

Report to APPA:
2011 National Electric Code Development

This report offers an opportunity for APPA facility executives to inform the ballot on the first of two phases in the development of the *2011 National Electric Code*. Code-Making Panel No. 1 (CMP-1), where APPA holds a principal voting position for our industry, met January 17-24 to develop a *Report on Proposals* for the NFPA. Three hundred technical, editorial and safety-related proposals were discussed by CMP-1 and a straw vote was taken in order for industry principals to have an estimate of committee consensus before the official written ballot.

Three key issues have been identified as important for electrical professionals in the education facilities industry. They are described in a general fashion in the following pages to help you formulate your own thoughts. Majority and minority opinions are highly nuanced on all three of these issues and therefore beyond the scope of an executive summary such as this. I hope I have represented them fairly. Note that the first two issues are variants of proposals that have been placed before CMP-1 in the past. They have been discussed in previous APPA publications.

Written ballots from industry principals are due in the NFPA offices by February 27th. Your response to these issues will inform APPA's official position as formulated by the APPA Code Advisory Task Force.

Dissenting views will be gratefully received.

If you would like to see the actual legislative language of these, and/or other issues that were brought before other NEC technical committees, please send your requests to maanthon@umich.edu.

1. Scope of NEC versus the National Electric Safety Code

Background. Many colleges and universities have complicated relationships with municipal and investor-owned power utilities. Most have “systems-within-a system” that form a microgrid; with wiring and equipment on either side of a boundary governed by standard easement and right-of-way agreements. Safety concerns along this boundary typically involve area lighting, emergency power sources, site placement of transformers and generators and alternative energy sources, metering, operation and maintenance of high voltage overhead and underground supply at the so-called “service point”. The service point is a legal artifice that, among other things, separates the scope of the *NEC* from the *National Electric Safety Code (NESC)*.

In 2000, APPA’s representative to the NEC was included in a national Ad Hoc Task Group set up by the NFPA that included representatives of the Edison Electric Institute (EEI), the International Brotherhood of Electrical Workers (IBEW), the National Electrical Manufacturers Association (NEMA) and the Institute of Electrical and Electronic Engineers (IEEE). This task group was charged with developing language to reconcile the competing objectives of safety and economy in installations on both sides of the service point; along the boundary where building premises and municipal/utility wiring systems overlap.

The work of the Task Group resulted in a three-word phrase – “**by other agreements**” – that was added to Section 90.2(B) of the 2002 NEC that, for the first time, effectively granted local rule for colleges and universities to enter into special (or, “other agreements”) with their local municipalities and utilities regarding electrical safety leading practices. This language remained in the 2002 and 2005 editions of the *NEC* as shown below [**comment and emphasis added in square brackets**].

In the 2008 edition of the NEC, however, this language was removed. The practical effect of this change not only reversed local rule, but it put a large class of electrical installations on the boundary of campuses – but outside a building -- under the scope of the NEC.

Based upon the results of straw votes taken last week, CMP-1 is positioned to sustain the 2008. A selection of opposing views (on Proposal 1-29 RE: Section 90.2(B)(5)) are summarized as follows:

Majority (*National Electrical Contractor’s Association, Intertek Testing Association, International Brotherhood of Electrical Workers, Underwriters’ Laboratories, Alliance for Telecommunications Industry, International Association of Electrical Inspectors, American Chemical Society, National Electrical Manufacturer’s Association*)

90.2 (B) Not Covered. This [2002 & 2005 NEC] *Code* does not cover the following:

- ...(5) Installations under the exclusive control of an electric utility where such installations...
- b. Are located in legally established easements, rights-of-way, or **[by other agreements]** either designated by or recognized by public service commissions, utility commissions, or other regulatory agencies having jurisdiction for such installations...

(C) Special Permission. The authority having jurisdiction for enforcing this *Code* may grant exception for the installation of conductors and equipment that are not under the exclusive control of the electric utilities and are used to connect the electric utility supply system to the service-entrance conductors of the premises served, provided such installations are outside a building or terminate immediately inside a building wall.

(Examples of utilities may include those entities that are typically designated or recognized by governmental law or regulation by public service/utility commissions and that install, operate, and maintain electric supply (such as generation, transmission, or distribution systems) or communication systems (such as telephone, CATV, Internet, satellite, or data services). Utilities may be subject to compliance with codes and standards covering their regulated activities as adopted under governmental law or regulation. Additional information can be found through consultation with the appropriate governmental bodies, such as state regulatory commissions, Federal Energy Regulatory Commission, and Federal Communications Commission.)

