electroindustry

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Protecting lives and property

through life-safety products

ALSO INSIDE

- Observing National Electrical Safety Month
- Supporting Shaheen-Portman Energy-Efficiency Bill
- DOE Finalizes Transformer Rulemaking
- FDA to Issue Guidance on Mobile Apps and HIT
- Noting Progress on Latin America Initiative

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CONTENTS

FEATURES

Strategic Initiative to Preserve Three-Year Code Adoption Cycle Puts Consumer Safety First **10**

Smoke Alarms—Phenomenal Life Safety Bargain **12**

AFCIs—Making an Impact on Fire Prevention **14**

New Technologies and the Challenge They Pose to Building Fire Alarm Systems **16**

Low-Power Electronics in Outdoor Settings Require Careful Attention to Surge Protection **18**

NEMA SPD Survey Substantiates their Role as Electrical Safety Devices **19**

A Systematic Approach to Arc-Flash Mitigation **20**

Emergency Lighting Shows the Way **21**

National Electrical Safety Month Spotlights Electrical Safety Leaders **22**

Using Generators Safely **23**

Re-Imagining Safer Power Systems in Education Facilities Industry **24**

Just the Tip of the Iceberg? **24**

Amperes—Not Volts—Kill **26**

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CONTENTS

NOTES

NEMA Officers 3
Comments from the C-Suite 3
View from the Top 4
Regulatory View 5
Learn More 32

DEPARTMENTS

Government Relations Update 8
The Silent Killer: Are Children Being Poisoned at School? 8
OSHA to Update Regulations to Reference Z535 Standards 9

Electroindustry News 27
FDA to Issue Guidance on Regulatory Environment for Mobile Medical Applications, Health Information Technology 27
2013 ARPA-E Energy Innovation Summit Expands Policy Focus 28
enLightenAmerica Lights Up NFMT Show 28

Code Actions/Standardization Trends 29
Rising Water—R U Ready? 29
Early Registration, Room Reservations Now Open 29

International Roundup 30
CANENA Annual Meeting Features Regional Standardization Focused on Canada 30
Progress on NEMA's Latin America Initiative 31

Economic Spotlight 32
What a Difference a Year Makes for Incandescent Lamps 32

NEMA Offers Guidance on Spring Flooding

As states across the Midwest begin preparations for spring floods, electrical inspectors and residents are encouraged to refer to NEMA's *Evaluating Water-Damaged Electrical Equipment* publication when assessing electrical equipment that has been submerged.

Evaluating Water-Damaged Electrical Equipment may be downloaded at no charge.

For a complimentary hardcopy, contact NEMA Communications at *communications@nema.org.*

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COMMENTS FROM THE C-SUITE

Membership on NEMA's Board of Governors (BOG) is coveted not just because the list of members represents many of the top leaders from multiple industries, but mainly because the board influences a wide range of actions directly affecting these industries.

A key reason that BOG has remained so successful is that nominees are selected on the basis that they are full-time senior executives (CEO, president, or executive vice president) with broad responsibilities and top policymaking authority for their companies. This high threshold ensures that the board can act quickly and decisively in response to fast-breaking business challenges and opportunities. Beyond this threshold, a nominee is considered on the basis of his or her willingness to serve actively and contribute substantively not just to BOG but also to policy groups and initiatives that it establishes.

The path to BOG is described succinctly in NEMA's bylaws. The number of seats is set at 30. Openings occur occasionally when a member's term expires or when a member steps down prior to the end of his or her term creating a vacancy. Nominations for board members are considered by the Nominating Committee, which the board must establish at least four months prior to the association's annual meeting. The committee has the latitude to consider board make up and continuity of experience on the board when trying to ensure an appropriate slate of candidates.

