RENOVATE & MAINTAIN

By Jeff Bodway and Dan Meloche

DO IT LIVE

Modifying electrical infrastructure while maintaining hospital operations

Hospital administrators and facilities staff look forward to modifying or servicing the building's electrical system about as much as they look forward to filing their taxes. Even though it's a prudent and sometimes unavoidable occurrence, their reluctance is justified.

An interruption in electrical power in a hospital is at the very least inconvenient. When it's severe and unplanned it can be catastrophic. With a well thought-out plan, tested safety procedures and an experienced team the impact of a planned shutdown on patients, staff and visitors can be minimized. Teamwork and planning are keys to a successful project.

Neglected maintenance — asking for trouble

In addition to expansion or renovation projects, periodic maintenance may also necessitate an interruption of power supply. If it's an older hospital whose electrical system and equipment have not been maintained according to the Joint Commission's most recent directive (see sidebar), delaying maintenance invites bigger problems. Hospitals are large consumers of electricity; they create heavy demands on their systems and over time they will fail. A look behind the curtain at many older systems reveals areas where repairs or modifications involved cobbling together old and new parts to keep the system functioning.

Unfortunately, some hospitals are dealing with such fiscal constraints that until systems are actually crippling operations, preventive maintenance stays low on the list of priorities. Administrators are tempted to minimize maintenance not only because of the cost, but also because it is disruptive to patient care — the very thing they are in business to provide. But as the staff is likely to point out, a scheduled, controlled shutdown is an assurance against the havoc that comes with an unplanned outage.

Planning, Planning, Planning

No matter what circumstances are prompting the modification, careful project planning involving all areas of the hospital is essential. To start, electrical engineers designing the project work closely with the hospital's maintenance/facilities department — the key resource for information about the facility's infrastructure. Plans will need to be in place for dealing with power outages.

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The team should develop a project schedule, one that is carefully planned, to avoid times when they anticipate a high level of activity. It also identifies all the departments that will be affected so key staff will be represented in the planning phase. Each department is responsible for developing alternate ways of accomplishing its work and caregiving role based on the extent and timing of the outage. For example, the food service staff may plan to use disposable plates and utensils and create menus that don't require cooking.

Medical staff, radiology and pharmacy all need sufficient time to develop workarounds and the rule of thumb is to hope for the best, but plan for the worst case.

Using emergency generators seems like the obvious solution. The problem is the large amount of electricity hospitals need to be fully functional for an extended period of time would exceed the emergency system's capacity.

Creative scheduling

When a longer shutdown is required and the schedule can be deferred, administrators may opt to schedule during a holiday — Christmas in particular — when bed counts are lower. If surgical suites and/or the emergency departments are involved in the modifications, the hospital may need to temporarily reroute ambulance services to other facilities. With adequate advanced planning, elective surgeries will not be on the schedule. Depending on the project design, the outages could be phased so to affect one system at a time and work could take place only on weekends and evenings to reduce disruption to hospital operations.

Healthcare emergencies that will impact the project do arise. The project team needs to be flexible and ready to wait onsite to start the project or suspend progress until an emergency procedure is completed. In this case, it is important to coordinate with relevant departments and wait for a go-ahead before moving forward.

Responsibilities of electrical engineers and technicians

A second level of planning and coordination occurs among engineers and technicians doing the work.

The hospital's own staff is responsible for scheduling maintenance on back-up generators and topping off fuel tanks in preparation for the shutdown. The team must include an electrical contractor with experience working in healthcare facilities. They perform installation work needed to implement the design and an electrical testing company must be available to ensure installation works as anticipated. Typically, the electrical contractor will have back-up teams that can be called if needed. In many cases, access to a wholesaler's facility will be arranged for unanticipated material needs that may arise during work on non-standard hours.

New electrical equipment installed in former office space ready for installation of new wiring.

Installation of new normal power feeder to new distribution equipment. Once energized and tested, new distribution equipment will backfeed existing loads, allowing for removal of existing distribution equipment.

COMMUNITY HOSPITALS AND WELLNESS CENTERS, BRYAN, OHIO

SSOE Group provided electrical engineering design for this extensive modification project. It exemplifies means through which the scope of work can be managed to minimize interference with hospital functions.

PROJECT SCOPE: An onsite replacement hospital project that involved replacement of main service, emergency generator and relocation of main electrical distribution equipment.

GOAL: Develop the engineering design to enable installation of new normal and emergency power distribution systems, while maintaining operation of the existing facility.

