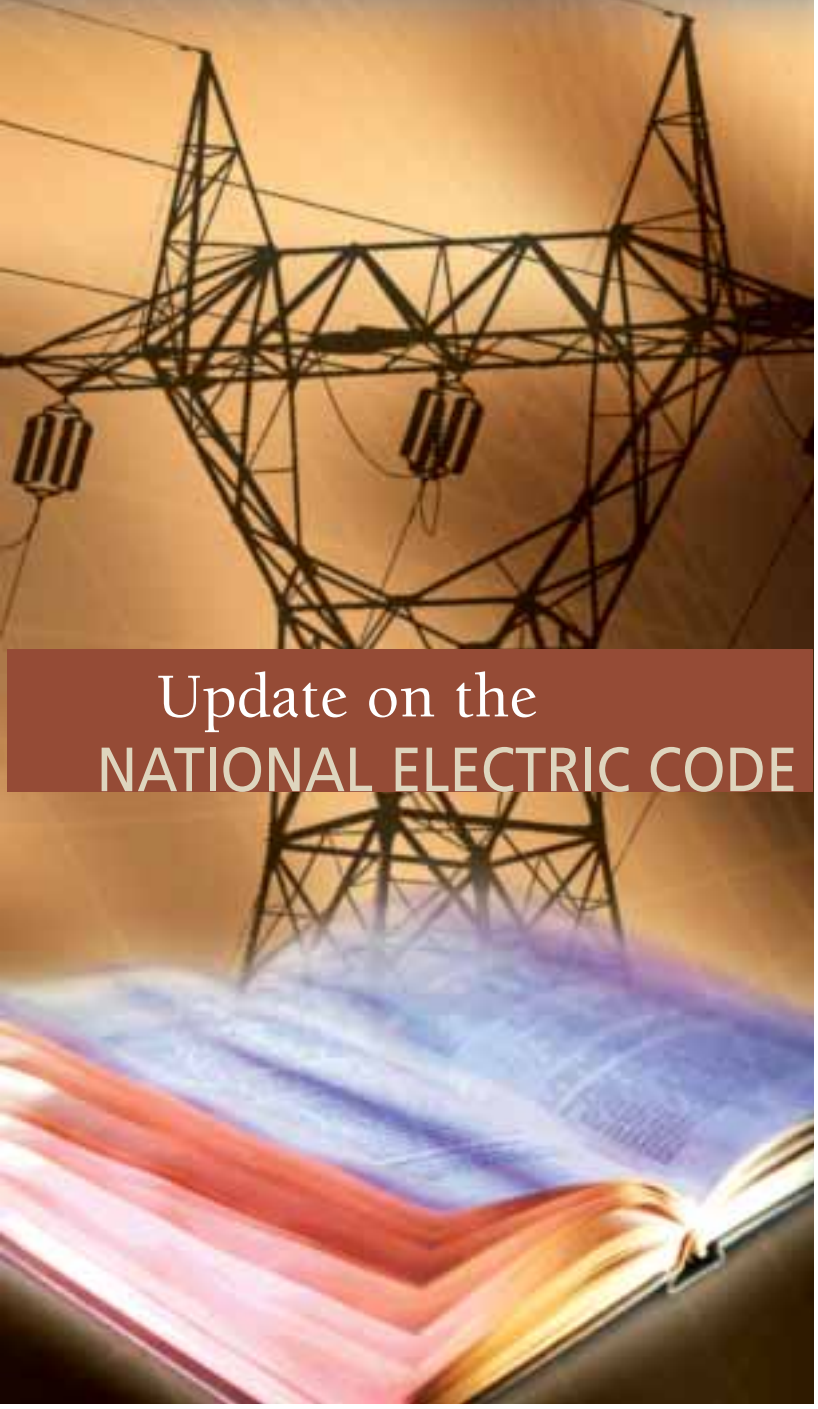

Update on the NATIONAL ELECTRIC CODE

By Michael A. Anthony, P.E.

When the 2005 edition of the National Electric Code is released later this year, it will be the first edition since the tragic and catastrophic events that occurred on September 11, 2001. It will also be the first update since August 14, 2003, when many colleges, universities, schools, and communities were affected by the worst power outage in U.S. history. The "lessons learned" from both events were on the mind of the technical committees that met over the past year in order to update the NEC.

A summary of noteworthy changes are as follows:

1. There will be modified language on the survivability of power systems during fires. The NEC is written, after all, under the auspices of the National Fire Protection Association, and the progressive way to fight fires is with the power on. Thus, for example, there will be clarifications in the language covering the locations of fire pump disconnecting means. Henceforth, fire pump disconnects shall not be located in emergency power distribution panelboards. There was a problem in some jurisdictions where physical space was at such a premium that when fire pumps were turned off, so went the entire emergency power distribution system.
2. Fuel cell systems that are specifically designed to be emergency systems shall be permitted to provide emergency power as long as they can meet full demand for emergency power for two hours. Fuel cells, like any other power source asset, are not allowed to be the normal and the emergency power source, however. It is noteworthy that the two-hour requirement is essentially a performance requirement, something that has been traditionally eschewed in the NEC.
3. Signal exchange with emergency power switchgear shall not be required for portable standby sources. It has been only recently that the NEC even covered portable sources of power. Some legacy provisions for the classical permanent installation remained in the NEC until now. It is obvious to the electrician operating the portable generator when the power to a building or event is not present; thus there is no point in requiring control signals between the exterior generator and interior switchgear even if such control circuitry exists.
4. Where an outdoor housed generator has its own disconnecting means located within sight of the building an additional disconnecting means shall not be required within the building. It makes sense that if you have a way to disconnect the generator—once at the generator itself and also within the interior service panel—you do not need a third device in between if the generator and the building it supports are in close proximity. This makes it less expensive to build code compliant on-site emergency generator systems in terms of dollars and interior space. Anytime the NEC reduces its requirements for wall space the better.

