



## Sentinel Event Alert

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# *Sentinel Event* **ALERT**

### Preventing adverse events caused by emergency electrical power system failures

Health care facilities are highly dependent on reliable sources of electrical power. Therefore, electric power is a mission-critical resource. Each health care facility must assess the risk of electrical power failure – at various degrees of magnitude and impact severity – and make plans to deal with such an emergency. Planning and implementation of risk reduction approaches to addressing electrical power failure are the responsibility of the facility engineer, as well as organization management, the risk manager, incident command leaders, and the medical staff. By assuming access to emergency electrical power systems and implementing contingency plans for clinicians to follow during both short-term and sustained losses of power, health care organizations can reduce the risk of adverse patient care events.

A power failure can range in magnitude and impact from a relatively modest curtailment of power caused by a local power disruption to a catastrophic regional blackout caused by a violent storm or terrorist attack. As reflected in numerous media reports, clinical operations were negatively affected when normal power was lost during the Houston floods of 2001, the northeastern United States blackout in 2003, and major hurricanes Charlie, Francis, Ivan and Jean in 2004 and Katrina and Rita in 2005. Three incidents relating to failures of emergency electrical power systems are in the Joint Commission's Sentinel Event Database (reporting period from January 1995 to the present). These range from single unit failures to entire large medical centers, and each was associated with one or more patient deaths.

#### Meeting NFPA codes and standards only a start

Each health care facility must have an emergency power testing program that includes generator load testing and Emergency Power Supply System (EPSS) maintenance. The National Fire Protection Association (NFPA) establishes codes and standards on the minimum design, installation, and testing of these systems in the National Electric Code (NFPA 70), the Standard on Health Care Facilities (NFPA 99), and the Standard for Emergency and Standby Power Systems (NFPA 110). EPSSs meeting the NFPA codes and standards are designed for immediate life safety – in other words, to complete surgical or other procedures where lives are in balance or to evacuate the building in case of fire. These systems should be designed to “hold out” until normal power is restored.

However, recent experiences demonstrate that emergency power systems that meet these standards are not always sufficient during major catastrophes. This is because they can only support the power needs of a small percentage of the needed equipment and systems, or they are unable to supply power for an extended period of time. For example, in the wake of hurricane Katrina, many health care organizations did not have sufficient emergency power to cool or ventilate their facilities. In other instances, evacuation of patients was delayed because only one or two elevators could be operated. To assure optimal safety during catastrophes, health care organizations are encouraged to go beyond the minimum NFPA life safety requirements and to conduct thorough vulnerability analyses of their facilities.

The Joint Commission addresses emergency electrical power systems in standards EC.7.20 and EC.7.40 and addresses emergency procedures for utility system disruptions in standard EC.7.10. To address the need to provide emergency power for an extended period of time, an additional Element of Performance (EP) for standard EC.7.40 was recently approved and will appear in the 2007 standards. The new EP requires each organization to test its emergency generators at least once every 36 months for a minimum of four continuous hours. This testing is over and beyond the current requirement to test emergency generators for 30 continuous minutes 12 times each year. In addition, if a test(s) required by standard EC.7.40 fails, the organization is required to implement interim measures to compensate for the risk to patients, visitors, and staffs until necessary repairs or corrections are completed.

#### Risk reduction strategies

Important suggestions for proactively assessing a facility's vulnerabilities, helping to assure sufficient electrical power during emergencies, and facilitating the development of contingency plans for clinicians to

follow in the event of short-term or sustained power loss include the following:

- Meet with your local utility provider and assess the reliability of the existing power system. Many facilities are served by overloaded power grids that have transformers and distribution equipment that date back to the 1950s. In other cases, expansions to the original power system have resulted in a “patchwork” system that may not operate reliably during periods of peak loads.
- Respond to facility brown-outs or black-outs as symptoms of marginal power supply. These may be related to the recent addition of new equipment.
- Fully test the entire emergency power supply system against the requirements of NFPA 110 to ensure minimum acceptable performance. Because appropriate testing may impact operations for periods of four hours or more, it is important that organization management, the medical staff, nursing, respiratory therapy, and other key staff participate in the test. The test should be scheduled well in advance of carrying it out, in the same way as any disaster drill would be planned. Electricians, mechanics, and other maintenance technicians should be stationed in strategic locations throughout the facility during testing to monitor the functioning of critical equipment and to minimize response time for problems that may occur. After testing, all fuel supplies should be replenished.
- For any new construction, undertake relevant infrastructure planning as part of a master facility plan. This will assure optimal location of the generator, fuel tank, and support equipment (for example, in flood prone areas, above potential flood levels) and proper redundancy (multiple generators feeding loads versus loads dedicated to a single generator). Such planning will also permit the addition of loads over time and will identify security needs respecting access to generators and other critical equipment such as fuel tanks and radiators, which are essential to generator function.
- Assess the need for additional redundancy through portable, truck-mounted generators and develop procedures to isolate generators from problem areas and to tie in supplemental equipment not normally fed by emergency power. Also, consider designing in emergency connection panels. These might, for example, be used to hook up a truck-mounted unit during construction or renovation.
- Maintain written procedures and record all test data. Written procedures help facility managers control the testing process and require testing personnel to take responsibility for performing required tasks. Many facilities use standardized testing forms to collect test-related data. Unanticipated occurrences should be reported immediately or right after the test for analysis by the supervisor in charge of the test. Mechanical system interactions can be recorded during the test on simple data forms to facilitate both data recording and system recovery. This information can also be used for performance improvement purposes.