The majority believes that NEC safety issues should prevail over utility industry practice wherever wiring and equipment is located on Owner premises, regardless of the ownership and control of the wiring and equipment.

- Properly-trained electricians can work safely on either side of the service point; low or medium voltage.
- Public utilities interpret that the 2002-2005 language to mean that the utility can install lighting installations in private parking areas, without proper permitting or oversight by the authority having jurisdiction (essentially, the Fire Marshall or Electrical Inspector.) For example, public utilities in Maryland have been granted the ability to by-pass the NEC by the public service commission and install private area lighting without service disconnects, branch circuit protection or proper grounding means under Article 250 NEC.

- There is no need for the phrase “by other agreements” since the language of Section 90.2(C) already permits flexibility for the authority having jurisdiction to grant exceptions for power utilities.
- The use of open-ended language such as “ by other agreements” could be compared to writing a blank check. As utilities continue to deregulate and the electrical industry as a whole continues to seek its own level, it is hard to imagine what the scope and implications of the words “or by other agreements” could one day mean.

Minority (*Edison Electric Institute, APPA.ORG and the American Public Power Association*).

The minority believes that local rule (upheld by the use of the phrase “by other agreements”) should be restored in the 2011 NEC for the following reasons:

- The text “or by other agreements” allows for the installation of utility facilities directed by their regulatory commissions on other-than easements or right of ways through applications executed for service to the premise.
- Writers of the NEC cannot decide what is within its scope without a corresponding change in the NESC.
- The 2008 language ignores the consequences of utility ownership of exterior luminaires, for example. Street lighting was the first application of electric power in the United States and has been guided safely by the NESC for the better part of 100 years.
- The 2008 language ignores the effect upon reliability that ungrounded emergency circuits provide. The NEC would require a disconnect switch at the property line that represents another failure point.
- There are differences in the work-practice culture between building premises wiring electricians, and high voltage electricians; often manifested in the different training and compensation structures. Building premises electricians should not be operating utility switchgear, typically ungrounded medium voltage distribution circuits with reclosers and utility-style overcurrent protection regimes. This prospect risks continuity of power to other loads on the utility distribution circuit – the so-called “last mile” of medium voltage distribution wiring.
- Out sourcing of work by utilities for work on area lighting should be determined by state public utility commissions. Since the NEC is typically adopted nationally—without exceptions—the removal of the term “by other agreements” creates burden upon state public utility commissions to restore the flexibility granted to local jurisdictions in the 2002-2005 language.

Each side cited the ANSI requirement for harmonization and coordination of standards. Neither side presented much in the way of case history where this jurisdictional issue had reached the courts. There was a great deal of anecdotal evidence of third party electrical contractors – working under contract for utilities – that were ignoring NEC installation rules in area lighting, generator, and metering projects. Neither side presented documented loss history.

Recommendation: APPA should continue support the minority opinion. Many colleges and universities are running “utility-like” enterprises and many are their own inspection authority. State utility regulations are uneven and not ready for a “one-size-fits-all” safety rule for the type of electrical installations that will be possible in distributed resource power delivery regimes. There may also be a tendency to retard innovation in alternative energy technologies in which many APPA member institutions are engaged.

2. Arc Flash Hazard

Background. The straw vote of CMP-1 was cast in favor of approval of a proposal (1-183 RE: Section 110-26) that would require short circuit calculations of available fault current to be posted on all service equipment. Approval of this proposal is tantamount to the requirement for incident energy calculations on labels that has been rejected in the past four code cycles since arc flash hazard protection emerged as a priority safety issue.

Electrical professionals in APPA member institutions will recall past NEC updates that anticipated continued interest by the electrical safety community in best practice development for protecting electricians and the general public from arc flash. Consistent with past voting on similar arc flash proposals, APPA entered another abstention during the straw voting last week.

Majority Opinion. (*Underwriters’ Laboratories, Alliance for Telecommunications Industry, International Association of Electrical Inspectors, American Chemical Society, National Electrical Manufacturer’s Association, National Electrical Contractor’s Association, Intertek Testing Association, International Brotherhood of Electrical Workers*)

The majority believes that the proposal for the posting of short circuit calculations on all electric services panels should be accepted for the following reasons:

- One of the NEC’s first principles is the listing of the products and a products’ suitability to the application. NFPA and UL find their origin in regulating the market in products from the standpoint of safety. The inspection community requires fault current information as surely as it is entitled to voltage and ampere information.
- The proposal is a scaled-down version of the more comprehensive requirement for incident energy calculations for all downstream equipment on the load side of the service point. It should more economically feasible than earlier conceptions for flash protection guided by incident energy calculations.
- The inspection community is entitled to this key metric in order to grant occupancy to a facility. While this requirement is reflected in OSHA workplace

safety requirements, it is more likely that the enforcement funding of the NEC will accomplish the safety objective more effectively over the life-cycle of the facility.

