RiskTopics

Guide to hurricane emergency action plans
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If you have property in a region prone to tropical storms, you should always have an up-to-date hurricane or typhoon emergency action plan in place.

Introduction

Hurricane or typhoon-prone regions exist around the world. The map below shows these regions, which are located in the tropical zones north and south of the equator.

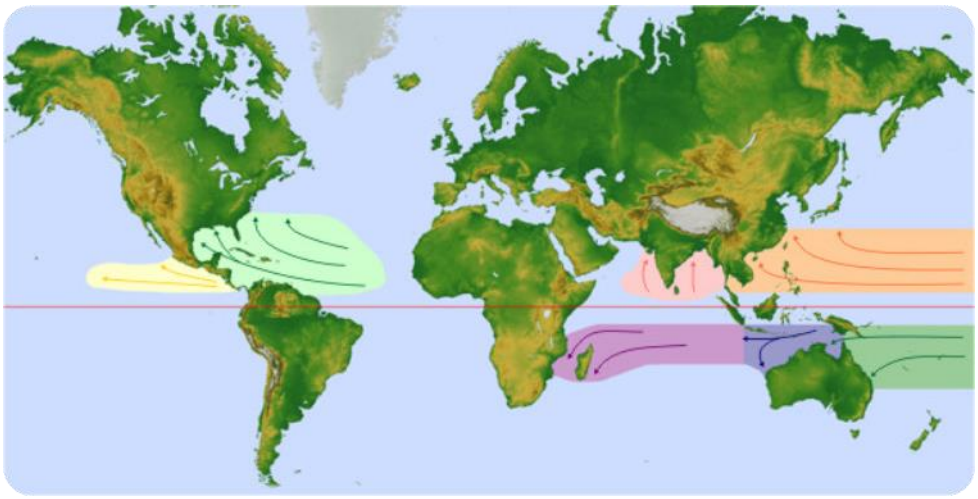

Figure 1. Tropical regions where hurricanes or typhoons are born. Source - National Weather

Color Code	Region
Yellow	Northeast Pacific region
Light green	North Atlantic region
Purple	Southwest Indian Ocean region
Pink	North Indian Ocean region
Blue	Southeast Indian Ocean region
Orange	Northwest Pacific region
Dark Green	Southwest Pacific region

Discussion

Terminology

Hurricane and typhoon are just two names for strong tropical storms. A complete list of names, along with the regions where the term is commonly used, is provided below.

Hurricane	North Atlantic, Northeast Pacific
Typhoon	Northwest Pacific
Severe Tropical Cyclone	Southwest Pacific, Southeast Indian Ocean
Severe Cyclonic Storm	North Indian Ocean

A hurricane emergency action plan should be a living document. It should be reviewed and updated each year before the season begins and after any major storm. It should address actions to take:

- Before hurricane season begins
- 48 hours before hurricane landfall
- 36 hours before hurricane landfall
- During a hurricane
- After a hurricane

Hurricane seasons occur at different times around the globe. The following table summarizes the typical seasons for the various hurricane-prone regions of the world.

Tropical storm seasons around the world

North Atlantic	June 1 to November 30
Northeast Pacific	May 15 to November 30
Northwest Pacific	All year with a main season from July to November
North Indian Ocean	April to December
Southwest Pacific	October to May
Southeast Indian Ocean	October to May

Quick, simple and practiced

A hurricane plan should be quick, simple and practiced.

- Quick means the plan must fit into a reasonable timeframe. A reasonable timeframe will begin no more than 48 hours before estimated hurricane landfall and needs to wrap up with sufficient time to allow for

personnel evacuation. For example, if a location requires more than two days to install shutters on windows, it is probably best to leave the shutters in place during hurricane season.

- Simple means a series of checklists to facilitate implementation. The checklists should be backed up with more detailed documentation as needed; however, keep in mind that as a hurricane approaches, no one will have time for the details.

Practiced means you have actually conducted a full-scale implementation test of your plan. You know how many people are needed, you know what tools and supplies are needed, and you know how long each task will take. In short, you know the plan will work because you have tried it.