### Joint Commission Recommendations

In addition to the current standards requirements that address emergency electrical power systems and current NFPA testing requirements, the Joint Commission recommends the following to help prevent adverse events caused by an emergency electrical power system failure:

1. Perform a gap analysis on the emergency power system that matches the critical equipment and systems needed in an extended emergency against the equipment and systems actually on the emergency power system. Use disaster scenario planning to identify critical systems that could potentially be lost (for example, potable water or elevators). This kind of planning will help assure that emergency power feeds critical systems such as water pumps in high-rise facilities; sewer pumps in low areas; heating, air conditioning and fan units in intense climate regions; and air handlers in isolation rooms (to minimize the risk of airborne infections), in protective environment rooms, and in laboratory and pharmacy hoods.
2. Maintain a complete, labeled inventory of all emergency power systems and the loads they serve.
3. Provide competency training and testing for all operators and others responsible for system maintenance of the emergency power supply system.
4. Test generator fuel oil, track expiration dates, and replace stale fuel oil not consumed within its storage life.
5. Ensure that engineering staff communicate the capabilities and limitations of the emergency power supply system to the organization’s management and clinical leaders. These communications should cover how long emergency power will be available, how long it will take the generators to provide power if and when the utility company’s power is lost, and what locations

#### Clinical Contingency Plans

Examples of provisions to include:

- Rapid deployment of battery- powered equipment (e.g., portable suction units).
- Assessment of critical equipment to ensure it is plugged into back-up power outlets.
- Identification of available HIT systems or manual back-up systems.
- Establishment of timelines and pre-arranged options for diverting, transferring or evacuating patients.
- Care for ventilator-

within the facility will and will not be powered by the emergency power.

6. Establish contingency plans for clinicians to follow during brief or sustained losses of emergency power and include this as part of the orientation and periodic continuing educational activities for medical and other clinical staff. These plans should focus on the requirements set forth in standard EC.7.20, to wit: organizations must supply reliable emergency power to alarm systems; exit sign and exit route illumination; emergency communication systems; blood, bone and tissue storage units; emergency/urgent care areas; at least one elevator for non-ambulatory patients; medical air compressors; medical and surgical vacuum systems; areas where electrically powered life-support equipment is used; and operating rooms, post-op recovery rooms, obstetrical delivery rooms, and newborn nurseries. Contingency plans must also address continued availability of essential health information technology (HIT) systems or of alternate (e.g., paper) systems. See sidebar box for examples of measures to include in the clinical contingency plan.

### References and resources

Joint Commission, *Emergency Power: Testing and Maintenance*. PTSM Series, No. 1, 1994

Stymiest, David L., *Managing Hospital Emergency Testing Programs*, American Society of Healthcare Engineering (ASHE) Management Monograph, July 2003

NFPA 70, *National Electric Code*, 2002 Edition, Quincy, MA: NFPA, 2002

NFPA 99, *Standard on Health Care Facilities*, 2002 Edition, Quincy, MA: NFPA, 2002

NFPA 110, *Standard for Emergency and Standby Power Systems*, 2002 Edition, Quincy, MA: NFPA, 2002

Joint Commission, *Standing Together: An Emergency Planning Guide for America's Communities*, 2005

Joint Commission, *Health Care at the Crossroads: Strategies for Creating and Sustaining Community-wide Emergency Preparedness Systems*, 2003

dependent patients and telemetry patients.

- Establishment of a command center.
- Provision for open lines of communication between on-site staff and any organization leaders who may be off-site.
- Access to and use of two-way radios.
- Establishment of a disaster bin for flashlights, extension cords, etc.
- Definition of precautions for immuno-compromised patients during HVAC failure.
- In the event of HVAC failure, provision for careful, manual monitoring of patient body temperatures.
- Establishment of a critical supply center for food, water, pharmaceuticals and linen.
- Assessment of critical refrigerators (pharmacy, lab, blood bank, etc.) to confirm power supply.
- Assessment of automated drug supply cabinets to confirm power supply.