

Hurricane Preparedness

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Hurricane season begins on June 1 and forecasters predict an “average” or “near normal” season. Fewer hurricanes, however, do not necessarily mean a lesser threat of disaster. Records for the most intense U.S. hurricane (1935 Florida Keys hurricane) and the second costliest, Andrew in 1992, occurred in years which had much below-average hurricane activity.

A recent survey of business leaders also indicates businesses may not be as prepared as they should be. Interviews of 100 U.S. and Canadian financial executives from large U.S. and Canadian corporations for the FM Global commissioned [2008 Natural Disaster Business Risk Study](#)ⁱ found that 48 percent are not well-prepared for a hurricane.



Figure 1. Hurricane Ike, September 2008, (NOAA)

2009 Hurricane Season Forecast

National Oceanic and Atmospheric Administration (NOAA) forecastersⁱⁱ predict a near-normal Atlantic hurricane season is most likely this year. Forecasters say there is a 70 percent chance of having nine to 14 named storms, of which four to seven could become hurricanes, including one to three major hurricanes (Category 3, 4 or 5).

In their April 7 forecastⁱⁱⁱ Professor William Gray and Philip Klotzbach at Colorado State University foresee average activity for the 2009 Atlantic hurricane season. “We anticipate an average probability of United States major hurricane landfall.”

The Colorado State University scientists are forecasting:

- 12 named storms
- 6 hurricanes
- 2 intense hurricanes (category 3, 4, or 5)
- 54% probability of at least one major (category 3-4-5) hurricane making landfall in the United States

Professor Mark Saunders and Dr. Adam Lea from the Aon Benfield Hazard Research Centre at the University College London predict^{iv} an active hurricane season with a “high likelihood that activity will be in the top one-third of years historically.”

Hurricane Hazards

Hurricane hazards include damaging wind, hurricane-spawned tornadoes, flooding from heavy rainfall, and coastal flooding from storm surge. Cascading impacts result from damage to critical infrastructure including electrical power, telecommunications, and transportation. Hurricane Katrina proved that these cascading impacts include widespread supply chain disruption.

Wind

High winds from a tropical storm or hurricane can damage buildings in many ways, and roofs are particularly vulnerable. Perimeter flashing can be loosened or removed. Failure of perimeter flashing allows wind to lift a portion of the roof covering and insulation. The covering may peel back, and roof deck panels may be dislodged.

Heating, ventilation, and air conditioning systems (HVAC) and equipment, antennas and satellite dishes, stacks, vent pipes, sky lights, and other fixtures and equipment on top of the roof may be damaged by the wind or by windblown “missiles”—objects or debris carried by the wind.

High winds and windblown debris also break windows and window assemblies, open poorly secured doors, and blow wall cladding in or out. When high winds are able to penetrate a building envelope, they increase internal building pressures that can result in structural damage to walls and roofs. Openings in walls or the roof



allow rain to enter causing water damage to building contents.

Flooding

High winds may not be the most significant hazard from tropical cyclones. Heavy rainfall associated with a slow moving or stalled tropical system can cause regional flooding. A large portion of the damage in four of the twenty costliest tropical cyclones (1851-2006) resulted from inland floods caused by torrential rain. Tropical Storm Allison (2001) produced rainfall amounts of over 30 inches in portions of Louisiana and southeast Texas. The Houston tunnel system, depicted in Figure 2, was inundated with water.



Figure 2. Flooding in the Houston Tunnel System following Tropical Storm Allison

Storm Surge

Storm surge is water that is pushed toward the shore by the force of the winds swirling around the storm. The advancing surge of water combines with the normal tides to create a hurricane storm tide.

The storm surge can increase the mean water level to heights impacting roads, buildings, and other critical infrastructure. In addition, wind driven waves are superimposed on the storm tide. This rise in water level can cause severe flooding in coastal areas, particularly when the storm tide coincides with the normal high tides.

In 2008 Hurricane Ike made landfall in Texas as a Category 2 hurricane. Although only a Category 2 hurricane (on a scale of 1 to 5), hurricane force winds extended as much as 125 mi from the center, and this large storm created a peak storm surge of 15-20 ft. By contrast, Hurricane Charley, which had Category 4 storm force winds extending only 25 mi from the center, had only a 6-7 ft. storm surge.

