
Environmental Health Needs & Habitability Assessment

Joint Taskforce

Centers for Disease Control and Prevention &
U.S. Environmental Protection Agency

Hurricane Katrina Response

Initial Assessment

September 17, 2005



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PREAMBLE

We are committed to working with the mayor and city officials and other federal, state, and local agencies and relief organizations to bringing back the great city of New Orleans. The Mayor of New Orleans has announced plans to reopen parts of the City to businesses and residents. While decisions regarding when and how to lift the mandatory evacuation order generally are within the authority of State and local officials, the Federal government has a responsibility to inform these decision makers and the public of the potential health and environmental risks associated with returning to the City.

This report provides an initial assessment of the overarching environmental health and infrastructure issues faced by New Orleans to reinhabit the city. It was prepared by a joint taskforce of the Centers for Disease Control and Prevention (CDC) in the Department of Health and Human Services (DHHS) and the U.S. Environmental Protection Agency (EPA). EPA and CDC are collaborating with state and local public health and environmental officials, including the New Orleans City Public Health Department, the Louisiana Department of Health and Hospitals, and the Louisiana Department of Environmental Quality.

Officials will need to attend to the environmental health and infrastructure issues identified in the report. EPA and CDC are committed to collecting and providing scientific data to decision makers and the public. However, the data are limited and conditions in the storm-damaged areas of the City are constantly changing. Consequently, significant additional risks may arise that do not exist currently. A wide variety of factors are driving the decision to reopen portions of the City, and many precautions beyond those mentioned in this report need to be taken. State and local leaders are advised to consider the potential hazards, caution returning inhabitants of the health risks, and provide for sufficient medical and other resources to address the returning population in light of existing conditions.

CDC and EPA are neither responsible for addressing all of the environmental health and infrastructure issues identified in the report nor for coordinating resources to attend to them. Furthermore, the report is neither a step-by-step guide nor a guidance document with criteria for reinhabiting the city.

The report identifies a number of barriers to overcome and critical decisions to make prior to reinhabiting New Orleans. CDC and EPA are not implying that it is our role to wholly attend to these barriers or make these decisions. These decisions will be made by the mayor and city officials in consultation with the authorities involved in the coordinated response.

The report is focused broadly at the city of New Orleans. Some of the environmental health and infrastructure issues discussed in the report may not apply to the less flooded and damaged neighborhoods in New Orleans. As a result, the decision to reinhabit New Orleans must be made neighborhood-by-neighborhood and requires a deliberate neighborhood-level analysis. Also, the decision to reopen a neighborhood must consider

the impact of returning residents on the broader recovery and redevelopment activities for the whole city.

Everyone is eager to restore the vibrant and unique city of New Orleans. It is our hope this report will highlight some of the cross-cutting environmental health and infrastructure issues requiring attention to reinhabit New Orleans. However, this report should not be relied upon as a comprehensive assessment of the environmental conditions of the City of New Orleans, or of the human health risks associated with returning to reopened portions of the City.

EXECUTIVE SUMMARY

Hurricane Katrina made landfall on Monday, August 29, 2005, as a category 4 hurricane and passed within 10 to 15 miles of New Orleans, Louisiana. The storm brought heavy winds and rain to the city, and the damage breached several levees protecting New Orleans from the water of Lake Pontchartrain. The levee breaches flooded up to 80% of the city with water reaching a depth of 25 feet in some places.

Among the wide-scale impacts of Hurricane Katrina, the storm caused significant loss of life and disrupted power, natural gas, water, and sewage treatment, road safety, and other essential services to the city.

Early in the disaster response and recovery, federal, state, and local elected officials and public health and environmental leaders recognized the significant role of environmental health in the post-hurricane rebuilding of New Orleans.

At the request of the Secretary Michael Leavitt of the Department of Health and Human Services (DHHS) and Administrator Steve Johnson of the U.S. Environmental Protection Agency (EPA), the Director of the Centers for Disease Control and Prevention (CDC), Dr. Julie Louise Gerberding, created the Environmental Health Needs Assessment and Habitability Taskforce (EH-NAHT). The taskforce was charged with identifying the overarching environmental health issues faced by New Orleans to reinhabit the city.

The EH-NAHT collaborated extensively with a diverse group of federal, state, and local partners, including the New Orleans City Public Health Department, the Louisiana Department of Health and Hospitals (LADHH), and Louisiana Department of Environmental Quality (LDEQ), Federal Emergency Management Agency (FEMA), and U.S. Army Corps of Engineers (USACE).

The team was guided by the following questions: (1) What are the core or fundamental environmental health issues to be addressed; (2) Which agencies and organizations at the federal, state, or local level are responsible for, or involved in, the various environmental health issues; (3) What progress has been made and what challenges exist; (4) What is the timetable to address these environmental health issues; (5) What resources exist or need to be brought to bear to address these environmental health issues; and (6) What are the key milestones and endpoints that define success.

The team identified 13 environmental health issues and supporting infrastructure to address. This initial assessment included drinking water, wastewater, solid waste/debris, sediments/soil contamination (toxic chemicals), power, natural gas, housing, unwatering/flood water, occupational safety and health/public security, vector/rodent/animal control, road conditions, underground storage tanks (e.g., gasoline), and food safety.

After the initial assessment, the EH-NAHT categorized these issues by increasing time and complexity to full restoration of services (Level 4, most complex and requiring the

most time to restoration). Part of the complexity relates to how specific and explicit the criteria for the end points are for each function.

Level 1	Level 2	Level 3	Level 4
<ul style="list-style-type: none"> • Unwatering • Power • Natural Gas • Vector/Rodent/Animal Control • Underground storage tanks (e.g., gasoline) • Food Safety 	<ul style="list-style-type: none"> • Drinking Water • Wastewater • Road Conditions 	<ul style="list-style-type: none"> • Solid Waste/Debris • Sediments/Soil Contamination (Toxic Chemicals) 	<ul style="list-style-type: none"> • Housing

Occupational safety and health as well as public security was identified as cross-cutting all the other areas.

Long-term solutions to these many issues are critical to allow resumption of normal life in New Orleans and to prevent reoccurrence of such an event in this area.

The EH-NAHT has the following conclusions based upon our initial assessment:

- **A complex array of environmental health problems exists in New Orleans.**

The most striking feature of the disaster is the array of key environmental health and infrastructure factors affected all at once. All key environmental health and related services are being reestablished, and this work needs to be done in a very coordinated and well-planned way.

- **The unwatering of New Orleans is a critical first step.**

The unwatering is an essential first step to allow access for assessment and repair of all basic services and habitability barriers. Some significant assessments are not yet started because of the continued unwatering, which could take an additional 4 weeks to complete. These assessments may impact the timing, resources and scope of the needed repairs/replacements.

- **It is important to bring infrastructure systems in New Orleans back on line.**

Different timeframes are necessary to bring the various infrastructure systems (e.g., drinking water, wastewater, power, and natural gas) on line with varying degrees of capabilities. Restoring drinking water systems and wastewater treatment systems needs a planned approach, but full restoration will be delayed by the many breaks in the distribution and collection systems and by the need for upgrade and repairs in older systems. Unanticipated delays must be kept in mind in the process of unwatering and the scope and complexity of the interdependent systems.

- **The cleanup of debris (including housing debris) and potentially contaminated soil/sediment in New Orleans are rate-limiting factors.**

The timeline for debris treatment, disposal, containment, and transport, as well as for the testing of potentially contaminated soils/sediment, will slow or accelerate the rate at which the city can be reinhabited. The potential contamination of soils/sediments has great uncertainty attached to it. A comprehensive sampling and testing of a broad array of toxic chemicals will be required to identify any widespread contamination or selected hot spots and to ensure the safety of returning inhabitants or for redevelopment.

- **Intense interest will exist to reinhabit New Orleans.**

Significant pressure will occur to allow rehabilitation. A single decision will not be made to reinhabit the whole city at one time. Rehabilitation is expected to be done neighborhood by neighborhood IF it is possible to prevent access to the closed areas of the city. Worker safety and health as well as public safety and security are mandatory enablers for all of the activities.