Minority Opinion. (The Edison Electric Institute) The minority believes that this proposal should be rejected for the following reasons:

- The energy level in a fault is not easy to determine because it is neither a steady state phenomenon like voltage and current, nor is it set up to be fixed. Available fault current changes as source-load and branch-node configuration change over time. Available fault current is always a computed – never measured – value.
- This proposal would place additional cost burden upon public utilities to provide dynamic impedance information to customers. Most designers over-specify interrupting capacity of service equipment to accommodate future increases in fault sources. Ampere ratings of service equipment is correlated with interrupting ratings.

Abstention (APPA). To summarize the basis of APPA’s abstention:

- The legal artifice known as the “service point” in many campus style complexes can be at any of three different locations: the line side of the primary switch, the line side of the transformer, or the load side of the secondary main breaker. This shifts the cost from building premises project cost to the utility-like workgroups within the education facilities industry.
- In most jurisdictions, AIC calculations must be supervised under a registered professional electrical engineer to accumulate impedance data and process it for posting on service labels. APPA electrical engineers would have to contact local utilities to obtain the circuit information. It is not clear whether the utilities are entitled to compensation for this additional work.
- Public utility commissions may grant utilities the ability to either increase rates or to back charge customers in order to pay for the additional engineering required to assist its customers to meet this requirement.
- When a new building service is supplied from an existing medium voltage distribution circuit all of the available fault levels on the buildings connected to the circuit will have to be re-calculated and re-posted on all of the service equipment. In some colleges and universities this shifts costs from building-specific project budgets to operations and maintenance budgets. APPA member institutions need time to assess the cost impact of this change.

Recommendation. Sustain the abstention and wait for the second phase of the code development process to begin in December 2009. NFPA’s implement of the ANSI process allows all points of view to be heard over the next eighteen months. Listen for a functional middle ground in the arguments and counterarguments to come in the Comment stage of 2011 NEC development.

APPA members should be aware that the 2009 version of *NFPA 70E: Standard for Electrical Safety in the Workplace* now contains a requirement that all applicable electrical equipment shall be field marked with a label containing the available incident energy or required level of PPE.

Refer to **Attachment #1** of this advisory for more complete information.

3. Installation Information for Copper and Aluminum

Background. A proposal (1-274 RE: Chapter 9 Tables) was submitted to CMP-1 to include, for the first time, termination torquing information for both copper and aluminum. CMP-1 was nearly unanimous in its recognition that aluminum is being used more widely as a wiring option nationally. The straw vote of the committee was to reject the proposal until the Aluminum and Copper Associations -- as well as UL and NEMA -- could remove inconsistencies in the tabulated data that was submitted in the proposal. If the data discrepancies between UL 486-series of standards and the Canadian Standards Association are cleared up in the Comment phase, then CMP-1 seems willing to approve any follow up comment that would include this vital installation information a dedicated annex.

Recommendation. APPA entered an abstention in the straw vote in order to send a signal to the electrical industry that the educational facilities industry is positioned to encourage innovation in products and installation methods that reduce the cost of electrical infrastructure. A new burst of regulations seems likely given federal policy changes that will attempt to merge the objectives of educational facility infrastructure investment and energy conservation. More information on UL 486E may be found at:
<http://ulstandardsinonet.ul.com/scopes/scopes.asp?fn=0486E.html>

Summary

These three issues have been selected because APPA, with its voting position, has a heavy stake in the determination of their outcome. As can be seen, two of them are new manifestations of code controversies that have been documented on the APPA web site in the past (see link below). At least two APPA proposals on emergency power systems were accepted by other committees. Sixteen other proposals were submitted on APPA's behalf during this code cycle – many driven by member input.

Other issues on 2011 rules for hospitals, critical operations power systems, engineering supervision, intersystem bonding, will be discussed on the APPA Code Advisory Task Force web page after the results of all panel voting is released to the public in July 2009.

Keep in mind that jurisdictions always have the option of taking an exception to the national consensus standard but there are risks to state and local governments that are associated with this possibility. In general, most jurisdictions try to adopt the National Electric Code whole cloth.

Even after a hundred years as the most widely adopted consensus standard on earth, the writers of the NEC are mindful that in order for the NEC be in step with the times it must not be too rigorous in its methods or burdensome in its cost impact. Yet no one is restrained from engineering and building a power system exceeding its minimum requirements.