Characteristics of an effective hurricane plan

Quick – Fits a reasonable timeframe starting 48 hours before hurricane landfall

Simple – Checklists to guide actions and provide reminders

Practiced – Fully tested to verify time, staff and resource needs

Guidance

Integrating the hurricane plan

When implementing a hurricane plan, consider other emergency plans, systems or practices that will support surviving and recovering from a storm. For example:

- Emergency power
  - Review emergency power systems. Are they sized and arranged to carry the appropriate loads? In addition to the traditional emergency loads, the system should carry loads needed to maintain the internal building environment, such as chillers and HVAC systems. For multi-story buildings, emergency power should carry elevators so all floors will be accessible for service and repairs. The fuel supply for the emergency power system should be sufficient to support the system for the anticipated duration of normal power interruption and the anticipated time frame to resume fuel deliveries.
  - Have spare generators located and available in a protected location. Generators may be in great demand after a hurricane. Remember the fuel needed to operate them.
- Business data
  - Verify there is a program in place for the routine backup of critical computer data. The data should be backed up to a location that will not be affected by the hurricane.
  - Identify vital business records (e.g. technical drawings, electronic files, paper files). Make plans to protect them or relocate them to a protected location.
- Utilities, medical gases and process gases
  - Verify the location of utility disconnects and confirm that shutoffs are identified with suitable markings. This includes electric and fuel gas utilities, but also applies to medical gases in healthcare facilities.

    For heavy industrial (chemical and petrochemical) facilities that rely upon nitrogen, will there be sufficient nitrogen available to maintain inert atmospheres in tanks and piping until normal deliveries resume? Nitrogen may be in very short supply in the days and weeks following a hurricane if local suppliers experienced the same hurricane conditions.

- Equipment and stock
  - Know the elevations of critical equipment including rotating equipment (motors) and electrical equipment (transformers and switchgear). This may help you identify equipment that may be exposed to damage due to storm surge or flooding. Relocating this type of equipment before a storm is difficult. Protecting or sparing the equipment may be the only realistic option. Maintain critical equipment spares in a protected location.
  - Verify practices for installing important electronic equipment. This would include equipment such as computers, local area networks, telephone systems and, for healthcare facilities, medical diagnostic equipment. To reduce exposure to water damage, electronic equipment should be located above any anticipated flood elevation including hurricane storm surge and at least 10 cm (4 in) above any floor.
  - Verify the skidding stock is at least 10 cm (4 in) above the floor to reduce water damage exposure.
- Vendors
  - Develop relationships with equipment suppliers. Arrange in advance to obtain supplies, services or spare equipment quickly. After a storm, there will be a demand surge for all resources. Established relationships improve access to priority service.
- Personnel
  - Verify there is a contact list for all facility personnel including contact information for the most likely destination in the event of an evacuation. This will assist in locating personnel after a storm.

Special note for the chemical and petrochemical industry

Are safety systems such as flare stacks designed to operate in a safe and reliable manner under anticipated hurricane conditions? For more information on flare stacks, see the Risktopic "Is your flare ready for hurricane season?"

Before the hurricane season begins

- Review the hurricane plan. Make sure it is current.
- Verify there is a designated person on site at all times during hurricane season with the authority to implement the hurricane emergency action plan. This includes ordering process shutdowns and facility evacuations.
- If responsibilities are assigned to specific individuals, update the assignments if positions or personnel have changed.
- Make sure dedicated hurricane supplies and equipment are on hand. Order replacement materials as needed. See Appendix A for a sample list of supplies and equipment.
- Conduct annual drills to test all aspects of the hurricane emergency action plan. Verify the plan reflects current conditions at the location. After each drill, request feedback from involved staff and Emergency Response Team members to assess the effectiveness of the plan and identify areas for improvement.
- Maintain a roofing company under contract to respond quickly should repairs be needed before or after a storm. Having a contract in place will allow faster access to critically needed repair services.

- Schedule an inspection of the building envelope. Have your roofing contractor check the condition of roof coverings and flashing. Verify rooftop equipment is secure and that connections and fasteners holding equipment in place are not corroded. Consider adding strapping or bracing to reinforce rooftop equipment. Verify the condition of all glazing systems and weather seals, and confirm windows and doors are secure and will close tight.

- Verify inspection, testing and maintenance of all emergency generators are up to date. Check the entire fuel system including centralized bulk fuel storage tanks and fuel transfer pumps.