- **It is critical to address the housing issues in New Orleans.**

Housing is likely the most critical issue in reinhabiting the city because of the

- Large percentage of city housing that was flooded and is not likely to be viable;
- Intense personal connection an individual has to their home;
- Legal, jurisdictional, and procedural issues involved in the decision-making process;
- Large proportion of the city population that is displaced. Some residents are a significant distance away from New Orleans or may not intend to return;
- Difficulty in establishing and maintaining communications with the widely dispersed population;
- Challenge of identifying acceptable methods and resources for assessing such a large number of homes; and the
- Scope of the demolition process and safe and efficient removal of debris.

- **An immediate need exists to allow temporary or transient entry of recovery workers, residents, and business owners.**

In the immediate period, explicit guidelines are being developed for safe entry of recovery workers to New Orleans, for brief entry by residential and business owners to retrieve key household or business items in neighborhoods of the city where it is safe to do so, and for reinhabiting the least impacted areas of the city where key environmental health and infrastructure conditions are met.

- **Ensuring worker safety and health and public safety and security are essential.**

Public security and intensive efforts to achieve worker safety and health for the very large recovery workforce, working often in extraordinarily difficult and challenging conditions, is essential to rebuilding New Orleans.

- **The criteria for short-term and long-term return to New Orleans should be tailored to the timeframe and population.**

Different criteria will be necessary for the short-term and long-term return to the city (e.g., use of bottled water in the absence of potable water will be acceptable for recovery workers and select others on a limited short-term basis versus the general population, which includes children and the elderly over the long-term).

The EH-NAHT has the following recommendations based on our initial assessment:

- **It is important to involve state, local, and other stakeholders in decision-making.**

All the issues in reinhabiting New Orleans are interwoven, complex, and cannot be addressed individually. It is extremely important that decisions are made involving state, local, and federal staff as well as all other stakeholders, particularly the local population.

- **Developing a shared vision for the rebuilding (including infrastructure) is critical.**

Because of the magnitude of the devastation, it is critical that decisions be guided by a clear, shared vision by all stakeholders of what the rebuilt New Orleans should be. As devastating as this event is, the vision of the future of the city is critical in guiding development for such a widely impacted area.

- **Federal, state, and local decision-makers should explore processes used by other areas in devastating circumstances.**

New Orleans should draw upon the experiences of other localities that addressed devastating events—areas such as New York (World Trade Center), Florida (repeated hurricanes), and San Francisco (earthquake). Their experiences and solutions might serve as examples to New Orleans on processes that can be used for creating a broad vision for redevelopment, for identifying key decisions and strategies, and for involving all stakeholders (including the displaced population) in the broad-impact, critical decisions that will have to be made.

- **Maintaining collaboration with involved agencies is essential.**

Maintain, through FEMA and other mechanisms, broad collaboration and a true sense of partnership in developing a very coordinated and sustained effort to recovery.

- **Attending to the housing decisions is critical.**

A number of critical decisions need to be made about housing. These decisions include

- Developing explicit guidelines for entry by recovery workers, for brief periods of entry by residents and business owners to retrieve essential belongings, and for reinhabiting relatively undamaged neighborhoods of the city.
- Creating a neighborhood-by-neighborhood approach for assessing housing, cleanup/demolition, and reinhabiting/rebuilding.
- Selecting method(s) for assessing large amounts of damaged housing, with rapid methods necessary for severely damaged housing.
- Resolving legal, administrative, and procedural issues.
- Fostering and maintaining ongoing contact with the large displaced population—particularly for any actions that might require owner authorization.

- **It is necessary to maintain a systems-level perspective.**

Monitoring the progress in all key areas of environmental health and infrastructure is important because reinhabiting New Orleans depends on success in all areas. This initial assessment identified 13 key areas that need to be tracked.

- **Resolving potential toxic chemical exposures is important.**

It is important to resolve the questions about the potential for toxic chemical exposure as quickly as possible. This issue has the widest degree of uncertainty.

- **Officials should ensure public safety and security and worker health and safety.**

Maintain a central focus on public safety and recovery worker health and safety throughout the rebuilding of New Orleans.

- **Engage and communicate with the displaced population.**

Develop a mechanism to regularly and substantively engage and communicate with the displaced population to provide a progress update on city-wide activities as well as activities related to neighborhoods and individual homes. This work could involve the use of GIS, the Internet, and other innovative strategies.

- **Maintain a broad vision on issues affecting the rehabilitation of the city.**

This initial assessment from the EH-NAHT focused on the immediate issues related to reinhabiting the city—primarily those issues that affect essential systems for safe living. As these immediate issues are dealt with, it will be important to focus on

issues related to quality of life and social well-being and how they are integrated into a redevelopment plan.

- **Create a long-term habitability strategy.**

The long-term solution to the risk of flooding and the viability of New Orleans depend on fully protective levee and unwatering systems for the population returning to and inhabiting the city. It is extremely important to address the long-term protection of the city from another such event of this magnitude.

Federal, state, and local agencies and relief organizations are responding heroically to the disaster. All organizations, including the agencies represented on this task force, should be doing their utmost to assist in recovery and rebuilding.

These conclusions and recommendations are current at the time of writing. Because the situation is dynamic and changing daily, updates on various topics will be given periodically by various organizations.

INTRODUCTION

Hurricane Katrina

Hurricane Katrina first made landfall at the southern tip of Florida on Thursday, August 25 as a category 1 storm on the Saffir-Simpson scale. Then, the hurricane moved into the Gulf of Mexico, grew to category 5, and turned north towards New Orleans (see Figure 1).

Hurricane Katrina made landfall on Monday, August 29 as a category 4 hurricane with winds of 140 mph at 6:10 AM central time near Buras-Triumph, Louisiana. A few hours later, it made landfall again near the Louisiana and Mississippi border with 125 mph Category 3 winds (see Figure 2).

Its lowest minimum pressure at landfall was 27.108 inches (918 mbar) (hPa), making it the third strongest hurricane on record to make landfall on the United States.

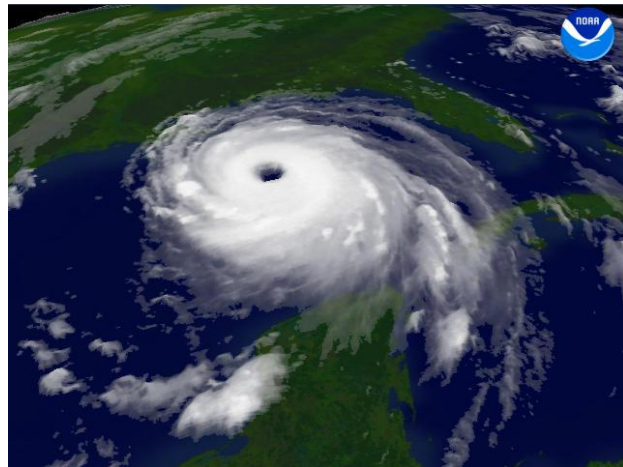
New Orleans

New Orleans is the largest city in the state of Louisiana. It is located in southeastern Louisiana along the Mississippi River just south of Lake Pontchartrain. New Orleans is all of Orleans Parish.

The City of New Orleans and the Parish of Orleans operate under a unified government. The “east bank” of New Orleans is north of the meandering Mississippi River and the “west bank” is south.