Nominations can be received by the Nominating Committee in two ways: self-identification, where a representative of a member company expresses an interest in being elected to the board, or nomination by a product section. Alternatively, a board member can nominate a candidate. Section nominations must be received at least 60 days prior to the annual meeting. Additionally, any member voting representative may nominate a representative to BOG at NEMA's annual meeting. This nomination will be included on the slate of candidates once a second voting representative from another member seconds the motion. From this candidate slate, association members attending the annual meeting elect a minimum of 10 board members for three-year terms plus additional members as required to complete the terms for anyone who may have resigned.

Regardless of the means by which the candidate's name is submitted, these pathways tend to yield nominees that have participated significantly in section activities or have otherwise volunteered services on behalf of the association or related industries. Their contributions are well known to the membership. In addition, BOG members understand that their responsibility is to represent NEMA's industries and not the viewpoint of their respective companies.

Nominations are now open for the 2014 Board of Governors. Please send nominations to the Chair of the Nominating Committee Dave FitzGibbon or to me at *NEMA_Office_Evan_Gaddis@nema.org.*

Evan R. Gaddis
President and CEO

› Challenges in Mexico Regarding Electrical Safety

Gabriel Garza, Vice President, Distribution Transformers, GE Mexico

Electrical safety in Mexico has become a high priority in recent years. There are approximately 560 deaths in the country linked to electricity each year.[1] Compared with the U.S., where annually there are around 395 deaths linked to electricity, the rate in Mexico is four times higher, taking into account the population difference between the two nations.

Almost one-third of these deaths in Mexico occurred in the home. The main causes of domestic electrically-related accidents are:

- lack of proper grounding of the electrical system
- lack of maintenance
- circuit overloading
- poor quality materials

In the workplace, electrical-related accidents rank fourth in the total causes of injuries. Each year, there are an estimated 2,800 injuries related to electricity. The productivity lost—and more importantly—the loss of lives and the impact on families are a big concern for the government and industrial community.

There have been a number of initiatives in the last few years to address this problem, involving government, associations, and business enterprises. For example, a program called Casa Segura (Safe House) was started in 2005 to increase awareness about the risk of accidents caused by obsolete electrical installations. This is an international program that has been implemented in Mexico as well as in Argentina, Brazil, Chile, and Peru.

Worker safety has also improved. In addition to stricter penalties that the government has established for work-related injuries, companies must implement formal programs that guarantee safe handling of electrical equipment.

> These challenges that Mexico faces to improve the safety of electrical systems in houses, public spaces, and enterprises create business opportunities for companies that manufacture and service electrical equipment and components.

Also, improved regulations have been an important factor in building a solid foundation for the growth of a safer electrical system. In November 2012, the Mexican government issued a major revision of NOM-001-SEDE 2012, the Mexican electrical installation code. New technologies involving electrical equipment, new energy sources, a tendency for higher efficiency, a focus on environmental impact, and increased safety were the main drivers for this revision. It takes effect May 29, 2013.

This standard will impact lighting, wire and cable, motors, a/c equipment, generators, transformers, and other equipment and components. Additions to this standard include:

- control systems for theme parks
- charging areas dedicated to trucks
- electric system for fuel cell and small wind generators

Private industry participation plays a key role in legislation modifications. For example, during the revision of the NOM-001, CANAME (Mexican Chamber of Electrical Manufacturers) consolidated more than 100 comments from all of its members and included them in the new standard. This involvement has also helped raise awareness to members of the changes and develop new products that will meet or exceed the new regulations.

New housing developments will need to comply with the new standards. Those requirements mean more electrical equipment and components. The big challenge for Mexico is the upgrade of the obsolete installations in more than 2.5 million houses 20 years or older. These older installations represent a higher risk of safety issues either by the deterioration of components or because the electricity demand is higher than the installed capacity of the house.

The recent industrial boom in Mexico also demands that new factories and offices will need to comply with current laws and standards. Proper involvement in regulation changes provides a clear understanding of business needs and opportunities either on service or product offering.