The foregoing is a short list of some of the least arcane amendments to the NEC that shall appear in the 2005 edition. In general, a substantial proportion of changes to the NEC are editorial in their nature and would fall below the radar of most facility managers in higher education. The writers of the NEC have stayed "on task" with respect to amending the NEC to reflect new safety realities without over-reaching in the stated purpose of providing "practical

Mike Anthony is the senior electrical engineer for the University of Michigan, Ann Arbor, Michigan, and can be reached at maanthon@bf.umich.edu. He has served for several years as APPA's representative to the National Electric Code; this is his first article for **Facilities Manager.**

The stated purpose of the NEC, which has survived scrutiny for many code cycles now, does not allow the NEC to be used to justify providing emergency power to a handicapped student's dormitory respirator, or to a laboratory freezer where twenty years of research data is contained.

safeguarding of persons and property from the hazards arising from the use of electricity."

The stated purpose of the NEC, which has survived scrutiny for many code cycles now, does not allow the NEC to be used to justify providing emergency power to a handicapped student's dormitory respirator, or to a laboratory freezer where twenty years of research data is contained. The NEC can only be used as a guide to build a safe emergency power installation should you decide to build one.

5. In one of the NEC's sister publications, the Fire Alarm Code (NFPA-72), we shall see amendments that permit "backup control centers." Prior to 9/11 the NFPA had required campus-wide networks to terminate in a single supervisory control room to ensure a uniform response to fire alarms. Again, survivability is the operative word. If a control panel is either unattainable under certain conditions, or if it fails, there must be an alternate location from which to maintain operations. Safeguards will be built into such systems to prevent two control locations from being active at the same time.
6. Finally, NFPA 1600, the Standard on Disaster/Emergency Management and Business Continuity Programs has been accepted by the Department of Homeland Security but those looking for substantive requirements in order to fund security projects will find mostly a list of cross-references to other ANSI standards.

For many years, avoiding another "Blackout of 1965" inspired power engineers. I saw my power engineering professors, typically given little support within the electrical engineering departments, focused on the reliability of transmission level protective relaying, sub-synchronous oscillations across the North American grid and the economic practicality of dynamic var compensators. Then August 14th came and went with hardly a fatality that can be directly attributed to it. Maybe it was an extended late summer weekend; maybe it was the relative speed at which the system was stitched back together; maybe the preparation for Y2K paid off, after all.

In 1992, I recall speaking an engineer at the Port Authority of New York who was in charge of the power system at the World Trade Center (before the first bombing). I was involved in designing the power system for a high-rise elevator and I approached him thinking that if I could understand the elevator power system at the World Trade Center, I will be able to do a better job planning for power for a 16-story elevator on a university campus. He described several emergency power systems—two redundant life safety systems using both natural gas and diesel; and a third, optional system that could be "subscribed-to" by any tenant for a monthly fee. All of these systems were then backed up by a fourth system—two underwater cables that supplied power from a utility in New Jersey. Clearly, a "balanced portfolio" of emergency power options was on the minds of the power engineers at the Port Authority.

One of the key issues facility professionals need to manage going forward is the degree to which we consider natural gas an independent source; especially with the drive to make fuel cells more widely applied. I draw from my personal experience from a couple of summers in college, as an engineering student drafting "as built" drawings of the power system of a natural gas pipeline that extends from Louisiana to the upper Midwest. While it is true that there is substantial on site power for keeping pressure up at compressor stations along a seven-state path, the supply of natural gas is only good as long as the pipes themselves are in good working order. Like transmission lines; pipelines are vulnerable.

One of the key issues facility professionals need to manage going forward is the degree to which we consider natural gas an independent source; especially with the drive to make fuel cells more widely applied.

At this point the NEC, and its related standards, leaves the determination of the independence of fuel and power supplies up to the Authority Having Jurisdiction. The response of NFPA technical committees to the most recent catastrophes would lead us to conclude that traditional allowance for natural gas as an independent source for on site generation may last only as long as it does not work. There is no widely accepted method of verifying normal and emergency power system reliability that a typical electrical inspector can use. Alas, we must rely upon common sense.

Some recommendations for educational facilities professionals are as follows:

- Consider a balanced portfolio of emergency power generating options—diesel as well as natural gas. If fuel cells gain in their acceptance as a source of normal power there will be limits to the degree to which natural gas can be relied upon to provide emergency power.
- Communication systems should also be balanced between wireless, satellite, and "wire-ful" old telephone service. There is widespread recognition that the copper wiring embedded in the old "Ma Bell" system served us well.
- Increase your coordinated emergency planning with your host communities. With city and county planners, look closely at the shared dependence upon water, natural gas, and electric power for opportunities to make emergency systems generate income as well as they provide security. The least expensive time to build an emergency power system is the day before the next outage.

My colleague at the World Trade Center was generous with his time in a way that power engineers may never be able to be again, and in a way that I shall never forget. What I took away from this conversation was the reminder that we write our own codes based upon the inherited wisdom we receive from those who preceded us and upon the shared experience of our own moment in history. The NEC, even after a hundred years as the most widely accepted standard on earth, is still mindful that in order to be relevant it must not be too rigorous. Yet no one is restrained from engineering and building a power system exceeding its minimum requirements.