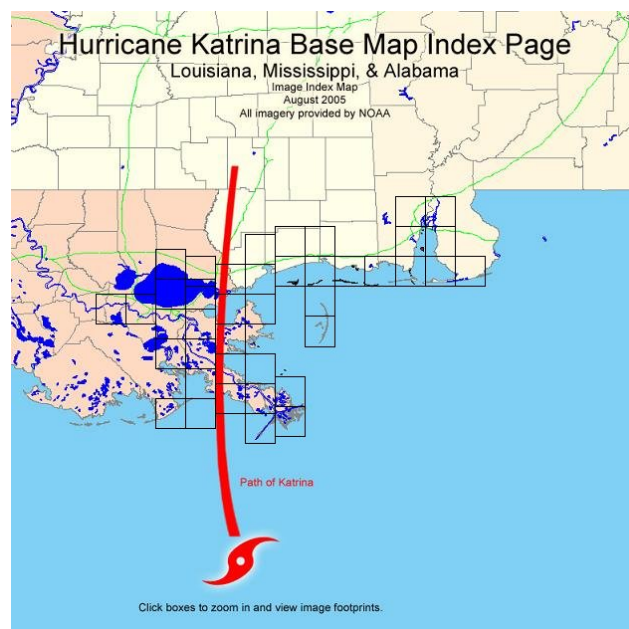
The population of New Orleans during the 2000 U.S. Census was 484,674, and the population of Greater New Orleans was 1,337,726 (see Figure 3).

Figure 1. Satellite Photograph of Hurricane Katrina Approaching Louisiana



Source: NOAA.gov

Figure 2. Path of Hurricane Katrina



Source: NOAA.gov

As of the 2000 U.S. Census, 188,251 households and 112,950 families resided in the city. The population density was 2,684.3/mi² (see Figure 4).

The racial makeup of the city was 67.25% African American, 28.05% White, 2.26% Asian, 0.20% Native American, 0.02% Pacific Islander, and 0.93% from other races. A total of 3.06% of the population were Hispanic or Latino of any race. The average household size was 2.48 persons and the average family size was 3.23.

The median income for a household in the city was \$27,133, and the median income for a family was \$32,338. A total of 27.9% of the population and 23.7% of families were below the poverty line.

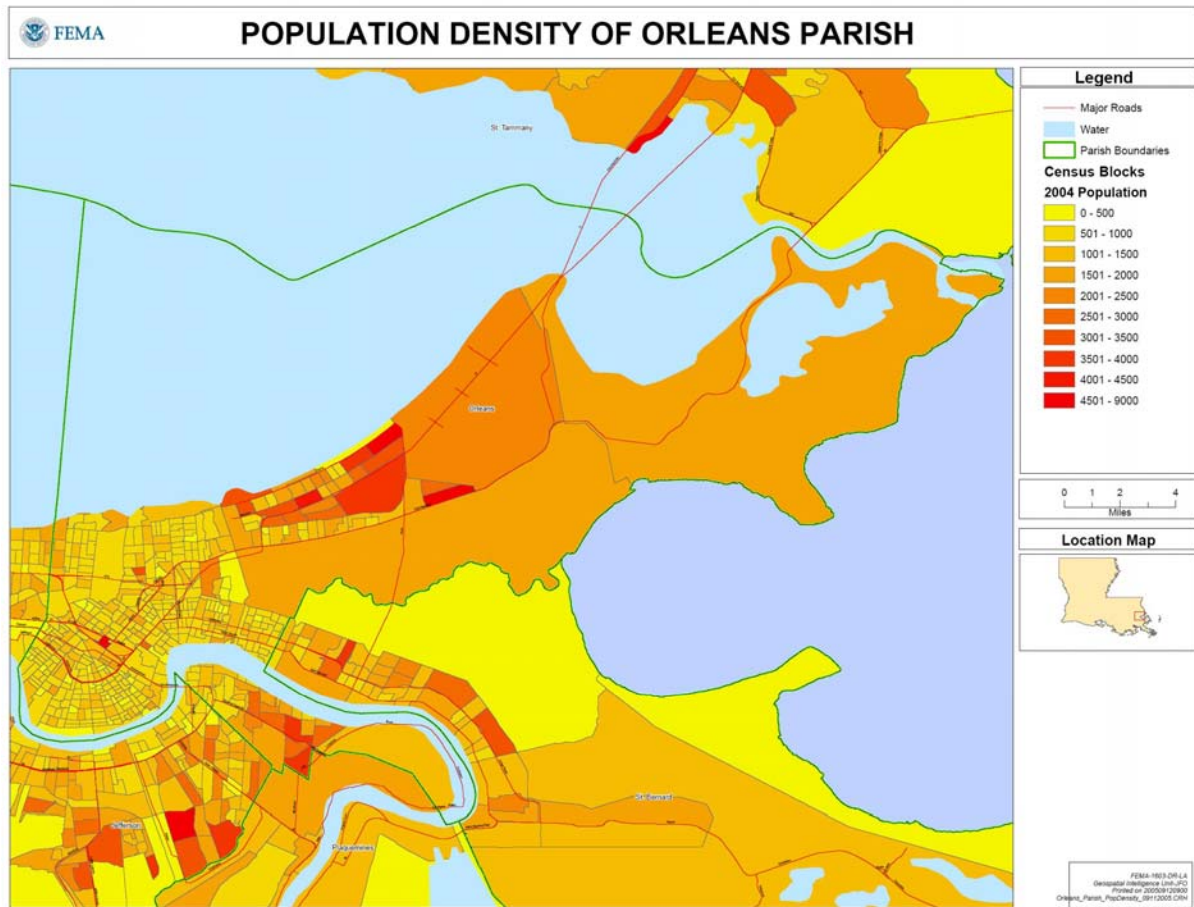
The city of New Orleans contains the lowest point in the state of Louisiana and one of the lowest points in the United States. A significant portion of New Orleans is located between 1 and 10 feet below sea level.

Figure 3. Map of Neighborhoods in Orleans Parish
Neighborhoods in Orleans Parish



Source: Greater New Orleans Community Data Center

Figure 4. Population Density of Orleans Parish – 2000 U.S. Census



Source: Federal Emergency Management Agency (FEMA)

Impact of Hurricane Katrina on New Orleans

A mandatory evacuation of New Orleans was issued in advance of landfall of Hurricane Katrina. A large portion of the city heeded the evacuation recommendation. However, estimates of up to 100,000 residents did not leave the city.

The eye of Hurricane Katrina missed New Orleans by 10 to 15 miles. Strong winds ravaged the city, shattering windows, spreading debris in many areas, and bringing heavy rains and flooding to the eastern areas of the city.

The impact of Hurricane Katrina worsened on August 30, 2005, when several levees were breached by the elevated waters of Lake Pontchartrain. Up to 80% of the city was flooded. In some areas, the height of the flooding reached a depth of 25 feet (see Figures 5 and 6). As evidenced by overlaying Figures 4 and 6, some of the heaviest flooding was in areas of high population density.

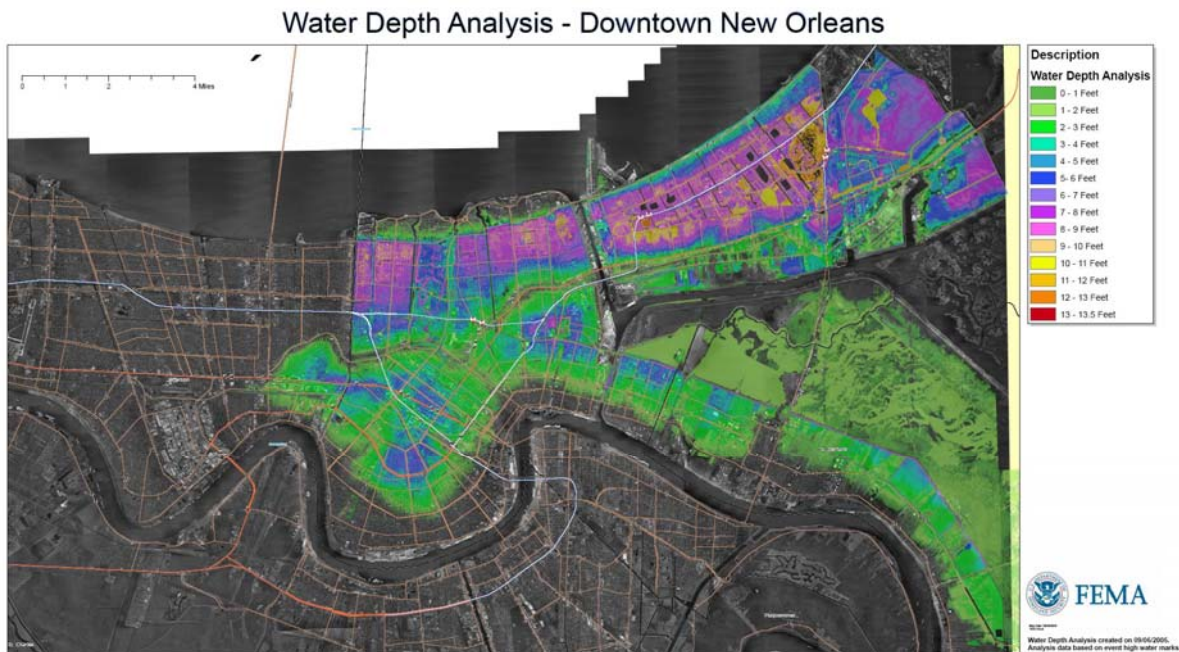
Note: Some portions of the Introduction are adapted from Wikipedia.org – Free Online Encyclopedia.

