YOUR GUIDE TO

RESILIENCY PREPAREDNESS

TLC ENGINEERING SOLUTIONS®

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Resiliency in building design refers to the ability of a structure to withstand and recover from various stressors, such as natural disasters, climate change impacts, and other unexpected events. It involves designing buildings to be robust and adaptable, capable of maintaining functionality and minimizing damage even under adverse conditions. Ultimately, resilient building design aims to minimize risks to occupants, preserve functionality during and after disruptive events, and reduce long-term costs associated with repairs and downtime.

Resiliency plays a crucial role in hurricane preparedness, as hurricanes can pose significant threats to both people and property. To help, we have developed this resiliency guide focused on lessons learned from past hurricanes, as seen through the eyes of our engineers when speaking with facility management. This guide is intended to serve as a quick reference and is not meant to replace your facility's Comprehensive Emergency Management Plan (CEMP).

While many of the suggestions and real-world examples are based on healthcare facilities, many of the suggested recommendations and vendor contact templates can be applied to other types of facilities that cannot afford a prolonged shutdown. Some examples of such facilities include police stations, fire stations, emergency operations centers, utility providers, school campuses, and many more.

Special thanks to Keyshia Owens, FEMA Center for Domestic Preparedness Indirect Authorized Trainer and member of the Orlando Health Hospital Emergency Response Team (HERT) for her contributions.

HURRICANE SEASON: 25 POINTS OF CONSIDERATION

STAGE 1: BEFORE STORM SEASON

1. VENDOR CONTACT LIST

A list of critical vendor contacts is important to compile well ahead of the season and much easier to do before an emergency. See the template and sample list of who to include at the back of the guide.

Ensure that the list is updated regularly and readily available to critical personnel. Create and save the original document digitally. Also, print and laminate hard copies after each update so they are accessible during and after a significant weather event that prevents computer access.

We recommend that you set up time and material contracts with key vendors prior to the season for support before, during, and after the event.

2. EMERGENCY EQUIPMENT

An emergency is no time to realize the facility is not prepared to face fuel shortages, inoperable equipment, or access restrictions. Begin by listing all the equipment that is crucial during and following a crisis.

FUEL CONSUMPTION/PRIORITY MATRIX

Begin with the emergency equipment list and organize by order of priority, starting with highest priority. Note the type of fuel (electric vs. gas for instance) and a metric beside each item.

This record can serve in the tracking and management of fuel during long stretches of recovery. Many facilities have 96 hours worth of fuel on hand at all times, but that is not the case for all types of facilities.

Note equipment requiring generator power and what can be removed from generator power in the case of conservation. For instance, in-room televisions don't sound critical but can aid in calming patients and guests. Refrigerators are another seemingly low-priority item that can become essential when sheltering those affected in an emergency.

REPLACEMENT PARTS

Restock frequently needed replacement parts and maintenance supplies for equipment, such as filters and lubricants. Keep staff and items safe from the elements by storing these items in an interior location where they are readily available and can't be damaged due to flooding or leaking.

HVAC EQUIPMENT

HVAC equipment is one of the most integral components in a preparedness plan. Consider what steps can be taken if rooftop AHU units fail. A remote reset is ideal, so that employees are not required to expose themselves to unsafe conditions. If remote access is not in place at this time, corrective measures can be taken before the start of storm season.

SHARED INVENTORY LIST

Creating a shared inventory list can be useful, particularly for systems that have multiple facilities. This list should include all the essential items necessary for the facility to function during and after the storm. For instance, portable pumps are sometimes stored at the facility that uses them the most or has priority over other facilities. That item can be shared within the system.

3. BACKUP KEYS

During Hurricane IRMA, one challenge that arose at one specific facility was the inability to locate keys for a particular service vehicle. To avoid such a situation, make copies of all keys needed for emergency access and discuss a logical location for them.

It is recommended to keep a list similar to the example list provided at the back of this guide. You may be surprised by how many keys are required. It may be helpful to refer to the Emergency Equipment list but keep in mind that forklifts, golf carts, storage closets, machinery, etc. can also require keys.

4. COMMUNICATIONS

Communication is vital during and after an emergency. Cell phones can be rendered useless, while hard-wired internet sources usually remain functional. When ground lines to the campus are left intact, applications like Zoom, Teams, and FaceTime are usable on Wi-Fi. This information can be easily ascertained and should be tested well ahead of any need.

