	17	1	

Other Considerations

- Asset capacity
- Percentage of service required to meet the function
- Outdoor remediation will occur first, then indoor
- Asset-specific vs. zonal remediation
 - Initial restoration is by CI asset priority
 - Later stages will transition to geographical zones
 - Residential

Process Next steps

- Deliver prioritization recommendations to city-wide Incident/Unified Command, which makes final prioritization decisions also considering:
 - broader context with state and national prioritization requirements
 - other practical & logistical considerations
 - in consultation with elected officials

- Calculate remediation cost & timing based on
 - Resource availability
 - Policy decisions
 - (show example using AWARE tool)

Recovery Cost & Time

- PATH/AWARE estimates the time and cost of the recovery effort
- Inputs include:
 - Mining of building data within the plume area (e.g., *building dimensions*)
 - Resource estimates (e.g., *numbers of sampling and decontamination teams*)
 - Rate estimates (e.g., *number of samples collected per hour; decontamination throughput & costs*)
 - Operational inputs (e.g., *judgmental and/or statistical sampling, contamination-level based decontamination methods, etc.*)
- The tools use these inputs to assign resources and track activity progress on a daily basis throughout the entire recovery process, providing a comprehensive estimate of the time and cost of recovery
- The model was run with a set of assumptions/inputs for the area of interest, resulting in the following:
 - **Approximately 4 years** to complete the cleanup process
 - **Roughly \$5.4B** for the cleanup
- Note that these costs/timelines are highly uncertain and will be different under different assumptions

After Action Discussion Topics

➔ Participant feedback on process and lessons learned

- Review take-away messages
- DOHMH Next steps

Participant Feedback on Process and Lessons Learned

- Prioritization Process (discussion)
 - What was helpful about this process?
 - How to improve the process for a real incident in NYC?
 - Suggestions on how to increase community acceptance
 - Suggestions on next steps
- Exercise Process (paper evaluations)

Take-Away Messages

- Prioritization is complex, politically charged, involves multiple stakeholders, and includes public and private organizations
- The demonstrated prioritization process
 - integrates diverse factors into a step-by-step process
 - provides a transparent solution that is generated from
 - decision-maker input, such as high-level restoration objectives
 - objective criteria, such as dependencies between assets
 - ethical perspective
- The results of this analytical approach provide
 - a starting point for negotiation
 - a transparent, explicit process that allows rationalization of prioritization decisions to decision-makers and the public

DOHMH Next Steps

- Summary of the prioritization process steps for quick reference
- After Action Report from the workshop
- Update the Bioremediation Plan to incorporate prioritization

**THANK YOU FOR YOUR
PARTICIPATION**

Decision-Support Tools