Endnotes:

- *NEC Update Archives are available at:*
http://www.appa.org/search/search.exe?zoom_per_page=20&zoom_query=%22michael+a.+anthony%22&zoom_and=0
- *APPA has been a voting member of the National Electric Code since 1999. APPA's Code Advisory Task Force would like to thank Rich Robben, Executive Director for Plant Operations, at the University of Michigan for the support provided by his staff.*
- *Other members of the APPA Code Advisory Task Force: Brooks Baker (University of Alabama- Birmingham), John Bernhards (Co-Chairman, APPA Staff), Richard Davis (Evergreen State College), Kevin Folsom (Chairman, Dallas Theological Seminary), David Handwork (Arkansas State University), Terri Konchesky (West Virginia State University)*
- *Thanks to the following individuals for the time spent reviewing this report:*

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Though they are in no way responsible for any errors of fact or judgment, there is no part of this report which has not been improved by their remarks.

Attachment #1

Selection from 2009 NFPA-70E (grayed area is NEW text)

130.3 Arc Flash Hazard Analysis.

An arc flash hazard analysis shall determine the Arc Flash Protection Boundary and the personal protective equipment that people within the Arc Flash Protection Boundary shall use.

The arc flash hazard analysis shall be updated when a major modification or renovation takes place. It shall be reviewed periodically, not to exceed five years, to account for changes in the electrical distribution system that could affect the results of the arc flash hazard analysis.

The arc flash hazard analysis shall take into consideration the design of the overcurrent protective device and its opening time, including its condition of maintenance.

Exception No. 1: An arc flash hazard analysis shall not be required where all of the following conditions exist:

- (1) *The circuit is rated 240 volts or less.*
- (2) *The circuit is supplied by one transformer.*
- (3) *The transformer supplying the circuit is rated less than 125 kVA.*

Exception No. 2: The requirements of 130.7(C)(9), 130.7(C)(10), and 130.7(C)(11) shall be permitted to be used in lieu of a detailed incident energy analysis.

FPN No. 1: Improper or inadequate maintenance can result in increased opening time of the overcurrent protective device, thus increasing the incident energy.

FPN No. 2: For additional direction for performing maintenance on overcurrent protective devices, see Chapter 2, Safety-Related Maintenance Requirements.

(A) Arc Flash Protection Boundary.

(1) **Voltage Levels Between 50 Volts and 600 Volts.** In those cases where detailed arc flash hazard analysis calculations are not performed for systems that are between 50 volts and 600 volts, the Arc Flash Protection Boundary shall be 4.0 ft, based on the product of clearing time of 2 cycles (0.033 sec) and the available bolted fault current of 50 kA or any combination not exceeding 100 kA cycles (1667 ampere seconds). When the product of clearing times and bolted fault current exceeds 100 kA cycles, the Arc Flash Protection Boundary shall be calculated.

(2) **Voltage Levels Above 600 Volts.** At voltage levels above 600 volts, the Arc Flash Protection Boundary shall be the distance at which the incident energy equals 5 J/cm² (1.2 cal/cm²). For situations where fault-clearing time is equal to or less than 0.1 sec, the Arc Flash Protection Boundary shall be the distance at which the incident energy level equals 6.24 J/cm² (1.5 cal/cm²).

FPN: For information on estimating the Arc Flash Protection Boundary, see Annex D.

(B) **Protective Clothing and Other Personal Protective Equipment (PPE) for Application with an Arc Flash Hazard Analysis.** Where it has been determined that work will be performed within the Arc Flash Protection Boundary identified by 130.3(A), one of the following methods shall be used for the selection of protective clothing and other personal protective equipment:

- (1) **Incident Energy Analysis.** The incident energy analysis shall determine, and the employer shall document, the incident energy exposure of the worker (in calories per square centimeter). The incident energy exposure level shall be based on the working distance of the employee's face and chest areas from a prospective arc source for the specific task to be performed. Arc-Rated FR clothing and other personal protective equipment (PPE) shall be used by the employee based on the incident energy exposure associated with the specific task. Recognizing that incident energy increases as the distance from the arc flash decreases, additional PPE shall be used for any parts of the body that are closer than the distance at which the incident energy was determined.

FPN: For information on estimating the incident energy, see Annex D.

- (2) **Hazard/Risk Categories.** The requirements of 130.7(C)(9), 130.7(C)(10), and 130.7(C)(11) shall be permitted to be used for the selection and use of personal and other protective equipment.

(C) **Equipment Labeling.** Equipment shall be field marked with a label containing the available incident energy or required level of PPE.