It is also important to have backup communication methods in place, including HAM radio, walkie-talkies, and other sources determined by the technology team. Many hospitals have HAM radio operators on staff to facilitate communication with state and local government.

5. FLOOD AND DAMAGE PREPARATION

Flooding can be the most damaging and dangerous issue after a weather event. A response plan to specific risks during a storm can save resources and lives when thoughtfully developed and proficiently implemented.

A team should be assembled before the start of storm season and provided with a clear outline of responsibilities so that when deployed in Stage 2, they can carry out the response plan without hesitation.

An example of one responsibility before deployment would be to procure the supplies needed to shore up areas at risk of flooding and damage, such as sandbags and plywood.

Another responsibility could be staging. There are several benefits to staging with the procured items prior to Stage 2. This exercise helps the team not only feel ready for action but confident as well. Staging also aids in documenting and confirming that the right quantity of material has been accumulated and stored in a safe, accessible space.

PREVENTATIVE MAINTENANCE

- If storm shutters are used, they are only effective if operational when the need arises. Confirm the quality of the Preventative Maintenance for shutters and make sure they are all operable before an event.
- Some facility managers realize too late that protective equipment like shutters can be missing hardware essential for a safe, secure installation. In staging, the equipment can be installed and uninstalled for an added measure of reassurance. Where will the equipment be stored in the off-season to prevent possible damage?
- Ensure you have the latest electrical one-line diagram and make available offline. This information can be critical in a power outage or emergency scenario; you may find the need to turn power off to some areas or connect systems that may not be on emergency power. Confirm ARC flash and any electrical safety equipment and/or meters are online.
- Check the status and connectivity of lightning protection systems where applicable. In particular, it is important to ensure that the system is electrically connected and tested to ensure the electrical pathway to the ground is intact.
- Extensive landscape maintenance should be conducted at the start of storm season, ridding the campus of dead branches and cutting back unruly foliage where appropriate. These become projectiles during storms and can be spread throughout the site.
- Roof leaks are a very real possibility during a weather event. Plan a temporary response to active leaks and assess the repairs needed after the storm has passed and the all-clear given.
- Doors can sometimes blow open during a storm. Give thought to what can be done to secure the ground, penthouse, and rooftop doors during weather and possibly unsafe conditions.
- One facility reported electronic doors shorting out in the open position. With no materials on hand to force the doors closed, a long hallway running the length of the building became a wind tunnel of sorts, suffering flooding and proving to be a hazard to staff.
- Electric service entrance equipment serves as a connection point between utility and the facility, typically locked in a room in a perimeter location with potential for flooding. This equipment, along with generators should be located where it is least likely to flood according to the 100-year flood elevation.
- Flood gates, if used on campus to prevent water intrusion and flooding, should be tested and well-maintained at this stage. It is critical that this equipment is ready for use.

6. COMMAND CENTER

Establish a Command Center and ensure communication capabilities and sufficient emergency power. Consider appointing a lead with a role description.

Most hospitals and healthcare agencies use the scalable Hospital Incident Command System (HICS) to respond to any size emergency or non-emergency incidents that threaten to overwhelm the system.

7. ELEVATOR PRECAUTIONS

Louvers, located at the top of the shaft may not have a damper component and can be a source of incoming water. Without the damper the elevator shaft is in danger of flooding. In these cases, a sump pump is often located at the bottom of the shaft and should be checked for capacity.

If a damper is present, it should be tested against debris and closed securely in response to a forecast weather event.

8. FIRE ALARM TRAINING

Often overlooked, nuisance alarms can be an issue during an event. A staff member should be trained on how to operate and bypass elements of the system, if needed.

9. THE HUMAN FACTOR

It will be imperative to consider who should be on-site and how best to manage personnel during a weather event. It's important to remember that curfews may be in effect, making it difficult to have staff and vendors come and go from the campus. Everyone who is on-site needs sleeping arrangements and bathing facilities.

FUEL

There may be limited access to fuel, with gas stations often compromised during and after storms. This can affect staff, vendors, patients, and guests alike. Extra fuel beyond emergency requirements would be greatly appreciated by those affected by the storm.