- Inspect and test all dewatering pumps and sump pumps controlling water that could otherwise inundate the building during a storm. Make sure they are connected to emergency power and operate correctly while on emergency power.

- Where manual storm shutters, plywood coverings or flood gates are used to protect the building during a hurricane, verify that all needed materials are on hand, readily available and in good condition. Verify the personnel needed to install or place manual protective systems are available at all times during hurricane season. Verify all personnel involved with installing these manual systems have received training and have practiced before hurricane season begins. Know how long each manual operation will take and how many people will be needed. This should be based upon actual timed practice drills.

- Establish and maintain emergency contact information and evacuation contact information for all personnel to assist restoring contact with employees after a hurricane event.

When hurricane season begins

During hurricane season, it is important to maintain an awareness of developing and approaching hurricane activity. Web sites are available for all hurricane-prone regions that provide this information.

The World Meteorological Organization of the United Nations maintains a Severe Weather Information Center at http://severe.worldweather.wmo.int/ that includes a map showing any current global tropical cyclone activity with links to advisories and warnings.

For the continental U.S., Caribbean and Northeast Pacific, awareness of hurricane activity can be maintained through the National Hurricane Center web site at http://www.nhc.noaa.gov/index.shtml. For these hurricane-prone regions, consider signing up for the Tropical Cyclone Advisory Mailing Lists at http://www.weather.gov/subscribe but be aware this is an experimental e-mail alert system and should not be the sole source of maintaining hurricane awareness.

These are just two of many web sites offering tropical storm alerts that may serve your needs for tracking tropical storms.

World Meteorological Organization – tropical storm watches, warnings and forecasts

As discussed above, the map at the Severe Weather Information Center web page provides links to hurricane advisories and warnings. These links include maps showing:

- Past hurricane track

- Current hurricane location

- Region of 30+ knot (56 kph, 35 mph) winds – yellow circle

- Region of 50+ knot (93 kph, 57 mph) winds – red circle
- Storm warning cone
- Storm path forecast for the next three days

National Hurricane Center ? hurricane watches, warnings and forecasts

As a hurricane develops in the North Atlantic and Northwest Pacific, the National Hurricane Center issues a sequence of maps showing hurricane watch areas, hurricane warning areas, the past hurricane track and the potential hurricane track. Figure 2 below shows an example of such a map.

Figure 2. Hurricane Ike - Coastal Watches/Warnings and 5-Day Track Forecast Cone. Source: NOAA

With the start of the 2010 hurricane season, the National Hurricane Center has revised its definitions of Hurricane Watch and Hurricane Warning. A hurricane watch area may experience hurricane conditions within 48 hours, and a hurricane warning area may experience hurricane conditions within 36 hours.

Following the sequence of hurricane tracking maps allows users to be aware of hurricane progress and the changing likelihood the hurricane may affect their location.

When and how to react to hurricanes

By maintaining a continuous awareness of hurricane activity, you can develop a sense of when and how to react to an approaching hurricane.

The coastal areas affected by hurricane watches and warnings change constantly as a hurricane moves. The watches and warnings provide an indication of the time available to you for taking action. Keep in mind these times are estimates at best, as hurricanes are unpredictable, and they can arrive early.

Plan to start taking action at least 48 hours before the estimated hurricane landfall at your location.

Easy-tough approach to taking action

At 48 hours before landfall, you will have a difficult time convincing yourself the approaching hurricane is going to affect your location. This is especially true if your facility is not located near the centerline of the potential track area. So, plan to start with "easy" actions. Those are actions you will not mind taking even if the hurricane never affects your site.

At 36 hours before landfall, it is time to start the "tough" actions. These are actions you only want to take if there is some certainty your location will be affected by the hurricane.

Easy-tough approach to hurricane planning

Easy actions – Measures you can take that will still make sense even if the hurricane turns and never affects your location.

Tough actions – Measures you would only want to take once you are certain a hurricane will be directly affecting your location.

