Hurricane Preparedness

Hurricanes are nature’s most powerful storms. Preparedness should include hazard mitigation in addition to emergency and business continuity planning.

Hurricane season begins each year on June 1. No matter the forecast for number of storms, major hurricanes, and land-falling hurricanes, it only takes one storm to cause many deaths and billions in damages. “Superstorm” Sandy was not technically a hurricane when it made landfall, but it caused billions in damages. Recovery efforts continue years later.

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

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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.

**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 rain-bands 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 land-falling 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].

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, alligatoring, 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 properly 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.

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

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*Sand bagged store front in Louisiana*  
(FEMA News Photo)
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 land-line 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.

■ Physically check all emergency and communications equipment including generators, transfer switches, lighting, portable pumps, and radios. Test all and ensure that generators will start automatically and power transfers properly. Check oil levels and fuel tanks and fill to capacity.

■ Fill all propane gas, fuel oil or other storage tanks (both aboveground and buried) to prevent them from floating.

■ Identify any hazardous materials that could react with water and relocate outside the path of the storm or protect from contact with water.

■ Fill available portable fuel tanks (for portable power equipment) and store in a location protected from wind and flood.

■ Inspect roof edging strips, gutters, flashing, covering, and drains. Remove anything from the roof that is not secured.
■ Inspect rooftop air handling units to ensure that latches are securely fastened.
■ Inspect exterior signs supports, guy wires, and anchorages; secure as necessary.
■ Check for weak door and window latches and hardware or for insecure panel fastenings.
■ Check roof, floor and yard drains to ensure they are clear and unobstructed.
■ Clean out street catch basins and drains to prevent street flooding.
■ Cover exterior building make-up air or ventilation louvers by securely fastening a sheet of plywood to the inside of the opening. Remove after the storm has passed in order to provide adequate ventilation.

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.
■ Cover up openings in the building shell with plastic sheeting or tarpaulins, begin salvage operations, and cleanup debris and remove standing water as soon as it is safe to do so.
■ Inspect electrical and process systems and equipment for water damage before restarting.
■ If electrical or electronic equipment is exposed to water, keep it turned off until it has been dried, cleaned and checked by a trained individual.
■ Drain, clean and lubricate any machinery before testing. Contact the manufacturer, if possible, for recommendations.
■ Do not operate boilers until they have been inspected and tested.
■ Compile a report with the results of the damage assessment to begin the insurance claims process.

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.

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.

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.

**Business Continuity Planning**

Business continuity planning is in some ways easier with a forecast event such as a hurricane. Data and paper records can be backed up off-site 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 keen forcing some users to relocate great distances to available backup data centers or work-sites.

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.”. 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.

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About Preparedness, LLC

Preparedness, LLC is a client-focused risk consult-
ing company. Our mission is to safeguard people,
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