STAFF

A staffing plan usually encompasses an A Team and a B Team with the understanding that the A Team will work in shifts during the storm and afterward until the B Team can be accounted for and travel to the facility safely. This allows the A Team to recuperate and attend to loved ones. Shelters can be set up with community partners specifically to house the families of hospital staff so they can focus, knowing their families are safe.

FAMILIES

Allowing staff and vendors to bring family to the campus during their shifts could increase the probability of their presence. Many will not have another option for dependents and pets. Allowing patients to have loved ones with them can alleviate anxiety as well.

CONSIDERATIONS

- How can pets be handled during this stressful time and can temporary shelter be offered? Perhaps carriers can be permitted during shifts, possibly with a coordinator for walks and feedings.
- Medical devices need to be secured with children present and space is at a premium.
- Is there enough water, food, toiletries, and sleeping accommodations? Where will this supply be stored?
- Can plumbing handle the increase in requirements? Are there accommodations for the general public?
- Determine approximately how many people will be housed on campus if the plan is implemented and increase supplies accordingly.

10. EMERGENCY PREPAREDNESS MEETINGS

Schedule meetings regularly with the final follow-up meeting in April. Prepare to discuss each of the topics outlined in this guide and send out an agenda. Invite outside experts from the vendor list to weigh in on the feasibility of proposed solutions.

STAGE 2: STORM IS IMMINENT

1. PREEMPTIVE SWITCH TO GENERATOR

Systematically switching to generator power before the storm hits or at the first major blip in power can forewarn patients, residents, and staff, preventing panic and additional anxiety. This also allows time for corrective measures to be taken if needed.

2. CRITICAL VENDORS

Take time to touch base with critical vendors. Make sure they are prepared, fueled, and their families are safe. Work together to successfully navigate the approaching weather event.

3. SCHEDULE STAFF TEAMS

Review the staffing plan with the teams and make sure everyone knows what is expected of them and when.

4. FUEL

Top off fuel in vehicles and equipment, according to the equipment/fuel matrix referenced at the beginning of Stage 1.

5. PROJECT REVIEW & PRIORITIZING

Review any open projects and prioritize, ensuring project sites are safe. Cycle fuel for all-day tanks as part of the polishing process. Fuel polishing systems/fuel cleaning, and generator filter changes are all tasks to be completed before storm season or at least six months prior to storm.

6. TRASH & DEBRIS MANAGEMENT

Secure plenty of trash receptacles. Where will trash and debris be held until service resumes?

7. DEPLOY FLOOD & WIND TEAMS

Now is the time that staging sandbags and/or plywood pays off. The assembled teams should put the plan into action.

8. EXERCISE FLOOD GATES

Deploy flood gates if present, at this time. If this equipment was tested in preventative maintenance of Stage 1, flood gates could be effective in preventing water intrusion at specific locations that may be exposed to flooding.

9. SURVEY CAMPUS

- Ensure cooling tower grounds are free of leaves and debris.
- Relocate lightweight items and loose materials inside.
- Check that louvers are operable and exhaust fans are appropriately connected to structure. Secure large acrylic sign faces with tension straps.

STAGE 3: AFTER THE STORM

1. ASSESS ROOF DAMAGE & LEAKS

Check for leaks when it is safe to employ the plan from the preventative maintenance section of Stage 1. Damage will have to be remedied by a professional when the storm has passed, keeping in mind they will be in high demand.

2. COOLING TOWER & CAMPUS GROUNDS

In one case during a weather event, a chiller was shut down due to a plastic bag blowing around. It had gotten pulled into the system and clogged the strainer.

Ensure that the cooling tower grounds are clear of leaves, trees, and debris that can obstruct or hinder functionality. The campus grounds should be surveyed as well for any fallen trees or limbs serving as obstacles.

3. BEGIN MINOR REPAIRS

Doors that were forced open might be damaged and other equipment frequently used during the course of a day may need attention. Begin assessing and prioritizing repairs with staff.

HEALTHCARE SPECIFIC

The following are a few considerations specific to healthcare.

1. EXPECTANT MOTHERS

Expectant mothers, particularly in the last trimester of pregnancy must be given special attention. It is a fact that stress can induce labor and a hurricane can certainly increase stress levels. An estimation of how many patients could be affected is a good measure.