Figure 5. Map of New Orleans Levees and Locations of Major Levee Breaches After Hurricane Katrina



Source: Washington Post.com

Figure 6. Water Depth Analysis Map of Downtown New Orleans on September 6, 2005



Source: Federal Emergency Management Agency (FEMA)

Among the wide-scale impacts of Hurricane Katrina, the storm caused significant loss of life and disrupted power, natural gas, water and sewage treatment, road safety, and other essential services to the city.

Furthermore, the flooding resulted in environmental health challenges in vector/animal control, food safety and sanitation, drinking water, wastewater, contamination of water and sediments from gasoline and other toxic chemicals.

Security and personal safety concerns also existed among those residents who were unable or unwilling to heed the evacuation order and who were housed at the Superdome and New Orleans Convention Center.

A significant portion of the housing stock of New Orleans was at least partially submerged in water (see Figure 7), compounding the problems listed above.

Figure 7. Satellite Photograph of Greater New Orleans on August 31, 2005



Source: Houston Chronicle.com

Note: This satellite photograph shows the extent of the flooding. The only sections in this photograph that are dry are the far left side of image and sections immediately adjacent to the Mississippi River (bottom of image).

Creation of the Environmental Health Needs Assessment and Habitability Taskforce (EH-NAHT)

The wide-spread impact of Hurricane Katrina mobilized federal, state, and local resources to assist with the response and recovery. Early in the disaster response and recovery, federal, state, and local elected officials and public health and environmental leaders recognized the significant role of environmental health in the post-hurricane rebuilding of New Orleans.

At the request of Secretary Michael Leavitt of the Department of Health & Human Services (DHHS) and Administrator Steve Johnson of the U.S. Environmental Protection Agency (EPA), the Director of the Centers for Disease Control and Prevention (CDC), Dr. Julie Louise Gerberding, tasked Dr. Henry Falk at CDC's Coordinating Center of Environmental Health and Injury Prevention (CCEHIP) to lead a joint CDC/EPA taskforce. Dr. Falk was accompanied by Mr. Benjamin Grumbles, Assistant Administrator, Office of Water, EPA.

The taskforce was charged with identifying the overarching environmental health issues faced by New Orleans to reinhabit the city.

Dr. Henry Falk lead a multidisciplinary and multiagency team with expertise in environmental health science, environmental engineering, medicine, health and risk communication, and administration/logistics. The initial eight-member team consisted of personnel from CDC and EPA (see Team Members section).

APPROACH

The EH-NAHT team arrived in Baton Rouge, Louisiana, on Tuesday, September 6, 2005. The EH-NAHT established a base of operations at the Joint Federal Operations Center (JFOC). The JFOC is the headquarters for the Louisiana portion of the Federal Emergency Management Agency (FEMA) response to Hurricane Katrina. All 14 Emergency Support Functions (ESF) in the National Response Plan use the JFOC as a base of operations.

The team made initial contacts with the CDC on-the-ground leadership in New Orleans, Drs. Ali Kahn and Carol Rubin as well as Tim Baker. In addition, the team met with federal, state, and local public health and environment leadership including:

- Rear Admiral W. Craig Vanderwagen, MD – ESF-8 (Health) Leader
- Dr. Fred Cerise, Director, Louisiana Department of Health and Hospitals (LA DHH)
- Dr. Jimmy Guidry, State Health Officer, Louisiana Department of Health and Hospitals (LA DHH)
- Bobbie Savoie, Environmental Health Director for the Office of Public Health in LA DHH
- Dr. Kevin Stephens, Director, New Orleans City Health Department

- Multiple members of EPA Region VI and Louisiana Department of Environmental Quality (LDEQ)

The team completed air- and surface-level tours of New Orleans to see firsthand the impact of Hurricane Katrina.

Vision

Assess the environmental health needs and resources in New Orleans as well as identify milestones that would help determine progress towards reinhabiting the city.

Key Questions

The following key questions guided the work of the EH-NAHT:

1. What are the core or fundamental environmental health issues to be addressed?
2. Which agencies and organizations at the federal, state, or local level are responsible for, or involved in, the various environmental health issues?
3. What progress has been made and what challenges exist?
4. What is the timetable to address these environmental health issues?
5. What resources exist or need to be brought to bear to address these environmental health issues?
6. What are the key milestones and endpoints that define success?

Key Environmental Health Issues

The team identified a suite of environmental health issues and supporting infrastructure to address. This includes drinking water, wastewater, solid waste/debris, sediments/soil contamination (toxic chemicals), power, natural gas, housing, unwatering/flood water, occupational safety and health/public security, vector/rodent/animal control, road conditions, underground storage tanks (e.g., gasoline), and food safety.

Collaboration with Federal, State, and Local Partners

The EH-NAHT collaborated extensively with a diverse group of federal, state, and local partners when completing this initial assessment. Key agencies included were (in alphabetical order by category):

Local

- New Orleans City Public Health Department
- New Orleans Mayor's Office/City Government

- New Orleans Sewage and Water Board

State

- Louisiana Department of Environmental Quality (LDEQ)
- Louisiana Department of Health and Hospitals (LADHH)
- Louisiana Department of Transportation and Development (LADOTD)
- Louisiana Department of Homeland Security and Emergency Preparedness (LOHSEP)

Federal

- Department of Defense (DOD)
- Department of Energy (DOE)
- Department of Health and Human Services (DHHS)
- Department of Housing and Urban Development (HUD)
- Environmental Protection Agency (EPA)
- Federal Emergency Management Agency (FEMA)
- Food and Drug Administration (FDA)
- U.S. Army Corps of Engineers (USACE)
- U.S. Department of Agriculture (USDA)

Private

- Entergy
- Vieux Carre Commission

See Figures 8 and 9 for the organizational charts of the Louisiana and New Orleans City governments.

Timetable for Preparing Initial Assessment

The EH-NAHT prepared this initial assessment between Tuesday, September 6, 2005, and Monday, September 12, 2005. The data and conclusions/recommendations are current at the time of writing. However, the situation is very dynamic and changing daily.