These challenges that Mexico faces to improve the safety of electrical systems in houses, public spaces, and enterprises create business opportunities for companies that manufacture and service electrical equipment and components. We also see an increase in diagnostics of installation, wire and cable, circuit breakers, outlets, lighting, control systems, etc.

In order to continue the trend of electrical safety, NEMA's Mexico office can facilitate contacts between any of its members and either CFE, CANAME, or Mexican manufacturers.

[1] FECIME (Federation of Colleges of Mechanical and Electrical Engineers of the Mexican Republic), 2009 data

› Doing Our Part to Promote Electrical Safety

Inez M. Tenenbaum, Chairman, U.S. Consumer Product Safety Commission

From warning about counterfeits and promoting "plug into safety" to encouraging annual electrical inspections and advocating for the use of ground-fault circuit interrupter (GFCIs), the U.S. Consumer Product Safety Commission (CPSC) has a 30-year history of supporting National Electrical Safety Month (NESM).

On behalf of CPSC, I lend my support to this year's theme, *Electrical Safety for All Ages*. NEMA and the Electrical Safety Foundation International have once again led the way in setting the tone for NESM and have produced an outstanding educational tool kit that can be tailored for any community.

Children and the older adults are among our most vulnerable consumers and they need extra layers of protection in the home. Each year, there are hundreds of tragic fire deaths, including children caught in fires started by space heaters, lamps, and outdated electrical systems. Additionally, reports indicate that many older adults don't have working smoke alarms and that fires generally start in the kitchen from faulty cooking appliances.

CPSC's approach to advancing electrical safety for children and the elderly has involved a combination of regulation and research. We established requirements aimed at preventing children from gaining access to electrical components in toys. We turned a voluntary standard, which called for an immersion protection device to be connected to all consumer hair dryers, into a federal requirement. We supported stronger consensus standards and codes by Underwriters Laboratories and the National Fire Protection Association for electric space heaters, major kitchen appliances, and smoke alarms. We have also been among the leading researchers of arc-fault circuit interrupter (AFCI) effectiveness—technologies which detect overheating on range tops—and solutions to minimize the occurrences of children and seniors sleeping through or not reacting to the sound of smoke alarms.

JOINT EFFORTS TO ADVANCING SAFETY

An area of joint and serious concern for CPSC and NEMA in recent years has been the severe—and even sometimes fatal—chemical burn hazard to young children who ingest coin cell button batteries. With the increasing use of the 20 mm 3V batteries in so many easily-accessible items (e.g., games, toys, remote controls, key fobs, watches), there continues to be an alarming increase in the exposure and risk to young children. The size, shape, and texture of these products can be attractive to children, yet these products should never be in their hands.

> Let us not be limited to focusing our collective efforts on electrical safety to National Electrical Safety Month.

I wrote to NEMA and major battery manufacturers calling on them to establish more secure packaging, stronger standards and warnings, and to develop innovative design solutions to eliminate the hazards associated with this product. Our goal was clearly defined: prevent fatalities and serious internal chemical burn injuries if a coin-size battery is ingested.

NEMA leadership stepped up and helped facilitate meetings between individual members and the CPSC's technical staff and staff from my office. I appreciated the positive role that NEMA played in advancing the cause of safety.

I am encouraged that the coin and button cell industry has taken action, including bringing to market more secure packaging with stronger icons and labels, as well as other safety steps that increase the likelihood the consumer will take notice of the hazard when interacting with the batteries. Broader and stronger outreach and education are also a positive development. We still need design to change to eliminate the hazards and I believe such changes are within our sights.

The approach that CPSC and NEMA used on coin cell batteries is a model for our future work and for other industries to follow. Throughout my four-year tenure as chairman, I have promised to be a firm but fair regulator. In keeping with this approach, I have sought to show respect for the knowledge and know-how in industry, while challenging manufacturers to pursue every possible solution to address emerging hazards—especially those affecting our most vulnerable populations.

