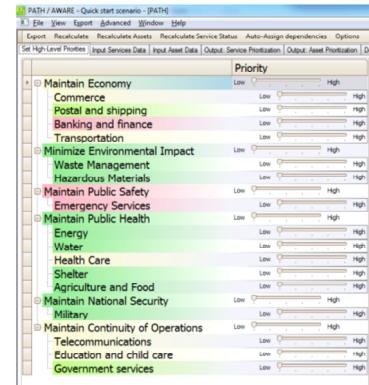




## NYC Department of Health and Mental Hygiene & Sandia National Laboratories



# 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

Sandia National Laboratories is a multi-mission laboratory managed and operated by National Technology & Engineering Solutions of Sandia, LLC., a wholly owned subsidiary of Honeywell International, Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525.

# Agenda

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

# 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



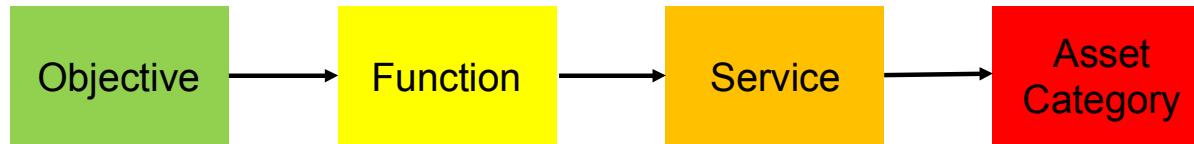
# Real-World Prioritization Process



- 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.

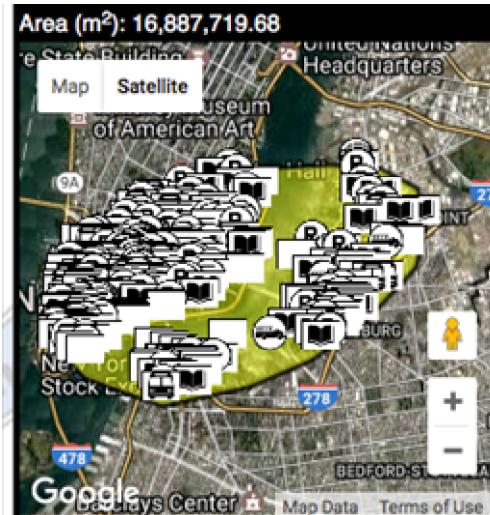
# Objective/Function/Service Mapping

*(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*
		Health Information Technology	Primary Care Clinic*
		Health Plans and Payers	Misc Care Facility*
		Mass Fatality Management Services	Healthcare IT Systems
		Medical Materials	Healthcare Insurance Facilities
		Laboratories and Supporting Services	Coronary Facilities
		Pharmaceuticals	Medical Supply Companies
		Public Health	Medical Laboratories
		Federal Response and Programs	Pharmacies*
		Other Healthcare and Public Health	Public Health Clinic*
		Nuclear Medicine and Associated Waste Products	Federal Medical Response
		Wastewater	Veterinary Care
		Garbage collection services	Nuclear Medicine Facilities
	Food and Agriculture	Supply	Waste Water Treatment
		Processing, Packaging, and Production	Garbage Companies
		Product Storage, Transportation, and Distribution	Food Supply Facilities
		Food and Agriculture Supporting Services	(Commercial - Other* )
		Other Food and Agriculture	Grocery Stores
			Food Supply Support Facilities
			Other Food & Ag Facilities

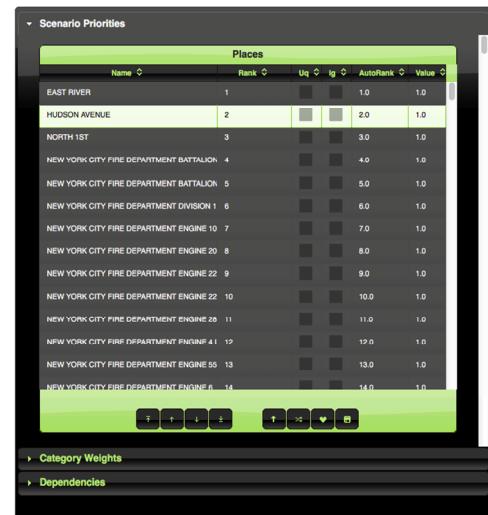
# Prioritization Analysis Tool for All-Hazards (PATH)