TEAM MEMBERS

The following team from the Centers for Disease Control and Prevention/DHHS and the U.S. Environmental Protection Agency prepared this initial assessment:

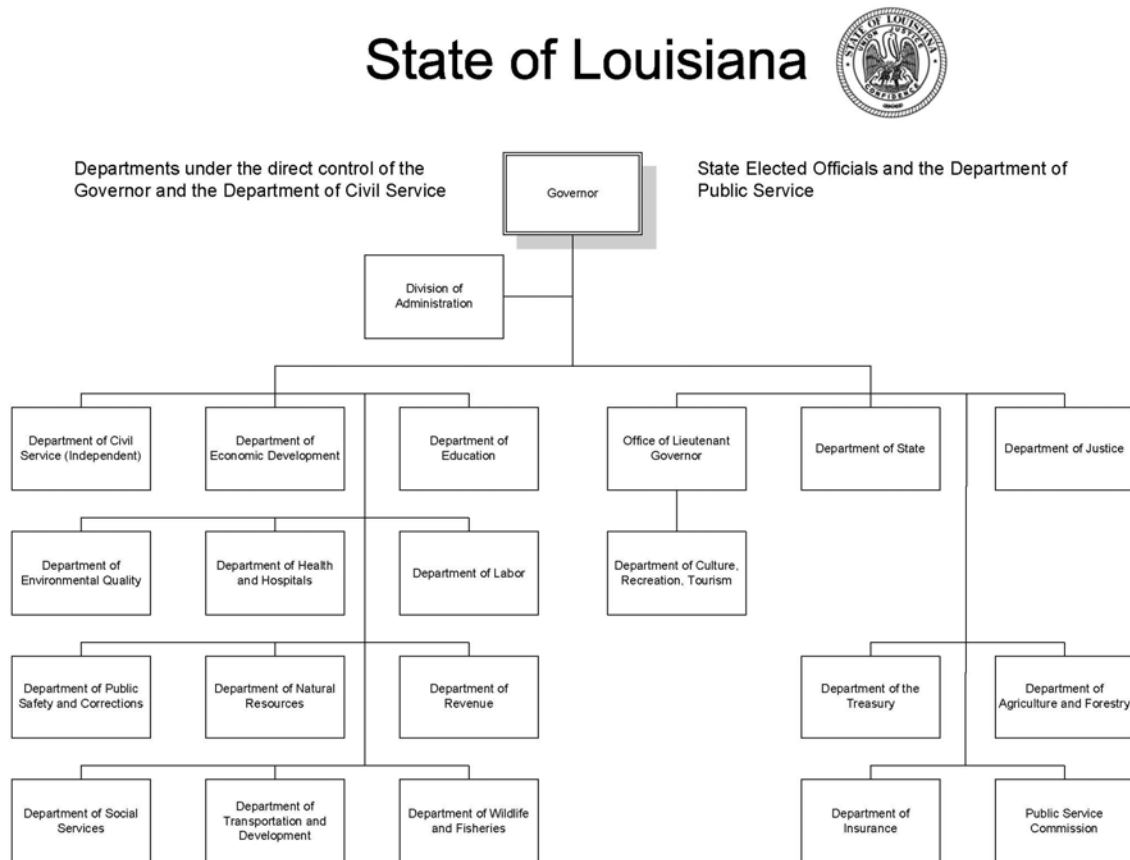
Centers for Disease Control and Prevention (CDC)

- **Henry Falk, MD, MPH**
Director, Coordinating Center for Environmental Health and Injury Prevention
- **CAPT Stephen Redd, MD**
Chief, Air Pollution and Respiratory Health Branch, National Center for Environmental Health
- **Judith Aguilar, BBA**
National Center for Health Marketing
- **Grant Baldwin, PhD, MPH**
Coordinating Center for Environmental Health and Injury Prevention
- **CAPT Sven Rodenbeck, ScD, PE, BCEE**
Agency for Toxic Substances and Disease Registry
- **Michael Youson, BS, CIS**
National Center for Environmental Health/Agency for Toxic Substances and Disease Registry

U.S. Environmental Protection Agency

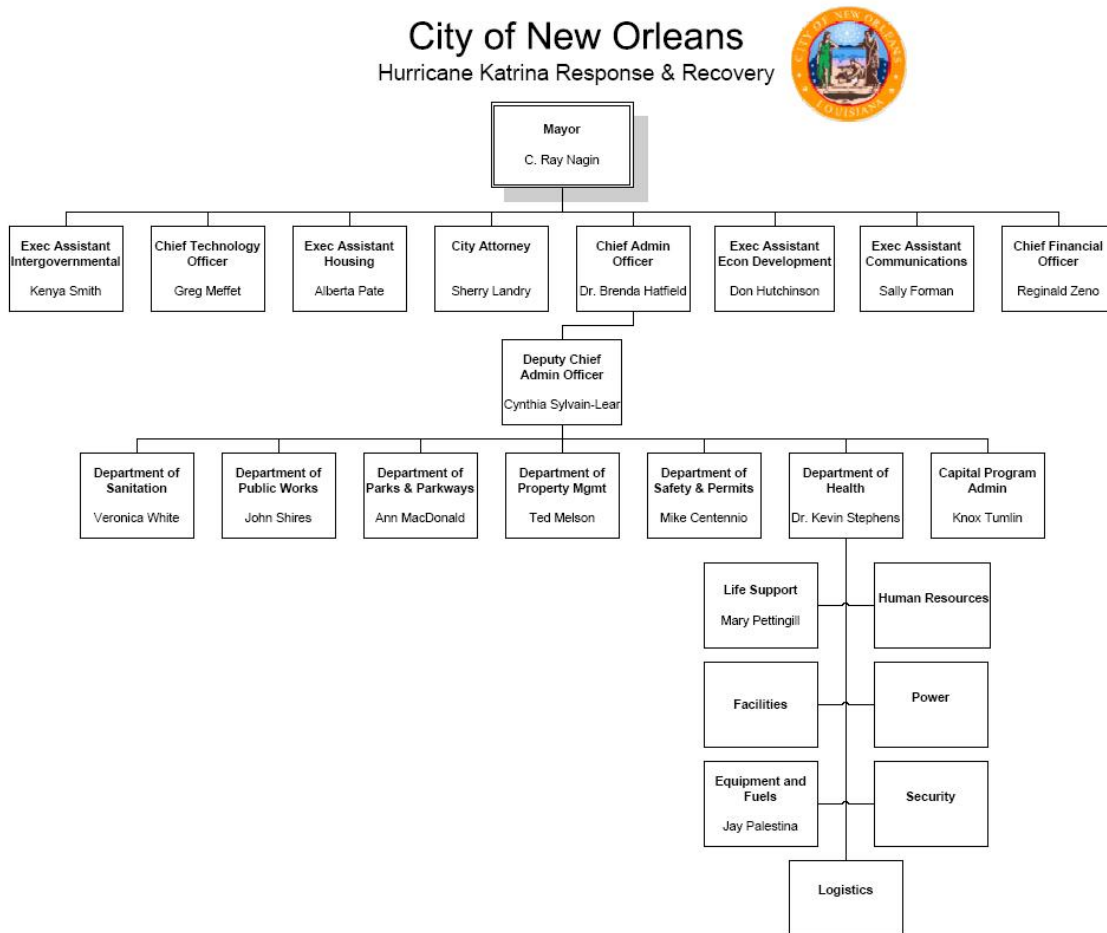
- **Benjamin Grumbles, JD, LL.M**
Assistant Administrator, Office of Water
- **Michael Shapiro, PhD**
Deputy Assistant Administrator, Office of Water

Figure 8. Organizational Chart for the State of Louisiana



Source: Adapted from Louisiana.gov

Figure 9. Organizational Chart for the City of New Orleans



Source: Adapted from New Orleans City Government

FINDINGS

Summary of the Status of 13 Key Areas Impacting Reinhabiting New Orleans

The following is a summary of the status of 13 key areas that impact the reinhabiting of New Orleans. All of the 13 key areas are complex in their own right and the categorization described below is meant simply to place each area in the context of the others given current progress of reinhabiting the city.

The table below groups these areas by increasing time and complexity to restoration of services. Part of the complexity relates to how specific and explicit the criteria for the end points are for each function (e.g., potable water has very specific regulatory criteria, whereas the assessment criteria for which houses are not viable and need to be demolished vary somewhat in different disaster settings).

Occupational safety and health as well as public security cross cut all the other areas.

Level 1	Level 2	Level 3	Level 4
<ul style="list-style-type: none"> • Unwatering • Power • Natural Gas • Vector/Rodent/Animal Control • Underground storage tanks (e.g., gasoline) • Food Safety 	<ul style="list-style-type: none"> • Drinking Water • Wastewater • Road Conditions 	<ul style="list-style-type: none"> • Solid Waste/Debris • Sediments/Soil Contamination (Toxic Chemicals) 	<ul style="list-style-type: none"> • Housing

Level 1

Unwatering

Current

- 60% of the city on the east side of the Mississippi River was under water on September 8, 2005.
- The water is being pumped into Lake Pontchartrain.
- Recent estimates suggest 3 to 4 weeks to completion.