Easy actions – 48 hours from landfall

About two days before a hurricane is expected to affect your location, begin implementing the easy actions. Easy actions include:

- Review the hurricane emergency action plan with all involved personnel.
- Check building roofs. Make repairs to coverings and flashing as time allows.
- Remove all loose items from the roof, secure equipment doors and covers, and remove debris.
- Verify roof drains are clear of trash and other obstructions.
- Fill fuel tanks serving emergency generators and other vital services.
- Verify dewatering pumps are in service and working.
- Verify outside storm drains and catch basins are clean.
- Remove debris from outdoor areas that may become "missiles."
- Remove loose, outdoor, inactive equipment.
- Back up computer data.
- For healthcare, verify 96 hours of supplies are on hand.
- For manufacturing:
  - Ship out as much stock as possible.
  - Verify all stock is skidded at least 4 inches above the floor.
- For new construction projects:
  - Remove loose equipment.
  - Secure and protect material storage
  - Temporarily brace new construction.
  - Secure roofing and items on the roof.

- For heavy industry (chemical and petrochemical):
  - Inventory tanks and vessels with enough material to secure them against the forces of buoyancy should they be exposed to flooding, surface water runoff or storm surge.
  - Maintain contact with suppliers of pipeline delivered materials. Those suppliers may also be making shutdown preparations. Verify you will have the necessary supplies to safely shut down your process. This is especially important for processes such as olefins units, which take several days to bring down. Natural gas and oxygen are just two pipeline supplied materials to consider.
  - Verify compressed air supplies needed for control purposes.
  - Remove any accumulated rain water from storage tank spill containment areas.
  - Allow time for Emergency Response Team members who will remain on site to go home and take care of their personal needs.

Based upon your specific needs, add to the list of easy actions, as these are just general concepts and every facility has its own requirements.

Tough actions – 36 hours from landfall

At 36 hours before anticipated landfall, time will be limited. Make sure you will have the staff needed to complete all of the tough actions, and leave plenty of time to evacuate personnel who will not be remaining on site (reference jurisdiction and/or authority's announcements and requirements). The tough actions may include:

- Protecting or relocating vital business records
- Removing all loose outdoor storage or equipment
- Anchoring portable buildings or trailers to the ground
- Securing outdoor storage or equipment that cannot be moved
- Installing manual protection systems (e.g. shutters, plywood covers and flood gates)
- Raising critical equipment off floors (e.g. PC towers)
- Moving critical equipment from basement and other below-ground areas
- Covering critical stock and equipment with waterproof tarpaulins
- Initiating an orderly shutdown of production equipment and systems that rely upon normal power
- Turning off fuel gas services
- Turning off non-essential electrical systems
- Verifying all fire protection systems are in service (e.g. water supplies, fire pumps, sprinklers, fire alarms and special extinguishing systems)
- For manufacturing:
  - Stopping incoming shipments of raw materials that will be exposed to damage
- For heavy industry (chemical and petrochemical):

  - Removing and securing cable tray covers and controlling wiring radiant barriers. These are features that frequently become wind-borne debris when exposed to high winds.
  - Removing or securing scaffolding

Again, based upon your specific needs, add to the list of tough actions.

Tough-tough actions

There can be a few tough actions that take so long to complete they need to be started during the easy-action period. Exceptional discipline will be required to make the decision to implement these very tough actions. These actions may include:

- Setting up flood barriers at all first floor doors and entrances
- Temporarily closing up buildings under construction to avoid entry of wind-driven rain
- Installing manual shutters on multi-story buildings
- For manufacturing, shutting down processes that will be exposed to damage
- For heavy industry (chemical and petrochemical), shutting down processes that take several days to bring to a safe shutdown (e.g. olefins units)

It is absolutely essential to recognize when you have a tough-tough action. The overall plan must recognize their existence. And, the needed guidance and authority must be provided to those who will be charged with making the decision.

During a hurricane

If an Emergency Response Team (ERT) is to remain onsite during the storm, consider the following:

- The ERT should consist of volunteer members willing to remain onsite during the hurricane (if allowed by local authorities).
- Carefully determine whether the location, design and building construction make it a safe place for ERT members to remain during the storm.
- The ERT members should be trained in all aspects of the emergency action plan and include representatives with decision-making authority as well as knowledge of facility operations.
- Security personnel may also be required.
- Prepare an ERT supply kit that includes items necessary during and immediately after the storm. This includes satellite phones, two-way radios, portable AM/FM radios, flashlights, lanterns, plenty of batteries, rubber boots, gloves, blankets or sleeping bags, first-aid kit, spare clothing and an adequate supply of shelf-stable food and water to last at least 72 hours.
- Anticipate loss of electrical power and municipal drinking water for several days following the storm.
- Storm-tracking procedures should be developed. The ERT should include personnel capable of monitoring conditions using various media and equipment (e.g. radio, television, Internet and portable phone).