Let us not be limited to focusing our collective efforts on electrical safety to NESM. We need to work together to develop a third generation of smoke alarms; encourage the installation of carbon monoxide alarms in more homes, schools, and public buildings; develop sensor technologies to detect and prevent cooktop fires; stop dangerous counterfeit circuit breakers and extension cords from entering the stream of commerce; and educate new homeowners about the value of using GFCIs and AFCIs to protect their home from shock and fire.

Let's all do our part to promote electrical safety, for all ages, at all times.

Government Relations Update

› NEMA Supports Focus of Shaheen-Portman Energy-Efficiency Bill

From left to right, Senator Jeanne Shaheen; Evan Gaddis, NEMA; Jay Timmons, National Association of Manufacturers (NAM); and Senator Rob Portman welcome the reintroduction of the Energy Savings and Industrial Competitiveness Act. *Photo courtesy of NAM*

NEMA joined national businesses, labor, and environmental organizations in welcoming the reintroduction of the *Energy Savings and Industrial Competitiveness Act* of 2013 at an event on Capitol Hill on April 18. Senators Jeanne Shaheen (D-NH) and Rob Portman (R-OH) first introduced the act in 2011 to stimulate greater energy efficiency and the U.S. economy.

"The nation's electrical manufacturers support this legislation because we believe energy efficiency is our 'first fuel.' It is the only one that's 100 percent efficient," said NEMA President and CEO Evan R. Gaddis.

The industry joins Shaheen-Portman in support of:

- reinforcing private sector participation in a consensus-driven approach to strengthening energy standards and building codes
- incentivizing the industrial sector to adopt available technologies and processes that accelerate productivity and energy efficiency
- encouraging the nation's number one energy consumer—the federal government—to adopt new programs that reduce energy consumption
- creating new incentives to broaden use of commercially available products and approaches
- supporting public-private R&D and commercialization efforts

According to the Energy Information Agency, the combined annual energy costs for U.S. commercial buildings and industrial facilities total $202.3 billion. A modest 10 percent improvement in efficiency would save $20 billion annually.

Kyle Pitsor, Vice President of Government Relations | *kyle.pitsor@nema.org*

› DOE Finalizes Transformer Rulemaking

On April 9, the U.S. Department of Energy (DOE) released the text of the long-awaited Final Rule for Distribution Transformer energy-efficiency standards. The final rule largely reflects NEMA's input.

In 2011, NEMA member companies, NEMA staff, utilities, energy-efficiency advocates, and other stakeholders participated in a "negotiated rulemaking" with DOE and its consultants. The goal was to come to an agreement for updated energy-efficiency levels in three categories of regulated distribution transformers—low voltage dry-type, medium voltage dry-type, and medium voltage liquid-filled. Under current energy conservation standards, distribution transformers are already the most energy-efficient product that DOE regulates, at 97–99 percent efficiency. NEMA members, however, believed there was an opportunity to increase energy conservation without unduly burdening sectors that supply materials for transformers, the manufacturers, and the consumers of transformers.

NEMA manufacturers provided data and analysis to DOE and participants in the negotiations justifying their recommendations. At the same time, manufacturers expressed strong reservations with performance tiers that relied on materials with limited availability and few suppliers, and which would have required significant capital investment for any company that lacked construction capabilities for these materials. The efficiency levels for medium voltage liquid-filled transformers in the final rule remain unchanged from DOE's proposed rule and NEMA's recommended levels. These efficiency levels ensure maximum energy savings while remaining within the bounds of technical feasibility and maintaining a competitive marketplace.

For low voltage dry-type transformers, the final rule requires slightly higher efficiency levels than were contained in the proposed rule and recommended by NEMA. During negotiations, NEMA expressed reservations about the higher efficiency levels out of concern for their impact on small manufacturers.

Updated efficiency levels for the third category of transformers—medium voltage dry-type—had been previously agreed to by all parties during the negotiations.