APPROACH: Technicians prepared new systems and installed raceways, wiring and splice boxes in advance to minimize duration of shutdowns. After new distribution equipment was installed, tested and operational existing feeders were disconnected from the equipment and reconnected to the new equipment. Work was completed during overnight hours over several weeks to reduce impact on operations. One power distribution system was modified at a time.

Selecting the best approach

There are two general approaches to modifying the electrical infrastructure. One involves installing a new piece of equipment — a panel or switchboard, for example — in the hospital in a space different than the original system. This approach requires sufficient space for the new system to be installed, while the existing system remains in place and functioning. Once the new installation is complete, select components from the old system can be connected to the new equipment. Typically, one system is modified at a time. The advantage of this phased shutdown is the majority of the hospital remains operational, while each system is being rerouted.

PHOTOS: SSOE GROUP

When there is not sufficient space to install a new system while the current one is still intact, the plan entails modifying or expanding the existing equipment in place. At the beginning, new equipment is designed and prepared to receive the wiring that was part of the old system. This scenario could involve a total shutdown as the existing equipment is removed and the new equipment is installed in its place and wires are connected to it.

Assuring safety of all participants

Hospitals are very vulnerable to certain safety risks, especially those requiring evacuation, because a significant percentage of the patient population have limited or no mobility. Fire is one such risk. If fire alarm or suppression systems will be involved in a shutdown, a "fire watch" is ordered. This involves assigning a group of people the responsibility for watching out for fires in the areas of the hospital affected by the shutdown.

Loss of parking and exterior campus lighting is another issue that has to be addressed by rerouting foot and vehicle traffic and possibly providing portable lighting towers.

In any setting, working with energized equipment is a safety risk and the industry guidelines continue to be expanded and strengthened to avoid injuries. Arc flashes are a primary concern because they cause molten metal to be released, which could result in serious personal injury or equipment damage. The team must comply with OSHA and the National Fire Protection Association standards to assure safety. OSHA guidelines require conducting hazard analyses to identify the appropriate precautions and personal protective equipment an individual should use when exposed to these hazards.

Thanks to the development of safer equipment, hot taps for example, electricians are exposed to fewer risks than a decade ago. Hot taps allow connections to energize conductors without being exposed to an energized conductor.

Preparing for the unexpected

Comprehensive advanced planning, including conducting dry runs and identifying "what if" scenarios are the best means of ensuring the safety and comfort of everyone. The team should conduct dry runs of emergency plans for any scenario to assure all participants know their roles. Although the team will provide a reasonable estimate of the duration of an outage, it is wise to plan for the worst.

An excellent resource in planning for an outage is a network of healthcare facilities managers. There are few situations a counterpart has not experienced. The website of any state's chapter of the American Society for Healthcare Engineering (www.ashe.org) is a good starting point.

The best power outage is the one that is planned for rather than unexpected. With proper planning and a qualified team, electrical shutdowns on equipment can be completed with minimal effect on hospital operations. Each project has unique issues to be addressed. Team members can bring respective knowledge, experience and skills to the table to provide the optimal solution for the hospital.

The result is the hospital maintains operations during the selected shutdowns. Limiting operation to one system at a time allows the majority of the hospital's electrical system to remain operational and reduces impact on the patients, visitors and staff. ■

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LEARNING FROM MAJOR DISASTERS

Hospitals learned hard lessons from the impact of catastrophic national disasters. Over the last 10 years, six major hurricanes including Katrina, the Houston floods of 2001 and the blackout that downed power from the Northeast to the Midwest in 2003 crippled clinical operations in the affected areas. These incidents demonstrated the importance of prevention and emergency preparedness and were the motivation behind the Joint Commission's issuance of Sentinel Event Alert No. 37.

SEA No. 37 asserts it is not enough for emergency power supply systems to meet NFPA codes and standards as these are designed for immediate life safety. While adherence would allow evacuation in case of fire or completion of a surgical procedure, they are not always sufficient during a major catastrophe. The Joint Commission has issued more stringent standards, including a requirement that each organization test its emergency generators under load at least once every 36 months for a minimum of four continuous hours.

The alert includes suggestions for developing contingency plans for hospital staff and ways of assessing potential vulnerabilities and assuring adequate emergency power. The publication also includes recommendations to prevent adverse events resulting from emergency electrical power system failures. This information is also valuable in a planned outage. Visit www.jointcommission.org.