- If the facility is in an area known to be exposed to a flood or storm surge, specific response procedures should be developed as part of the emergency action plan to manage the water exposures.
- During the height of the storm, the ERT personnel should remain in a location that has been secured from wind and flood and proven secure.

After a hurricane

- When returning to the site, bring identification, additional supplies and cameras to document conditions.
- Communicate with the ERT to determine what supplies are needed.
- Survey the site for hazards:
  - Live electrical wires
  - Broken glass and sharp metal
  - Leaking fuel gases or flammable liquids
  - Damaged building features or contents that could shift or collapse
  - Paved or hardscape areas undermined by wave action and subject to collapse
  - Flammable atmosphere in vapor space of flammable storage tanks
- Reinforce appropriate management loss prevention programs including:
  - Controlling the use of smoking materials
  - Using hot work permits to manage all cutting or welding operations
- Verify the status of protection systems. Check water supplies, fire pumps, automatic sprinklers, fire alarms and security systems.
- Manage impairment for protection systems:
  - Expedite repairs.
  - Post fire watch in area with impaired fire protection.
  - Post security personnel in areas where building or site access is not suitably controlled.
- Survey the damage and initiate repairs immediately:
  - Promptly notify contractors to avoid waiting in line for service.
  - Establish repair priorities, including the building envelope, utilities and fire protection systems.
- Begin salvage as soon as possible to prevent further damage:
  - Protect the building and contents from further damage.
  - Separate damaged goods.
  - Save all damaged goods.
  - Avoid accumulations of combustible materials inside the building.
  - Avoid storage in areas with impaired fire protection.
- Maintain contact with corporate management and your insurance broker.
- Contact Zurich to report claims and fire protection impairments.

- Clear roof drains, balcony drains and ground-level catch basins and drains in preparation for future rain events.
- Have qualified personnel thoroughly check all utility systems and hazardous processes before returning them to service.
- Restore HVAC system to maintain or restore building interior environment.
- Determine whether adequate raw materials will be available when the plant is physically ready to begin operations. Remember that local suppliers and distributors may still be down or at reduced rates.
- Provide a means to stay in contact with displaced personnel. Consider a telephone number that delivers a recorded message with daily updates.

Conclusion

Hurricanes and typhoons can occur in any tropical region of the world. Where a facility is exposed to this threat, establish a hurricane emergency action plan.

The hurricane emergency action plan should be quick, simple and practiced. The plan should be integrated with other facility emergency plans and management programs. The plan should consider actions to take before hurricane season, when hurricane watches and warnings are issued, during a hurricane and after a hurricane.

As a hurricane approaches, know the easy actions to take first. Once you are sure a hurricane will affect your facility, implement the tough actions. Be sure to identify any tough actions that will require a lot of time. They will need to be started with the easy actions.

Remember, a successful hurricane outcome begins before hurricane season starts.

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Related Risktopics

- Zurich easy-tough guide to starting a hurricane emergency action plan
- Zurich recommended practice for facilities in hurricane prone regions
- Guide to emergency power for hurricane-prone regions
- Guide to securing rooftop equipment in hurricane-prone regions
- Guide to perimeter roof flashing in hurricane-prone regions
- Is your flare ready for hurricane season?

Appendix A – Sample list of hurricane supplies and equipment

- Emergency lighting
- Lumber and nails/screws
- Tape for windows
- Sandbags
- Roofing cement, sealant and other repair materials
- Tarpaulins
- Caulk
- Duct tape
- Power and manual tools
- Shovels and axes
- Chainsaws and fuel
- Nonperishable food and drinking water
- Cell phone with charged spare batteries
- Satellite phones (as land telephone lines and cell phone service may be interrupted)
- Two-way radios with charged spare batteries
- Flashlights with spare batteries

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