READY FOR TOMORROW

SIX CRITICAL AREAS OF EMERGENCY POWER MANAGEMENT

BY DAVID L. STYMIEST, P.E., CHFM, FASHE
A n emergency power (EP) sys-
tem’s role in patient safety is
critical to hospitals and regula-
tors. Each hospital EP system
must power what the health care facility
needs, when and for as long as it needs it.
That is a tall order and one that likely
will become more complicated as new
requirements and technologies increase
the demands on these systems.
So, how can hospitals prepare for
these challenges? What measures should
they take? Of what dangers should they
be aware? These questions can be
answered by exploring and analyzing
six critical areas of emergency power
management.

1 System reliability
Reliability continues to be one of the
most important challenges in health care
facility EP systems. Needs are growing as
budgets continue to shrink. How do facili-
ty professionals inspect, test and main-
tain more with less operating funds? How
do they meet more restrictive codes and
standards with smaller capital budgets?

Tightening construction budgets results
in a focus on “Is it code-required or not?”
Facility professionals often see the dispar-
ity between code-required minimums and
what it really takes to keep a hospital
operating effectively.
Some wish for tighter codes so they
will be able to argue for features they
want in their new EP systems, such as
transfer switch bypass/isolation functions
and larger generator sets. Others argue
against tighter codes because of higher
capital cost, and because their operational
budgets simply cannot afford the increas-
ing emphasis on testing and maintenance.
A strong groundswell also is building
within the health care industry against
any code changes that are not supported
by sufficient empirical proof of value.

Many concerns with EP reliability par-
allel the requirements found in the new
critical operations power systems (COPS)
requirements that first appeared in the
2008 version of the National Fire Protec-
tion Association’s NFPA 70, National Elec-
trical Code.

While many hospital power systems are
not necessarily classified as COPS, the
COPS requirements cover many issues
that are important to EP reliability. They
include: risk assessments; identifying haz-
ards and undertaking hazard mitigation
strategies; performing documented load
testing and documented maintenance;
comissioning new power systems; pro-
viding surge protection and selective coor-
dination; using bypass-isolation transfer
switches; selective load pickup and load
sheding; keeping at least 72 hours of on-
site fuel storage; providing means to con-
nect portable generator sets; providing both physical security and physical pro-
tection; separating between normal power
and EP; limiting possible equipment loca-
tions; considering exposure to the 100-
year floodplain; clear labeling; fire protec-
tion; and many other requirements.

The Joint Commission issued its “Sen-
tinel Event Alert, Issue 37: Preventing
adverse events caused by emergency
electrical power system failures” in 2006.
Since then, many hospitals have per-
fomed an EP gap analysis that considers
what is powered from EP and what is not.
Moreover, many hospitals have per-
fomed vulnerability analyses and risk
assessments of EP reliability. However,
many other hospitals have not performed
these assessments.

An industry ListServ has seen many
recent discussions about the pros and
cons of running a hospital’s generators
weekly, including finding incipient fail-
ures sooner vs. the impact of increased
cycling from more starts each month.
Some states require it; many do not.
Some generator manufacturers recom-
mand it. There are good arguments on
both sides of the issue, particularly
about following manufacturers’ recom-
mandations.

2 Maintenance and shutdowns
How many hospitals actually conduct
down power shutdowns to perform main-
tance? What backup provisions are
considered when equipment is de-ener-
gized for maintenance? Safe electrical
maintenance requires turning off the
power, and with the changes in the
2009 edition of NFPA 70E, Standard for
Electrical Safety in the Workplace, there
has been an increasing focus on electric-
ical arc-flash safety.

How many hospitals keep their elec-
trical one-line diagrams updated to
reflect current system configuration?
Without updated documentation, how
do hospitals plan to manage internal
electrical failures effectively? There are
parallels between activities required for
successful planned shutdowns and
emergency management procedures for
unplanned failures.

Hospitals that are not fortunate
efficient to have bypass-isolation transfer
switches find it difficult to maintain
their transfer switches, because doing
so safely requires de-energizing the
branch fed by the switch. As a result,
transfer-switch maintenance in those
cases is often minimal at best.

3 Circuit breaker testing
Emergency power circuit breaker exercis-
ing requirements generally have been
enforced inconsistently in the past. How-
ever, some Centers for Medicare & Medi-
caid Services-contracted state organiza-
tions have started enforcing these require-
ments during surveys.

This situation has caused consternation
for facilities that previously have not been
held to them. The 1999 edition of NFPA
99, Standard for Health Care Facilities,
requires that the essential electrical sys-
tem (EES) “main and feeder circuit break-
ers shall be inspected annually and a pro-
gram for periodically exercising the com-
ponents shall be established according to
manufacturer’s recommendations.”