Barriers

- Resumption of nonemergency power to pumping stations
- Restoration of the pumping station capacity
- Potential delays due to concerns about the quality of water being pumped into Lake Pontchartrain

Issues/Decisions

- Need to evaluate quality of water going into Lake Pontchartrain and other associated water systems (see Food Safety section).

- Long-Term: Need to determine extent of restoration and modernization of the unwatering and levee systems.

Power

Current

- Power is on in some portions of the downtown business area.
- Power is being restored as areas are unwatered and given the available workforce. It is likely power will be restored by sections of the city soon after they are unwatered.

Barriers

- Unanticipated slowdown in the unwatering process is a barrier.

Issues/Decisions

- Long-Term: Need to reconfigure the power system based on redevelopment decisions.

Natural Gas

Current

- Adequate pressure was maintained at central facility and much of the distribution system.
- Assessing areas as they unwater and finding limited leaks that are being repaired.
- Shutting off ruptured lines in the 17th Street levee break area.
- Closed valves and isolated eastern New Orleans (see Figure 5) from remainder of the system because of extensive flooding and potential damage to system.

Barriers

- Unanticipated slowdown in the unwatering process to allow access for repairs
- Restoration of natural gas flow to eastern New Orleans

Issues/Decisions

- Long-Term: Need to reconfigure the natural gas system based on redevelopment decisions.

Vector/Rodent/Animal Control

Current

- Standing water within New Orleans will likely result in a population increase of mosquitoes and flies.
- The New Orleans Mosquito and Termite Control Board can resume normal operations as soon as unwatering operations are completed and major road blockage is removed.
- The flood waters will have caused the rodent population to relocate to higher ground.
- Stray household pets and animals may be a hazard.

Barriers

- Unanticipated delays in unwatering and the unavailability of equipment

Issues/Decisions

- Frequency and extent of control activities

Underground Storage Tanks (e.g., gasoline)

Current

- Flood water is contaminated with gasoline.
- Structural damage to tanks and flood waters entering tanks may have caused release of contents.
- Assessment of storage tanks will begin after unwatering.

Barriers

- Qualified inspectors are needed to rapidly assess conditions for all tank sites.
- Have uncertain capacity to remove and replace damaged tanks and clean up contamination.

Issues/Decisions

- With adequate staff, assessment can be quickly completed.
- Need for adequate resources if extensive damage to storage tanks exists.

Food Safety

Current

- Wind and flood damage resulted in structural damage to the building infrastructures of the food wholesale and retail establishments (approximately 3,800 within Orleans Parish).
- Power loss in the impacted areas has resulted in food spoilage.
- Some food items came in direct contact with contaminated flood waters.

Barriers

- LA Department of Health and Hospitals needs many additional sanitarians to conduct timely inspections of food establishments.
- Potable drinking water and electricity needs to be available at the food establishments before inspections and food service permits are issued.

Issues/Decisions

- Develop a strategy for retail and wholesale food inspections, permitting when potable water and electricity are available.
- Explicit guidance to retailers, consumers, and residents on proper handling or disposition of food items that came in contact with flood waters or that spoiled because lack of refrigeration.

- Determine safety of fish and shellfish as a result of unwatering into Lake Pontchartrain and associated water systems.

Level 2

Drinking Water

Current

- Water supply for New Orleans on the East Bank (approximately 90% of the population) is not potable.
- Limited provision of potable water available in approximately 1 month.
- The major water treatment plant (Carrollton) is operating but water pressure is low throughout the distribution system.
- Damage to the distribution system is anticipated.

Barriers

- Repair of antiquated equipment
- Significant damage to the distribution system
- Full restoration of the system could take a year or more

Issues/Decisions

- Need to restore service on limited basis to serve recovery workers.
- Extent of reconstruction needed for Carrollton treatment plant and distribution lines.
- Long-Term: Need to reconfigure the drinking water system based on redevelopment decisions.

Wastewater

Current

- Treatment plant serving most of the East Bank of New Orleans is flooded and not functioning.
- Treatment plant serving most of the East Bank of New Orleans may be returned to limited operation in the near term.
- Treatment plant serving most of the West Bank of New Orleans is not fully functional.
- Raw sewage is being discharged into the Mississippi River.
- Damage to the collection system on the East Bank is anticipated.

Barriers

- Repair of antiquated equipment is needed.
- Collection system is significantly damaged.
- Flood water removal and institution of sewage treatment capacity could take up to several months for the East Bank of New Orleans.
- Full restoration of the system could take 1 year or more.

Issues/Decisions

- Need to integrate collection system repair with existing regulatory requirements to upgrade system.
- Decide the extent of raw sewage outflow that is acceptable on a temporary basis.
- Long-Term: Need to reconfigure the wastewater system based on redevelopment decision.

Road Conditions

Current

- Road access is available to New Orleans from all directions except east.
- Road access from the east will require a minimum of several months.
- Approximately 60% of city roads are still under water with 30%–40% of roads passable.
- City is patching asphalt in central business district.

Barriers

- Unanticipated delays in unwatering or inadequate fuel, equipment, or support
- Hidden damage to flooded roads

Issues/Decisions

- Long-Term: Need to reconfigure the road system based on redevelopment decisions.

Level 3

Solid Waste/Debris

Current

- Huge quantities of debris estimates ranging as high as 30 million cubic yards will need to be removed and managed as a result of storm damage and future demolition and reconstruction activities.
- Some of these materials are hazardous.
- Inter-Agency task force is developing plan for management, disposition, and containment of debris.

Barriers

- Treatment, disposal, and containment methods must be determined.
- Sufficient appropriate sites for landfill, incineration, or other method of volume reduction must be selected.
- Need to separate hazardous materials from other debris.
- Regulatory issues must be addressed.
- Demolition and debris treatment, disposal, and containment could be ongoing for greater than 1 year.

Issues/Decisions

- Extent of demolition can significantly alter the amount and scope of debris.
- Determine the amount and method of environmental monitoring to be done during debris treatment, disposal, containment, and transport.

Sediments/Soil Contamination

Current

- Potential exists for releases from chemical plants, manufacturing facilities, refineries, homes, and other buildings because of flooding and other hurricane-related damage.
- Distribution of contamination is unknown in the city.
- Sampling and analysis of sediments and soil is just beginning.

Barriers

- Potentially large areas of the city may need to be assessed and cleaned up.
- Unanticipated delays in unwatering may delay sampling.

Issues/Decisions

- Decide on the degree to which repeated, costly, and time-consuming analysis may be required.
- Design comprehensive sampling and analysis plan.
- Determine appropriate clean-up levels (standards and regulations).
- Safely treat, transport, and dispose contaminated materials.
- Timeline is difficult to predict until extent of contamination is determined.

Level 4

Housing

Current

- Estimates range as high as 80% of residential structures in New Orleans that sustained flood damage.
- A large proportion of all New Orleans homes may have sustained severe structural damage and may not be viable.
- The full extent of the problem is not known.

Barriers

- The problem will be fully known when unwatering is complete, assessments done, and policy guidance developed and agreed upon.
- Legal and procedural issues need to be resolved.
- It is difficult to track and communicate with a large and widely-dispersed displaced population..

Issues/Decisions

- Procedures are needed to be established on how to permit safe and controlled access to the city for recovery workers, transient and temporary visitation to homes and businesses, and rehabilitation neighborhood by neighborhood.
- Key decisions need to be made (see next section) before it is possible to:
 1. Move people back to minimally damaged structures.
 2. Begin cleanup of buildings that are damaged but do not require demolition and other buildings that are of particular historical significance.
 3. Begin inspection and demolition of buildings that are structurally unsound or otherwise uninhabitable. In all cases, methods to communicate with building owners and non-owner residents are needed.
- The rehabilitation, cleanup, demolition, and reconstruction process will take years to complete.