The final rule goes a long way in promoting efficiency while maintaining a vibrant transformer manufacturing industry.

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Jim Creevy, Director of Government Relations | *jim.creevy@nema.org*

Part Two of a Two-Part Series

When Giving It Your Best Is No Longer Good Enough

The New Frontier of Regulatory and Incentive Programs

What happens when you've done all you can with component/appliance-based regulations and programs?

How to model systems outside of company-specific combinations of products and how to fold them into regulatory and incentive programs is the next frontier for industry and government. One practice is the ENERGY STAR® Building Technologies Program, which focuses not on the individual components but the building as a whole. Rather than simply buying ENERGY STAR–listed HVAC, lighting, and IT products and calling it an ENERGY STAR building, the whole building energy design is evaluated and then tested post-construction before the final certification is granted.

The Environmental Protection Agency (EPA) is able to use this flexibility since its program is not regulatory in nature and post-construction evaluation is feasible. EPA is exploring the performance approach in its emerging Data Centers Program, which will evaluate installation based on final performance rather than by individual components. NEMA is involved in this process and will keep an eye out for lessons that can benefit other programs.

DIMINISHING RETURNS

Regulatory agencies are challenged differently. Often when a product begins to be regulated, energy savings are more readily achieved, especially if a product is not sold to a market concerned with energy efficiency at the outset or if it has just undergone an evolution based on performance and satisfaction based designs. However, as the regulatory process engages in short order, the products in question are at a point of diminishing returns for energy savings, but the existing regulatory models and processes cannot call a stop to the effort.

Case in point: when distribution transformers began to be regulated decades ago, double-digit efficiency gains were realized in the first round. Flash forward to 2012—the Proposed Rulemaking for Distribution Transformers is pursuing 0.1 to 0.4 percent gains in efficiency per product class. One might argue, and NEMA has, that time and resources might be better spent elsewhere. But the process is not well suited to saying "when." This is because, unlike the EPA's voluntary programs, the Department of Energy (DOE) office that oversees appliance regulations does not have as much flexibility.

DOE personnel are pursuing legislated mandates to examine product efficiency regulations with an implied mission to save any and all watts possible. The current model for DOE regulation examines energy savings at the national level, rolling up 0.01 watt per product savings across hundreds of products and over nationwide sales volume. There is some logic to the argument, but rulemakings are becoming over-scoped, overly detailed, and unwieldy as a result.

For more information:

DOE Building Technologies Program: *www1.eere.energy.gov/buildings/appliance_standards/index.html*

ENERGY STAR: *www.energystar.gov*

NEMA Premium®: *www.nema.orgNEMA-Premium.aspx*

enLIGHTen America campaign for energy-efficient lighting retrofits: *www.nemasavesenergy.org*

Lost Savings from Obama's Delay on New Energy-Saving Standards is $3.7 Billion and Counting: *aceee.org/blog/2013/01/lost-savings-obama-s-delay-new-energy*

DOE is frequently late in reaching rulemaking milestones, and the result is industry being caught up responding to the process and wondering what will happen. Earlier this year, the American Council for an Energy Efficient Economy, a leading energy advocate, took the government to task for repeat lateness in regulatory rulemakings and the lost energy savings through product improvements happening later than they should (e.g., after the rulemaking concludes, not before).

NEMA is working internally among members, and with other industries, advocates, and DOE to address this and search for mutually agreeable solutions to move past the current inflexibilities and into systems-level approaches, which relax overly prescriptive appliance requirements.

For example, even the most highly efficient lighting system in an office building is wasting 100 percent energy if the lights are all on at 4 a.m. when no one is in the building. On the other hand, lights need not be on if no one is in the room. Technology exists to address these instances, but not all programs and regulations lead the builder, owner, or operator to this solution.