Because much of the United States' densely populated Atlantic and Gulf Coast coastlines lie less than 10 feet above mean sea level, the danger from storm surge is tremendous.

Tornadoes

Tornadoes are often produced by and embedded in hurricanes causing pockets of heavy damage. They are most likely to occur in the right-front quadrant of the hurricane, however, they are often found embedded in rainbands well away from the center of the hurricane.

Tornadoes can develop at any time of the day or night during landfall. Tornado production can occur for days after landfall when the tropical cyclone remnants maintain an identifiable low pressure circulation.

Studies have shown that more than half of the landfalling hurricanes produce at least one tornado; Hurricane Buelah (1967) spawned 141 according to one study.

Hazard Mitigation

Hazard mitigation can substantially reduce the damage caused by hurricanes. Property insurer FM Global compared the loss history of its policyholders that implemented its loss prevention recommendations with those with outstanding recommendations to complete. FM found that those policyholders that fully implemented its preparedness recommendations had on average 75% to 85% lower dollar losses than those policyholders that did not implement such measures [FM Global data provided to InterCEP[®]].

“48 percent of U.S. and Canadian financial executives interviewed say their companies are not well-prepared for a hurricane.”

2008 Natural Disaster Business Risk Study

Prior to hurricane season survey the entire property and inspect all buildings to identify vulnerabilities. Begin at the roof level and inspect the flashing along the perimeter. Repair loose or damaged flashing and ensure sufficient mechanical fasteners are used.

Inspect the roof covering for evidence of ponding, blistering, alligating, delamination, surface erosion, or cracks that could result in tears or leaks. Verify that all access panels and doors to mechanical equipment and roof hatches have been property secured. Confirm that all antennas,



satellite dishes, and other appliances installed on the roof have been securely anchored.

Inspect all exterior walls for openings that could be penetrated by wind and evaluate methods to protect when a storm watch is issued. Consider installing glazing rated to withstand debris impact, hurricane shutters, or pre-cut plywood for protection of exterior glass that is especially vulnerable. Check all exterior doors—especially loose fitting, large overhead doors. Make exterior doors weather tight and equip them with secure latches.



Figure 3. Boarded up glass store front in Louisiana (FEMA News Photo)

Inspect exterior storage, tanks, equipment, signs, and vehicle storage and verify they are properly anchored to withstand expected wind forces. Identify what can be moved inside a building or removed from the site, if a storm watch is issued.

Focus on critical building areas, equipment, and utilities including data centers and process systems. Evaluate means to protect against damage from water entry in the event of structural damage or flooding.

Hurricane Preparedness & Response Team

Organize a hurricane preparedness and response team and appoint a person in charge. Assign responsibilities to each department head and ask each department to prepare a plan for preparing their department.

Department heads should become part of the team that directs hurricane preparedness activities when a hurricane watch is issued. They should meet periodically to manage preparedness efforts until the watch is rescinded or upgraded to a warning. This team also manages recovery after the storm.

Appoint staff for safety, crisis communications, liaison with external service providers and other

company facilities. Assign responsibility for planning, logistics, and finance/administration in accordance with the Incident Command System.

Resources

There are many resources needed for hurricane preparedness. First, identify the complement of staff, including contract employees, needed to prepare your facility in the available time between a hurricane watch and hurricane warning.

Procure materials and equipment to prepare the facility including storm shutters, plywood, sandbags, and the power tools, equipment, and supplies to install them. A supply of tarpaulins and plastic sheeting can be used to cover valuable furnishings or equipment and provide temporary protection after a storm. Service pumps and emergency generators to ensure they are in good condition, and calculate the required quantity of fuel for each.

Procure weather monitoring equipment and ensure reliable access to broadcast and internet weather reports including forecasts from the National Hurricane Center. On-site weather monitoring equipment enable you to monitor local wind conditions and rainfall.

Evaluate communications capabilities assuming that landline telecommunications will be interrupted. Test communications equipment including two-way radios and satellite telephones. Evaluate how communications equipment could be used if roof mounted antennas are damaged.

Stockpile supplies for cleanup and repairs. Don't forget food and water for employees restoring the facility.

Arrange in advance for procurement of equipment, supplies, and contractors from firms located well outside the immediate area for cleanup, repair, and restoration of buildings, equipment and stock. Establish mutual aid agreements with other company facilities outside the storm's potential impact area.