Cross-Cutting Area

Occupational Safety and Health/Public Security

Current

- Worker health and safety is a critical issue.
- Current additional security provided will remain essential for some time to come.

Barriers

- Need fuel for vehicles.

Issues/Decisions

- Give clear guidance for recovery workers and public on appropriate health and safety methods.

Future Considerations

Additional areas may be added to this list in succeeding updates as conditions change (e.g., air pollution may become a more significant issue as large-scale movement of debris commences). In addition, we have not addressed restoration of health services system. This issue is being addressed by others, and it is clearly an essential service to re-inhabiting the city.

In this early emergency phase, our team focused on environmental issues related to restoring essential services and initial decisions about re-inhabiting the city. The EH-NAHT recognized that many additional factors associated with quality of life (e.g., urban design and development decisions) as well as factors related to social well-being and mental health are critically important. These factors were beyond the scope of the initial assessment but can be considered later.

DISCUSSION

It is important to attend to each of the 13 areas highlighted above. The timeline for healthy rehabilitation of the city depends upon addressing the suite of these issues systematically. Each area has critical decision points where decision-makers need to balance the pressures of reinhabiting the city with the need to attend to these environmental health and infrastructure areas fully.

Housing was identified as a unique challenge to reinhabiting New Orleans. Further, guidelines and standards to drive decision-making are less explicit for problems of this scope and complexity.

The remainder of the discussion focuses on housing because of its central role in fully reinhabiting New Orleans.

Housing Assessment

A substantial proportion of all residential structures in New Orleans have sustained severe structural damage from flooding. Additionally, the nature of the flood water may make some dwellings uninhabitable even if they are structurally sound.

Newspaper accounts and preliminary assessments indicate that as many as 80% of dwellings will have sustained damage rendering them at risk. If this proportion is correct, about 100,000 structures may require assessment for viability. These estimates are based on a qualitative review of satellite images of the extent and depth of floodwaters. In general, areas located along the lakefront and east of the industrial canal appear to be most severely affected. The West Bank area sustained little damage from flooding and areas just north of the Mississippi appear relatively spared. Therefore, this discussion focuses on the issues of the East Bank of New Orleans.

FEMA (Individual Assistance Program) has requested authority to use satellite images to identify neighborhoods and residential structures for paying housing losses sustained in the hurricane and floods. This is significant because it will probably be the first attempt at quantifying the number of structures that will need to be demolished. As flood waters recede, strike teams (from the FEMA Individual Assistance Program) will enter New Orleans and evaluate needs, including the structural integrity of residential structures.

The primary responsibility for housing is with city government (Housing and Neighborhood Development – City Cabinet). The projected timeline for resolving the housing situation is uncertain and is dependent on a series of policy decisions that local government officials will be making in the weeks and months ahead. Depending on the policy choices of local government, demolitions could begin within weeks to months and could take several years to complete. Demolitions could be completed within 1 year if rapid decisions for wide areas are possible.

Responsible officials need to review the existing legal authorities and ordinances to declare housing as uninhabitable and requiring demolition. In addition, state laws should also be examined. These reviews will help officials understand the range of possibilities and to what extent these authorities are adequate to deal with the unprecedented scale of destruction. Further, officials need to have a clear knowledge of the authority to declare a structure as an imminent health hazard, requiring demolition.

The policy issues related to housing confronting New Orleans are complex and interdependent, the scale and breadth of which is unprecedented in the United States. Some of these policy choices require careful examination of existing legal authorities, others require expert advice, and others will require careful consideration of a broad range of affected stakeholders.

A reasonable approach to the New Orleans housing situation is to do a rapid, preliminary sorting of housing structures to separate those that sustained minimal or no damage. This is the initial policy decision.

Methods for Home Assessments in Flood Affected Areas

Structures sustaining some flood damage that could be remediated without demolition or those structures which appear to require demolition could be assessed using one of the following methods.

Individual Home Inspections

Individual inspection of each housing unit or structure is the most time consuming and exacting method to determine whether structural integrity is preserved and whether the structure is free of other hazards that would constitute a threat to health. Teams of building engineers and housing inspectors would conduct these assessments. The advantage of this method is that it would provide a high degree of confidence that the classification decision to demolish is correct. The disadvantage is that it would be very time consuming, costly, and perhaps not feasible because of the scale of the flooding. In addition, individual authorization to enter each structure would be required under normal procedures.

Neighborhood Inspections

Teams of surveyors could determine the maximum height of the flood waters in neighborhoods by visual inspection. In this instance, neighborhoods could probably best be defined using topographical features that would indicate a similar level of flooding. This assessment of maximum level of flooding could then be used to determine the extent of flooding in each structure.

Geospatial Imaging Inspections

Another method to assess flooding of homes would be to use geospatial imaging to assess the extent and depth of flooding by neighborhood and use these data to classify all housing in neighborhoods meeting certain criteria for degree and duration of flooding as requiring demolition. This method is similar to the method of having surveyors determine the height of flooding and would similarly require criteria for classifying housing as requiring demolition. This method would be the simplest and least expensive to apply. It also would be the most subject to dispute from property owners.

Non Housing-Stock Criteria

A final method to determine that housing requires demolition is to declare that housing is an imminent hazard to health. The criteria for such a determination would also have to be determined, and additional data, perhaps from sampling of debris or sediment, would be needed to support such determinations. This is not likely to be a large-scale method but may be appropriate in certain settings.

Other Considerations

A wide variety of other considerations drive decision-making about housing. Several of these are discussed in detail below.

Demolition Protocol

In addition to the procedures to identify structures needing demolition, the procedures for actually conducting the demolition need to be developed. The potential for hazardous materials in residential structures before demolition need to be considered, such as mercury in thermostats, paint (including lead-based), pesticides, and asbestos in roof, insulation, or flooring material. How extensive the removal of these materials is and the ultimate destination, treatment, and reduction of the debris from the demolished structure will need to be determined.

Right of Entry to Home

Legal issues need to be addressed and resolved, including temporary entry into houses not being renovated.

Historic Buildings

Responsible officials should develop policies for dealing with historic buildings that sustained damage that would otherwise be classified as requiring demolition. This could be handled through an appeal process through which other owners of housing structures that require demolition could also appeal that decision. Owners of such structures should be required to submit a plan for renovation with a timeline to building authorities for evaluation.

Reentry to New Orleans

The demolition process requires some method for preventing residents from returning to areas of New Orleans where the demolition is occurring. This is likely to be challenging on several fronts. From a public perception perspective, residents are likely to want to return to the area. As residents, workers and others reenter New Orleans, it will become extremely difficult to keep persons out of these areas without physical barriers, checkpoints, and patrolling.

Responsible officials need to develop criteria to permit reopening to residents of neighborhoods of New Orleans that were minimally flooded or not flooded at all. These can be classified under the general heading of restoration of essential civil services including power, drinking water, wastewater, storm water, EMS, Fire and police services, and access to medical care.

Mold and Microbial Growth

Structures that need cleanup but not demolition present a different series of challenges. In addition to ensuring structural integrity, renovation plans would have to include plans to remove or dry flooded building material to assure that mold and other microbial growth does not recur after renovation. Worker safety concerns must be addressed in these plans for renovation. Mold growth is likely to be extensive and appropriate precautions during this process are essential.

Temporary Housing for Residents and Recovery Workers

As demolition and reconstruction commence, persons who were displaced from New Orleans will attempt to return. In many cases, their residences will have been destroyed. How and where these people will be housed will be a major issue. Because of the scale and timeline of debris removal and restoration efforts, as well as demolition and reconstruction, housing temporary workers will be a major issue.

Communications

In all these decisions, communications need to be consistent, clear and sensitive to the needs of the local population. Communication will be important in gaining and retaining the trust of all stakeholders

Communicating the extent of the destruction of housing may be the most important first step. A clear explanation of the process used to make this preliminary assessment is a critical component of this communication.