In some cases, the women due to deliver within a week before or after the storm are moved into the maternity wing in Stage 2. Consider the likelihood of family members staying with the expectant mother and how this will affect supplies and sleeping arrangements.

2. MORGUE

In an emergency situation, space in the morgue may become limited. It is not something anyone wants to think about but the recent epidemic certainly taught us that this point deserves heavy consideration.

While morgue trailers and funerary staff can be brought in by state and local government in some cases, a plan should be in place to create temporary holding, if necessary.

3. SURGE IN ED VISITS

There will be a surge in the number of people checking into the Emergency Department following the storm and curfew lift if any. Staff and supply accordingly.

In conclusion, preparing for a hurricane requires a lot of planning and coordination. With careful consideration, public spaces can be prepared to successfully withstand a crisis.

We have provided the following sample templates to assist your staff in organizing and customizing checklists that can prove invaluable in times of emergency to your facility.

VENDOR CONTACT LIST

Pre-qualified vendors contracted to service the facility before and after emergency

ENGINEER - ELECTRICAL

Company Name
Contact Name
Emergency Ph. No. and/or alt. contact info.

ENGINEER - MECHANICAL

Company Name
Contact Name
Emergency Ph. No. and/or alt. contact info.

ENGINEER - STRUCTURAL

Company Name
Contact Name
Emergency Ph. No. and/or alt. contact info.

ELECTRICIAN

Company Name
Contact Name
Emergency Ph. No. and/or alt. contact info.

HVAC CONTRACTOR

Company Name
Contact Name
Emergency Ph. No. and/or alt. contact info.

PLUMBER

Company Name
Contact Name
Emergency Ph. No. and/or alt. contact info.

CONTROLS CONTRACTOR

Company Name
Contact Name
Emergency Ph. No. and/or alt. contact info.

GENERAL CONTRACTOR

Company Name
Contact Name
Emergency Ph. No. and/or alt. contact info.

ROOFER

Company Name
Contact Name
Emergency Ph. No. and/or alt. contact info.

GENERATOR VENDOR

Company Name
Contact Name
Emergency Ph. No. and/or alt. contact info.

PARALLEL SWITCHGEAR / ATS VENDOR

Company Name
Contact Name
Emergency Ph. No. and/or alt. contact info.

CHILLERS VENDOR

Company Name
Contact Name
Emergency Ph. No. and/or alt. contact info.

AIR HANDLING EQUIPMENT VENDOR

Company Name
Contact Name
Emergency Ph. No. and/or alt. contact info.

FUEL SUPPLIER

Company Name
Contact Name
Emergency Ph. No. and/or alt. contact info.

OXYGEN SUPPLIER

Company Name
Contact Name
Emergency Ph. No. and/or alt. contact info.

DOOR HARDWARE VENDOR

Company Name
Contact Name
Emergency Ph. No. and/or alt. contact info.

EMERGENCY POWER CHECKLIST

Equipment to go on generator power during emergency

Elevation of service entrance equipment and generators review

Access to latest one-line diagram for facility confirmed

Status/connectivity of lightning protection system confirmed, if applicable

EQUIPMENT

CAMPUS	AREA OF OPERATION
Lights	Equipment
HVAC	Equipment
Fans	Equipment

KITCHEN	AREA OF OPERATION
Chilled Water	Equipment
Refrigeration	Equipment
Additional Equipment	Equipment

IMAGING	AREA OF OPERATION
MRI (Quench Concerns)	Equipment
Additional Equipment	Equipment
Additional Equipment	Equipment

PHARMACY	AREA OF OPERATION
Pneumatic Tube	Equipment
Additional Equipment	Equipment
Additional Equipment	Equipment

LAB	AREA OF OPERATION
Refrigeration	Equipment
Additional Equipment	Equipment
Additional Equipment	Equipment

PATIENT ROOMS	AREA OF OPERATION
Monitors	Equipment
TVs	Equipment
Additional Equipment	Equipment

AREA OF OPERATION	AREA OF OPERATION
Equipment	Equipment
Equipment	Equipment
Equipment	Equipment

BACK-UP KEYS

List keys, back-up location, and responsible contact.

AREA OF OPERATION	ELEMENT	KEY LOCATION	STAFF CONTACT


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