Hurricane Preparedness Plan

Write a hurricane preparedness plan that includes multiple phases:

- Before hurricane season
- Tropical Storm or Hurricane Watch
- Tropical Storm or Hurricane Warning
- During the Storm (only if personnel must and are authorized to remain on-site during a storm)



■ After the Storm

Watch and warning phases can be expanded to include additional actions when a major hurricane has been forecast and to address a facility's vulnerabilities to hurricane hazards.

Before Hurricane Season

Preparedness prior to hurricane season begins with conducting or reviewing the facility's hurricane risk assessment, which is the basis for the hurricane plan.

Contact public officials to obtain the latest information on wind fields, storm surge, and flooding, which should be incorporated into your plan. If available, obtain official credentials for managers that will enable them to re-enter your facility after a storm but before the area is opened to the general public.

Walk the entire site and facility top to bottom to evaluate vulnerabilities and hazard mitigation. Complete hazard mitigation activities as soon as possible.

Review property insurance coverage including flood coverage, which may require a special endorsement. Evaluate business interruption limits especially if multiple facilities may be impacted by a single storm.

Verify that all resources required for preparing the facility for a hurricane are available and in good condition. This includes all pumps, generators, communications equipment, personal protective equipment, hand and power tools, and supplies.

Conduct training of all staff, so they know their role and responsibilities as defined in the plan. Conduct a tabletop exercise to familiarize the leaders of your hurricane preparedness and response team with the plan and identify any gaps or deficiencies.

Storm or Hurricane Watch

When a hurricane watch is issued, hurricane conditions are possible within 36 hours. This section of the plan should detail all facility preparations.

Hurricane Warning

When a hurricane warning is issued, sustained winds greater than 74 mph or higher associated with a hurricane are expected in a specified coastal area in 24 hours or less. Preparations must be rushed to completion before any mandated evacuation order is issued.

After the Storm

A damage assessment protocol should be developed and assignments made to quickly assess the condition of infrastructure, buildings, utilities, furniture, equipment, and supplies. Prior to conducting the damage assessment, identify hazards such as downed electrical lines, leaking hazardous materials (e.g., liquids and gases), broken glass, and collapse hazards. Prohibit entry into unsafe areas.



Figure 4. Flooding in New Orleans following Hurricane Katrina (FEMA News Photo)

Employee Family Preparedness

In addition to planning for your facility, be sure to provide preparedness information for employees to share with their families. Distribute information from Ready.gov and your local emergency management agency.

Ask all employees to develop a family disaster plan that includes a communications plan. Encourage them to prepare a family disaster kit. Make sure that you have emergency contact information for all employees, which includes the name and telephone numbers for a distant relative who can be contacted if the employee has evacuated.

Business Continuity Planning

Business continuity planning is in some ways easier with a forecasted event such as a hurricane. Data and paper records can be backed up offsite and systems can be shutdown without data loss. Relocation and or protection of raw materials, finished goods, equipment, supplies, and vital records can be accomplished before damaging winds or flood waters arrive.

However, a regional event such as a hurricane may impact a wide area that encompasses more than one company owned facility. Planning must address all facilities potentially impacted by the



storm. Competition for resources including computer “hot sites” may be kept forcing some users to relocate great distances to available backup data centers or worksites.

Business continuity plans must be based on a business impact analysis that identifies the potential impacts from damage to or loss of all facilities within the path of a hurricane. Strategies must be developed to ensure the continuity of critical functions, processes, and services. Sufficient resources, outside of the area impacted by the storm, must be available even in the face of competition—even competition from government authorities. Following Hurricane Katrina in 2005, generators brought into storm damaged areas by private businesses were redirected by public officials and never reached their intended facility.

Plan for the Challenges

Hurricanes pose numerous challenges for emergency planning. Forecasting the intensity and landfall of an approaching storm is extremely difficult. Over the past 25 years “no statistically significant improvement or degradation is noted for landfall position forecasts. Time of landfall forecasts indicate significant improvement for the 19-30-hr period.”^{vi}. Public officials have to be conservative and issue warnings sufficiently in advance of predicted landfall to allow residents in vulnerable areas to evacuate to safety inland. Mandatory evacuation orders may require completion of preparedness efforts earlier than expected.