Communicating with owners is likely to be very difficult as contact information will be difficult to obtain. A variety of methods could be used to develop a registry of displaced persons, which would have utility beyond communicating on housing issues. FEMA's

Individual Assistance Program has an established procedure for collecting information from residents who are seeking reimbursement for housing losses.

CONCLUSIONS

Hurricane Katrina was an extraordinary catastrophe for the city of New Orleans and its inhabitants. Federal, state, and local agencies and relief organizations are responding heroically to the disaster. The federal government, including the agencies represented on this task force, should be doing their utmost to assist in recovery and rebuilding. This initial assessment is an attempt to provide an initial assessment of the key environmental health issues as they relate to reinhabiting the city of New Orleans.

Because of the dynamic nature of each phase of recovery, these initial impressions will be revised and refined with time. The EH-NAHT, while not directly engaged in immediate response activities, has interacted closely with federal, state, and local partners in developing this initial assessment.

All systems are an issue at this time. Long-term solutions to these many issues are critical to allow resumption of normal life in New Orleans and to prevent reoccurrence of such an event in this area. The EH-NAHT evaluated 13 critical areas related to environmental health and habitability.

The EH-NAHT has the following conclusions based upon our initial assessment:

- **A complex array of environmental health problems exist in New Orleans.**

The most striking feature of the disaster is the array of key environmental health and infrastructure factors affected all at once. All key environmental health and related services are being reestablished and this needs to be done in a very coordinated and well-planned way.

- **The unwatering of New Orleans is a critical first step.**

The unwatering is an essential first step to allow access for assessment and repair of all basic services and habitability barriers. Some significant assessments are not yet started because of the continued unwatering, which could take an additional 4 weeks to complete. These assessments may impact the timing, resources and scope of the needed repairs/replacements.

- **It is important to bring infrastructure systems in New Orleans back on line.**

Different timeframes are needed to bring the various infrastructure systems (e.g., drinking water, wastewater, power, and natural gas) on line with varying degrees of capabilities. Drinking water systems and wastewater treatment systems have a planned course to restoration but full restoration will be delayed by the many breaks in the distribution and collection systems and by the need for upgrade and repairs in older systems. Unanticipated delays in unwatering and the scope and complexity of the interdependent systems must be kept in mind.

- **The cleanup of debris (including housing debris) and potentially contaminated soil/sediment in New Orleans are rate-limiting factors.**

The timeline for debris treatment, disposal, containment, and transport as well as the testing of potentially contaminated soils/sediment will slow or accelerate the rate at which the city can be reinhabited. The potential contamination of soils/sediments has great uncertainty attached to it. This will require comprehensive sampling and testing of a broad array of materials to identify any widespread contamination or selected hot spots and to ensure safety to returning inhabitants or for redevelopment.

- **Intense interest will exist to reinhabit New Orleans.**

Significant pressure will occur to allow rehabilitation. A single decision will not be made to reinhabit the whole city at one time. It is expected to be done neighborhood by neighborhood IF it is possible to prevent access to the closed areas of the city. Worker safety and health as well as public safety and security are mandatory enablers for all of the activities.

- **It is critical to address the housing issues in New Orleans.**

Housing is likely the most critical issue in reinhabiting the city because of the

- Large percentage of city housing that was flooded and is not likely to be viable;
 - Intense personal connection an individual has to their home;
 - Legal, jurisdictional, and procedural issues involved in the decision-making process;
 - Large proportion of the city population that is displaced. Some residents are a significant distance away from New Orleans or may not intend to return;
 - Difficulty in establishing and maintaining communications with the widely dispersed population;
 - Challenge of identifying acceptable methods and resources for assessing such a large number of homes; and the
 - Scope of the demolition process and safe and efficient removal of debris.
- **An immediate need exists to allow temporary or transient entry of recovery workers, residents, and business owners.**

In the immediate period, explicit guidelines are being developed for safe entry of recovery workers to New Orleans, for brief entry by residential and business owners to retrieve key household or business items in neighborhoods of the city where it is safe to do so, and for reinhabiting the least impacted areas of the city where key environmental health and infrastructure conditions are met.

- **Ensuring worker safety and health and public safety and security are essential.**

Public security and intensive efforts to achieve worker safety and health for the very large recovery workforce, working often in extraordinarily difficult and challenging conditions, is essential to rebuilding New Orleans.

- **The criteria for short-term and long-term return to New Orleans should be tailored to the timeframe and population.**

Different criteria is needed for the short-term and long-term return to the city (e.g., use of bottled water in the absence of potable water will be acceptable for recovery workers and select others on a limited short-term basis versus the general population, which includes children and the elderly over the long-term).

RECOMMENDATIONS

The EH-NAHT has the following recommendations based on our initial assessment:

- **It is important to involve state, local, and other stakeholders in decision making.**

All the issues in reinhabiting New Orleans are interwoven, complex, and cannot be addressed individually. It is extremely important that decisions are made involving state, local, and federal staff as well as all other stakeholders, particularly the local population.

- **Developing a shared vision for the rebuilding (including infrastructure) is critical.**

Because of the magnitude of the devastation, it is critical that decisions be guided by a clear shared vision by all stakeholders of what the rebuilt New Orleans should be. As devastating as this event is, the vision of the future of the city is critical in guiding development for such a widely impacted area.

- **Federal, state, and local decision-makers should explore processes used by other areas in devastating circumstances.**

New Orleans should draw upon the experiences of other localities that addressed devastating events—areas such as New York (World Trade Center), Florida (repeated hurricanes), and San Francisco (earthquake). Their experiences and solutions might serve as examples to New Orleans on processes that can be used for creating a broad vision for redevelopment, for identifying key decisions and strategies, and for involving all stakeholders, including the displaced population, in the broad-impact, critical decisions that will have to be made.

- **Maintaining collaboration with involved agencies is essential.**

Maintain, through FEMA and other mechanisms, broad collaboration and a true sense of partnership in developing a very coordinated and sustained effort to recovery.

- **Attending to the housing decisions is critical.**

A number of critical decisions need to be made about housing. These decisions include

- Developing explicit guidelines for entry by recovery workers, for brief periods of entry by residents and business owners to retrieve essential belongings, and for reinhabiting relatively undamaged neighborhoods of the city.
- Creating a neighborhood-by-neighborhood approach for assessing housing, cleanup/demolition, and reinhabiting/rebuilding.

- Selecting method(s) for assessing large amount of damaged housing, with rapid methods necessary for severely damaged housing.
- Resolving legal, administrative, and procedural issues.
- Fostering and maintain on-going contact with the large displaced population – particularly for any actions that might require owner authorization.

- **It is necessary to maintain a systems-level perspective.**

Monitoring the progress in all key areas of environmental health and infrastructure is important because reinhabiting New Orleans depends upon success in all areas. This initial assessment identified 13 key areas that need to be tracked.

- **Resolving potential exposures to hazardous material is important.**

It is important to resolve the questions about the potential for exposure as quickly as possible. This issue has the widest degree of uncertainty.

- **Officials should ensure public safety and security and worker health and safety.**

Maintain a central focus on public safety and recovery worker health and safety throughout the rebuilding of New Orleans.

- **Engage and communicate with the displaced population.**

Develop a mechanism to regularly and substantively engage and communicate with the displaced population to provide a progress update on city-wide activities as well as activities related to neighborhoods and individual homes. This work could involve the use of GIS, the Internet, and other innovative strategies.

- **Maintain a broad vision on issues affecting the rehabilitation of the city.**

This initial assessment from the EH-NAHT focused on the immediate issues related to reinhabiting the city—primarily those issues that affect essential systems for safe living. As these immediate issues are dealt with, it will be important to focus on issues related to quality of life and social well-being and how they are integrated into a redevelopment plan.

- **Create a long-term habitability strategy.**

The long-term solution to the risk of flooding and the viability of New Orleans depend on fully protective levee and unwatering systems for the population returning to and reinhabiting the city. It is extremely important to address the long-term protection of the city from another such event of this magnitude.