So what is "best" going forward? This concept is evolving as appliance regulations and designs begin to reach maximum technological and economic feasibility, and systems concepts begin to gain traction. The challenge lies in identifying the best vehicles at the federal, state, CEO, and office manager level so that feasible, understandable solutions can be identified, incentivized, installed, tested, and operated over the long term. NEMA is involved at every step of the process.

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› The Silent Killer: Are Children Being Poisoned at School?

Carbon Monoxide Leaks Prompt Legislative, Regulatory Response

On December 3, 2012, an elementary school in Atlanta, Georgia, was evacuated due to elevated—and potentially lethal—levels of carbon monoxide (CO). Forty-three students and ten adults were sent to area hospitals for treatment after exhibiting mild to moderate symptoms of CO poisoning. This event quickly gained national media attention, with coverage on NBC's *Today Show* and *Nightly News*, as well as in *USA Today* and countless newspapers, radio stations, and TV networks.

Unfortunately, it wasn't an isolated incident. Based on a compilation of media reports, NEMA has estimated that more than 60 incidents of suspected or confirmed CO leaks have been reported at schools nationwide since 2004. Because CO affects each individual differently and symptoms of exposure mimic those of common ailments such as the flu (see below "What is Carbon Monoxide?"), it is highly probable that the number of CO exposure incidents has been underreported. Because of their size, young children are especially vulnerable to the effects of CO, may be more severely affected by exposure to the gas, and may exhibit signs sooner. An adult teacher may not intuitively recognize that a number of sleepy students could be attributable to exposure to elevated levels of CO if she has not been affected to the same extent.

NEMA's Signaling, Protection, and Communication Section has been at the forefront of promoting life safety and CO detection in homes, apartments, dormitories, hotels, and other residential and commercial occupancies for years. As a result, more than three dozen states have adopted some level of CO detection requirements via statute or code.

Recognizing that CO dangers in schools pose a new frontier for advancing life safety, NEMA engaged the Connecticut legislature in 2011 on legislation (PL 11-248) to require CO detection in all public and non-public schools. Building on that success, NEMA achieved enactment of a second statewide law in Maryland (SB 173, Chapter 38) in 2012.

In 2013, legislation has been introduced in several states to mandate the installation of CO detection systems in educational occupancies including California (AB 56), Florida (HB 63 / SB 116), Georgia (HB 23/SB 89), Illinois (HB (3059), Maine (LD 593), Massachusetts (H 2168), New Jersey (AB 3640 / SB 2402), New York (AB 3752 / SB 1848), Pennsylvania (HB 615), and South Carolina (H 3363). In addition, Georgia and Virginia are considering administrative rules to require CO

› What is Carbon Monoxide?

Carbon monoxide (CO) is a colorless, odorless, tasteless, poisonous gas that is produced by the incomplete burning of various fuels including coal, wood, charcoal, oil, kerosene, propane, and natural gas. Equipment powered by internal combustion engines—such as cars, portable generators, lawn mowers, and power washers—all produce CO.

Through the normal process of respiration, oxygen enters the lungs and is transported by hemoglobin in the blood to various organs and tissues in the body, such as the heart and brain. When CO is inhaled, it enters the bloodstream and attaches to hemoglobin forming the COHb molecule. COHb reduces the ability of the blood to carry oxygen to vital organs by preventing the oxygen molecule from attaching to the hemoglobin.

SYMPTOMS OF CO POISONING

At low to moderate concentrations, CO symptoms are similar to the flu and include:

- headaches
- dizziness
- sleepiness
- nausea
- shortness of breath
- mental confusion
- disorientation
- vomiting

At high concentrations in the blood, CO can cause:

- cognitive impairment
- loss of muscle coordination
- loss of consciousness
- coma
- death

› CO podcasts

This four-part podcast series with Richard Roberts, co-chair of NEMA 3SB Smoke/CO Group, covers carbon monoxide detection, difference between detectors and alarms, detection in buildings and dwellings, state and model building code developments, and frequently asked questions.

www.nema.org/podcast-series-Carbon-Monoxide

detection in schools, and Atlanta adopted an ordinance earlier this year to require CO detectors in all public buildings—including schools—within the city. NEMA has specifically engaged representation in New York to advocate for enactment of AB 3752 / SB 1848 and is actively working with the bill sponsors to advance this bill during the remainder of the 2013 legislative session.