Based on the EES definition, one might
The requirement for periodic exercising extends not only to the breakers between the generator and related transfer switches (which is the limited scope of a somewhat similar 1999 NFPA 110, Standard for Emergency and Standby Power Systems requirement), but also the life-safety branch and critical-branch circuit breakers on the load side of the transfer switch. Feeder breakers can be found in electrical distribution systems down to and including main breakers on the lowest-level panelboards.

But what about facilities in which the generators are paralleled with the incoming utility service? In those situations, depending on the design, the power to the emergency loads might go through the hospital's main switchboard. So, it is possible that the requirement for periodic exercising might extend to most or all of the circuit breakers in the higher distribution system levels. Facilities, therefore, should be careful in system designs and boundary definitions or they may be in for a surprise from an authority having jurisdiction (AHJ).

There has been some pushback about this requirement from health facilities professionals who believe exercising (opening and closing) an EES circuit breaker can cause substantial disruption within the hospital.

Fuel oil storage

Although many hospitals have more than the minimum required on-site storage of fuel oil as a result of years of focused emergency-management planning, those intending to make changes in existing EP systems or to install new EP systems could be affected by the change in fuel oil storage requirements in the 2010 Guidelines for Design and Construction of Health Care Facilities.

Whereas the 2006 edition required only 4 hours of fuel storage, the 2010 edition now requires storage capacity that permits continuous operation for at least 24 hours. The required on-site EP fuel oil storage capacity is different for different states, and is sometimes even different depending on the locality.

Regardless of the on-site storage capacity, hospitals continue to face the question of how much fuel to have on hand and how to manage that stored fuel oil according to NFPA 110 requirements.

Failure planning

As more clinical, support and infrastructure-management functions become electronic, the EP system importance continues to grow. For instance, has the increasing importance of the electronic health record been matched by equally robust contingency planning for internal electrical failures?

Hospitals should ensure that their internal EP component and system failure contingency plans are effective and that user responses also will be equally effective. Most hospitals have failure procedures for generator failures. Many also have practiced those procedures. If a generator fails during a utility outage, there likely will be clinical and support service impact.

Those protocols should be determined and practiced as well.

Other than generator failures, there also can be such internal failures as a transfer switch or the critical branch riser in a patient tower. Transfer switches are complex electromechanical devices that fail from time to time. Riser failures have been caused by events such as sprinkler head damage or contractor core drilling. It is wise to have predetermined responses for these internal failures that could have severe impact on patient care.

Construction and modifications

Without clear EP system branch marking and strong construction management policies, it is easy for ongoing changes in hospitals to lead to improper connections of new equipment and modifications.

Many hospitals find equipment connected to the wrong branch (e.g., life-support equipment connected to the life-safety branch). Hospitals also report that they are surprised to find red outlets that go dead when normal power drops out.

Sometimes such situations occur with new construction or renovation projects and could have been corrected with a concerted commissioning effort. Sometimes this situation is long-standing and the culprit cannot be determined.

Without an effort to field-validate the existing EP system, these situations are hidden from view until an internal failure exposes them. At that point one can only hope that there is no negative patient-care impact.
Another impact of ongoing construction and renovations is the impact on the loading that will be seen by the transfer switches and generators under worst-case conditions, also known as peak demand loading. Because monthly load tests often are scheduled for low-activity times, load test readings usually do not represent real peak demand load.

Some state AHJs require that hospitals know and report their existing EP peak demand loading before modifications are approved. However, most do not. Most hospitals do not have permanently installed metering to facilitate that process. There are a number of approaches for accurately determining EP peak demand loading.

Some also have expressed concern not only about not being able to predict EP load growth over years, but also after utility power has been off for days. Some have reported that upon investigation, existing transfer switches and even generators have been found to be overloaded for worst-case situations. In fact, EP load growth actually has surprised some health facilities after disasters occurred.

Substantial electrical system modifications also could invoke the need to update existing electrical system selective coordination studies and the corresponding arc-flash hazard energy analysis. Electrical systems with poor selective coordination can have outages that are more extensive than necessary.

The selective coordination issue has been and still is controversial, and some NFPA code-making panels have been attempting to deal with it.

David L. Stymiest, P.E., CHFM, FASHE, is a senior consultant at Smith Seckman Reid Inc., Nashville, Tenn., and chairman of the NFPA Technical Committee on Emergency Power Supplies. His e-mail is DStymiest@SSR-inc.com. The views and opinions expressed in this article are the author’s own and not the official position of NFPA or any of its technical committees and should not be considered to be, or relied upon to be, a formal interpretation. Readers are encouraged to refer to the entire text of all referenced documents and NFPA members can obtain staff interpretations of the various standards by logging on to www.nfpa.org.