Coordination with emergency management officials is essential to ensure you have the latest forecast, are aware of the timing for issuance of mandatory evacuation orders, and understand the time needed to safely evacuate on crowded roads.

The availability of resources to prepare a facility becomes limited when a hurricane watch is issued as businesses and citizens compete for materials and labor. Employees have to prepare their own homes and ensure the safety of family members.

A hurricane plan that accurately identifies the resources and time needed to prepare a facility has the greatest chance of success. Procuring necessary resources before hurricane season and arranging in advance for labor to assist with hurricane preparations is essential. Providing resources to protect the homes of managers will allow them to focus their attention on preparing your facility.



Figure 5. August 30, 2008, Beaumont TX. Hundreds of vehicles line the interstate evacuating from Hurricane Ike, (FEMA News Photo)

Build a project management plan that defines major tasks and the resources and time needed for completion. Use the timeline to calculate when preparations must begin, so they are completed before a mandatory evacuation order is issued.

Hurricane Preparedness

We can help you develop your hurricane preparedness and response plan:

- Conduct a hurricane risk assessment to identify vulnerabilities and opportunities for risk mitigation
- Define roles, responsibilities, authorities, and tasks for hurricane preparedness, response, and recovery
- Identify the resources needed for preparedness and recovery; evaluate the adequacy of existing resources
- Write a phased hurricane preparedness and response plan
- Conduct training and facilitate exercises to familiarize personnel with the plan

If you need assistance, please [contact us](#).



Planning Resources

The following are some of the numerous planning resources available online. This list is periodically updated at the [Preparedness, LLC website](#).

- National Hurricane Center
- Tropical Cyclone Advisory Mailing Lists
- NHC Hurricane Preparedness
- Natural Hazards Center, at the University of Colorado at Boulder
- Educational and preparedness information from Federal Emergency Management Agency
- Historical Hurricane Tracks, National Oceanic and Atmospheric Administration, Coastal Services Center (interactive mapping application that allows you to easily search and display Atlantic Basin and Eastern North Pacific Basin tropical cyclone data)
- The Deadliest, Costliest, and Most Intense United States Tropical Cyclones From 1851-2007, National Weather Service, Tropical Prediction Center
- Atlantic Seasonal Hurricane Forecast, The Tropical Meteorology Project at Colorado State University (Professors William M Gray and Philip J. Klotzbach)
- Tropical Storm Risk, (resource for forecasting the risk from tropical storms worldwide)
- National Hurricane Survival Initiative, (public-private partnership to educate hurricane-vulnerable individuals)
- Hurricanes: The Greatest Storms on Earth, NASA's Earth Observatory
- Community Hurricane Preparedness, (computer-based learning) provides information about how the NWS forecasts future hurricane behavior and more
- Keeping Disaster Site Workers Safe During Cleanup and Recovery Operations, U. S. Occupational Safety & Health Administration

All of these resources can be accessed [here](#).

Additional Resources

Links to dozens of documents to help you with your preparedness program can be found on the ["Resources" page](#) of the Preparedness, LLC website.

Check out our [blog](#) if you are interested in developments in national standards, industry best practices, current events, and what it means for your preparedness program.

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About Preparedness, LLC

Preparedness, LLC is a client-focused risk consulting company. Our mission is to assist our clients safeguard people, protect property and minimize business interruption. Our vision is to thoroughly understand each client's business and become a long-term, trusted advisor.

If you would like a copy of our self-assessment checklist; have questions; or need assistance with the development, implementation, or evaluation of your preparedness program, please contact us.

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ⁱ http://www.fmglobal.com/press_release/2008/FMGStudy_080608.html

ⁱⁱ http://www.noaanews.noaa.gov/stories2009/20090521_atlantic_hurricane.html

ⁱⁱⁱ <http://hurricane.atmos.colostate.edu/Forecasts/2009/april2009/apr2009.pdf>

^{iv} <http://www.tropicalstormrisk.com/docs/TSRATLForecastApr2009.pdf>

^v <http://www.nyu.edu/intercep/events/20061009-256.html>

^{vi} Accuracy of United States Tropical Cyclone Landfall Forecasts in the Atlantic Basin (1976-2000), Mark D. Powell and Sim D. Aberson, NOAA/AOML/Hurricane Research Division, Miami, Florida <http://www.aoml.noaa.gov/hrd/Powell/accuracy.pdf>

