

Hospital Engineering

TRENDS



Lessons Learned

Recent disasters give reason to rethink emergency management strategies

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Recent natural disasters along the Gulf Coast highlighted areas where hospitals might soon be modifying their existing emergency power (EP) systems and emergency management plans. Should the heretofore almost universally followed dictum of “defend in place” be replaced by a newer version—“defend in place as long as you can, then be able to evacuate”?

Perhaps, or perhaps not. In either case, however, recent events have demonstrated room for improvement across the board.

Power System Considerations

Rising floodwaters in New Orleans and elsewhere caused street-level generator sets at some hospitals to fail. Other hospitals whose generators were above the floodwater also lost EP when water seeped into lower elevation conduit systems and boxes, causing the distribution to fail. Generators are useless if their power cannot be distributed to their loads. Wiring in some hospital basements thus became an unanticipated common mode failure mechanism for both normal and emergency power, with the precipitating factor being the rising floodwater. This issue is not just a coastal issue, since basement flooding can occur anywhere when rivers rise or water mains are broken.

Hospitals that arrange for temporary backup generators should have a pre-established location for the generators out of harm’s way, along with the means to connect the temporary generators safely into appropriate parts of the existing wiring systems.

Additional Backup Power Needs

NFPA 99 contains a detailed list of areas and types of loads that must be powered by a hospital’s essential power system. NFPA 99 also permits hospitals some latitude in assigning additional loads to either the critical branch or the equipment system where the hospital determines they are needed for effective facility operation. Some hospitals might decide to use this latitude to accommodate recent lessons learned during prolonged multiple utility outages.

- Equipment required to operate during extended power outages can include cooling for clinical labs, radiology, and other diagnostic equipment spaces to avoid equipment shutdown from overheating of the electronics; more hallway outlets with capacity to power box-type fans to move air in case the main HVAC systems are disabled; cooling in yet more areas; kitchen ventilation and exhaust hoods not already on the essential system.
- Other changes to help patients and employees better cope with extended loss of multiple utility services can include putting patient room TV sets on EP and resurrecting mothballed TV antenna systems in case local cable TV services fail; onsite water storage or a well with well pumps for backup water in case of municipal water failure; local sewer lift stations and storage in case of municipal sewer disruption.
- Additional backup lighting might be needed in loading docks for nighttime deliveries without municipal street lighting; temporary helicopter landing spaces, including parking garage rooftops, and safe evacuation routes to them; spaces and supporting services required for high patient surge levels, citizens seeking shelter, and employees’

families; additional public and employee bathrooms; temporary triage locations, morgues, and other elements of an enhanced disaster plan. Backup lighting power provisions also include charging stations for large quantities of rechargeable batteries for flashlights & portable hand lanterns.

- **Backup communications capabilities** are needed in case regional communications, including 911 systems and cellular systems, are disrupted as they were during September 11, 2001 and Hurricane Katrina. These could include battery chargers with plenty of extra rechargeable batteries for satellite phones, portable two-way radios, cell phones and PDA's that have communication functions; portable radios to tune into regional emergency broadcast system radio stations; out-of-area cell phones in case local area codes are disabled; and a communications center with battery-powered amateur (ham) radio capabilities and a spare radio antenna in case all other regional communications fail. A boost to employee morale in disaster situations would be spaces and backup communications capabilities for employees to contact their families. Putting rooftop antenna towers on hinges so they can be lowered for the duration of a hurricane or tornado can mitigate wind damage.
- **Other modifications to increase operational flexibility** can include additional elevators that presently turn off when an elevator bank switches to EP; elevators in other buildings that might be needed if older less robust elevator penthouses fall victim to the disaster; additional clinical operations beyond those stipulated in NFPA 99; repair shops and equipment used in making repairs; expanded dialysis capabilities for citizens that cannot use their usual free-standing dialysis centers; upper or interior spaces for operational flexibility if lower floors or a specific wing, for example, must be abandoned due to flooding or structural damage.

A large regional disaster may also require that hospitals establish temporary "MASH" unit locations, temporary triage areas, temporary morgues, and corresponding support services. These services could require portable generators with their flammable gasoline storage issues. EP system allowances need to take hospital surge capacity

into consideration, along with other disaster-related loading, because disaster-related surge will require that more medical devices be used. ED surge may also require that existing intermittent essential loads be used more frequently, resulting in increased generator load.

Some of the additional loads that may be considered for backup power are the same types of loads that are often identified when the hospital is planning for a building-wide normal power maintenance shutdown. Capture lessons learned from these shutdowns and project them into longer duration outages and multiple utility outages.

Remember that additional equipment on backup power will release heat into a potentially non-cooled and non-ventilated space. This may have been one of the more common issues faced by hospitals that remained open after the 2005 hurricanes damaged utility power systems.

Planning Ahead

It may be necessary to plan for weeks without power and water/sewer if roads are not passable or the extent of damage exceeds the 3 to 5 days that most hospitals plan for. Hospitals might also consider ordering extra fuel, portable generators, and other supplies for early delivery, before the state of emergency is declared. It is advisable to work with local government to make sure the deliveries actually get to your hospital and do not get confiscated or redirected by others.

Also remember that having a lot of extra fuel oil on hand increases the possibility of fuel aging and contamination if the need is less than anticipated. See the NFPA 110 Annex discussion of fuel oil aging issues.

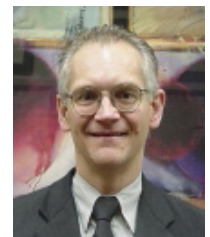
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Hospital Engineering Trends

A newsletter dedicated to healthcare-related engineering issues for hospital engineers, administrators, and design and construction personnel

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