Hurricane Katrina - Lessons Learned for the CIH
AIHA Conference & Exposition
Philadelphia, PA
June 6, 2007
PO 126 – Microbial & Allergen General Topics
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LESSONS LEARNED - BUILDINGS WITH PHYSICAL DAMAGES AND WATER INTRUSION

• August 29\textsuperscript{th} Hurricane Katrina – Direct Physical Damages And Water Intrusion
• Two Weeks of Sustained Power Outage and Interior Water Wetted Surfaces With Mold Growth
• September 23\textsuperscript{rd} Hurricane Rita – Additional Water Intrusion Through Openings
Hurricane Katrina

• Two modern high rise buildings
  – Building with glass and aluminum curtain wall
  – Building with stone veneer curtain wall with aluminum and glass windows

• A historic wood frame building
Glass and Aluminum Curtain Wall

- ~ 100’ of Cap Flashing Torn
- Water Cascade Down And Into Structure
- Window Damages
- A 20’ X 30’ Section Of Roof Physically Sucked Out
- Water Intrusion Through Windows
- ‘Surge’ of Water from Parking Structure Entered Building Through Expansion Joint
Obvious Damage – Broken Windows
Damage to Windows

• Obvious failure of glazing with flooding between panes
• Additional Water Intrusion Through Broken Windows, Loose Spandrel Panels and Via Interstitial Spaces
Stone veneer curtain wall

- Roof Mounted equipment damaged
- Primary Roof Intact
- Limited Window damage (Approximately 15 total)
- Limited Evidence of Water Intrusion Through Windows
- First Floor Exterior Curtain Window Wall was dislocated in one area
- Floodwater entered building
Historical Wood Frame

- Pre-Civil War Construction with Renovations
- Physical Damages & Water Intrusion
  - Wood Frame Window Assemblies
  - Building Envelope (Uninsulated Exterior walls Wood Siding)
- Wet + Warm + Time
- Widespread Mold Growth on finishes and contents
Secondary Hurricane Impacts

Aggravated by Restricted Access to City and Power Outage Over a 3 Week Period

• Buildings Remain “Closed Up”
• Minimal Attempt to Mitigate Damage
  – Drying of Structure/Contents
  – Removal of Saturated and Ruined Finishes
• No HVAC Operation or Natural Ventilation

Result = Mold Growth on Nearly All Susceptible Surfaces or “Mold Bloom”
Damage Assessments

• Assessment of moisture conditions
  – Map wet materials
  – Map mold locations
  – Determine remediation requirements
    • Drying
      • Wet material removal before mold growth
      • Mold remediation
  – Substrates (concrete, framing, etc.) dry enough for finishes?
Moisture Survey
Proof Of Claim Activities

- Moisture Survey With Visual, Photo and Moisture Measurement Documentation Is Critical
- Mapping of Floor Plans with Keyed Areas Aids In Containment
- Restoration Should Start Immediately
Visible Mold
Ceiling Damage
Collateral Work
Damage Assessment Basics

• Core and Shell vs. Tenant Spaces
  – Rehab requirements

• Structural evaluation
  – Hurricane and/or flood damage

• Feasibility of rehabilitation of structure or component
  – Physical feasibility
  – Economic feasibility
  – Repair vs. replace
Damage Assessment

• Building envelope (exterior walls and roof) rehab requirements
  – Roofs
  – Curtain walls
  – Windows

• MEP (Mechanical / HVAC, Electrical and Plumbing)
  – Storm damage
  – Environmental damage (high heat and humidity)
Roof Ripped Off
Building Open to Rain
Roof Looks OK
Water in Roof Assembly
Obvious MEP Damage – Fan
Ripped Off Curb
Ductwork Affected by High Humidity
Remediation, Restoration and Construction

• Construction management in the midst of crises
  – scheduling,
  – budgeting,
  – bidding or negotiation,
  – coordination of trades during construction,
  – expediting of construction work.
Remediation, Restoration and Construction

• Remediation
  – Drying
  – Mold remediation
  – Removal of mold, moisture damaged materials,
  – Asbestos abatement
  – Lead paint abatement
  – Blackwater - remediation of chemical and biological contaminants.
  – Clearance sampling and visual inspection
Remediation, Restoration and Construction

• Restoration.
  – Rehabilitation of building envelope (exterior walls and roof).
  – Replacement of finishes and furnishings.
  – Rehabilitation of a building’s core and shell.
  – Rehabilitation of MEP equipment and facilities.
  – Structure rehabilitation.
  – Demolition.
Remediation, Restoration and Construction

- Commissioning and testing
- Design of temporary conditioning and dehumidification systems
Remediation, Restoration and Construction

• Confounders
  – Improve construction to avoid future problems
  – Updated building codes
  – Changes in zoning ordinances
  – Historic restoration
  – Unavailability of replacement parts
  – Repair or replace obsolete equipment and systems
Environmental and Materials Assessment

• Indoor air quality assessments and surface contamination
  – Assess habitability prior to remediation
  – Determine feasibility of partial occupancy
  – Monitor environment during partial occupancy
  – Document habitability prior to re-occupancy of remediated areas.
Partial Occupancy

- Mold Remediation in North End of Building
- South End of Building Occupied
Environmental and Materials Assessment

• Environmental Issues
  – Asbestos survey
  – Lead paint survey
• Fire protection requirements
• Evaluate water affected substrates for continued utility and feasibility of rehabilitation
  – Drywall
  – Plaster
  – Wood
Environmental and Materials Assessment

• Hidden damage
  – Roofs
  – Curtain walls
  – Glazing
  – Adverse hygrothermal reactions to wetting
Lessons Learned for the CIH

• Before the Storm
• After the Storm
• Dispute Resolution
• Mapping and Database Development
• Don’t forget safety!!!!
• Waste Reduction and Sustainable Development Issues
Before the Storm

- Document existing conditions of the building
- Get drawing to high ground
- Make sure that roof and wall construction meets current hurricane codes
- Make sure that roofs and walls are well maintained
- Correct conditions that make the building sensitive to moisture damage
- Negotiate a contract with an environmental consultant
- Negotiate a contract with a restoration contractor
- Negotiate a contract with a drying contractor
After the Storm

- Damage Assessment
- Environmental and Materials Assessment
- Remediation, Restoration and Construction
- Dispute Resolution, and
- Mapping and Documentation.
Dispute Resolution

• Restoration vs. Betterment
  – Mold result of the hurricane or some pre-existing defect
    • Was there improper design, construction or maintenance
  – Need to upgrade facility to meet current building codes.
  – Does value of corrective work trigger requirement for meeting current building codes.
Mapping and Database Development

• Photographic and videographic documentation
  – Visible light
  – Infrared

• Aerial photograph interpretation of facility damage and extent
  – Visible light
  – Infrared
Mapping and Database Development

• GPS mapping
  – contamination and sampling locations.
  – flood zone location.

• Preparation of geographical information systems (GIS) databases of sampling and contamination locations.
Mapping and Database Development

• Computer assisted evaluation of physical assets
  – building envelope,
  – core and shell,
  – finishes,
  – MEP,
  – site facilities.

• Facility management

• Documentation for dispute resolution
Don’t Forget Safety!!!
Waste Reduction and Sustainable Development Issues
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