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



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



Places						
Name	Rank	Uq	Ig	C	AutoRank	Value
EAST RIVER	1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1.0	1.0
HUDSON AVENUE	2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2.0	1.0
NORTH 1ST	3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	3.0	1.0
NEW YORK CITY FIRE DEPARTMENT BATTALION 4	4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	4.0	1.0
NEW YORK CITY FIRE DEPARTMENT BATTALION 5	5	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	5.0	1.0
NEW YORK CITY FIRE DEPARTMENT DIVISION 1	6	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	6.0	1.0
NEW YORK CITY FIRE DEPARTMENT ENGINE 10	7	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	7.0	1.0
NEW YORK CITY FIRE DEPARTMENT ENGINE 20	8	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	8.0	1.0
NEW YORK CITY FIRE DEPARTMENT ENGINE 22	9	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	9.0	1.0
NEW YORK CITY FIRE DEPARTMENT ENGINE 22	10	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	10.0	1.0
NEW YORK CITY FIRE DEPARTMENT ENGINE 25	11	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	11.0	1.0
NEW YORK CITY FIRE DEPARTMENT ENGINE 41	12	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	12.0	1.0
NEW YORK CITY FIRE DEPARTMENT ENGINE 55	13	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	13.0	1.0
NEW YORK CITY FIRE DEPARTMENT ENGINE 6	14	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	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

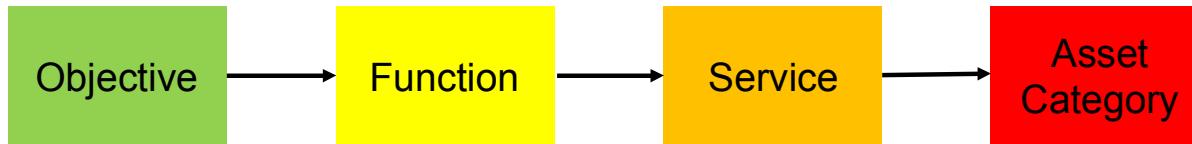
## Exercise Artificialities

- 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
<b>Maintain Economy</b> = restore infrastructure critical to national/local economy		
<b>Maintain Continuity of Operations</b> = maintain government continuity and restore local & regional lifelines		
<b>Maintain Public Safety</b> = restore local/regional emergency services		
<b>Maintain Public Health</b> = restore infrastructure that supports resident population health		
<b>Maintain Federal Capabilities &amp; National Security</b> = restore infrastructure that supports critical federal capabilities & national security		
<b>Maintain Community</b> = 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
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	Healthcare and Public Health	Direct Patient Healthcare	Hospitals*
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		Medical Materials	Healthcare Insurance Facilities
		Laboratories and Supporting Services	Coronary Facilities
		Pharmaceuticals	Medical Supply Companies
		Public Health	Medical Laboratories
		Federal Response and Programs	Pharmacies*
		Other Healthcare and Public Health	Public Health Clinic*
		Nuclear Medicine and Associated Waste Products	Federal Medical Response
		Wastewater	Veterinary Care
		Garbage collection services	Nuclear Medicine Facilities
	Food and Agriculture	Supply	Waste Water Treatment
		Processing, Packaging, and Production	Garbage Companies
		Product Storage, Transportation, and Distribution	Food Supply Facilities
		Food and Agriculture Supporting Services	(Commercial - Other* )
		Other Food and Agriculture	Grocery Stores
			Food Supply Support Facilities
			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	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 16<sup>th</sup> 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		
NEW YC			
ENGINE			
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