C&S COMMUNITY RESPONDS

The need for CO detection in educational occupancies also has garnered the attention of the codes and standards community. The current 2012 edition of National Fire Protection Association (NFPA) 101 *Life Safety Code®*, has entered a revision cycle to create the 2015 version. During the First Draft meeting in August 2012, the committee accepted a NEMA Public Input to require CO detection in K-12 educational occupancies. The First Draft Report was open for public comment via the NFPA website through May 3, 2013. In addition, the 2012 editions of the *International Building Code* and *International Fire Code* have entered the 2015 revision cycle, and in April 2013, the International Code Council (ICC) membership and interested stakeholders will have the opportunity to review and vote on code change proposals to require CO detection in Group E (Educational) Occupancies for both codes.

Recognizing the importance of ensuring that children, faculty, and support staff are protected from CO dangers while they are away from home, NEMA has positioned itself within the life safety community as a leading advocate for CO detection in schools. NEMA is working closely with state legislators and regulators, the codes and standards community, and other partners to raise awareness of this need and to work toward common-sense solutions. Requiring CO detectors in schools has the potential to save lives, prevent illness, and lessen the time away from school. It is an idea whose time has come.

For more information on carbon monoxide and other fire and life safety issues, please visit *www.lifesafetysolutionsonline.com*.

Sarah Owen, Manager, Government Relations | *sarah.owen@nema.org*

› OSHA to Update Regulations to Reference Z535 Standards

At NEMA's request, the Occupational Safety and Health Administration (OSHA) plans to issue a direct final rule (DFR) this spring to incorporate in its regulations references to 2011 versions of several ANSI Z535 standards published by NEMA.

Recommended for publication by OSHA's Advisory Committee on Construction Safety and Health, the DFR will update ANSI standards references in four provisions of OSHA's general industry and construction standards (29 CFR):

- §1910.07 *Nonionizing radiation*;
- §1910.145 *Specifications for accident prevention signs and tags*;
- §1910.261 *Pulp, paper, and paper board bills*; and
- §1926.200 *Accident prevention signs and tags*.

OSHA's existing regulations reference American Standards Association (ASA) Z53.1-1967 (*Safety Color Code for Marking Physical Hazards and the Identification of Certain Equipment*), Z35.1-1968 (*Specifications for Accident Prevention Signs*), and Z35.2-1968 (*Specifications for Accident Prevention Tags*).

Currently, employers who want to use signage that comply with the newer Z535 standards are technically in violation of existing regulations, but are not fined by OSHA via a "*de minimus* situation" provision.

To right this wrong and minimize compliance burdens for industry, OSHA will allow manufacturers to comply with either OSHA's existing referenced standards or the referenced 2011 ANSI Z535 standards. The ANSI Z535 series of standards are routinely cited in litigation as defining the state of the art when there is a question to the adequacy of safety communication.

ANSI Z535 standards offer several advantages over the outdated ASA standards including better definition for safety sign content; improved sign formats; differentiation between varying degrees of risk/hazard severity; consistency leading to improved comprehension, particularly for increasingly multicultural workforces; and superior overall guidance on safety sign design.

OSHA is pursuing a dual path of utilizing the DFR in conjunction with a typical Notice of Proposed Rulemaking (NPRM). If OSHA receives no significant adverse comments on the DFR during the public comment period, the changes will become effective 90 days after publication in the *Federal Register* and OSHA will withdraw the NPRM.

If OSHA receives significant adverse comments, it will withdraw the DFR and proceed with rulemaking through the standard NPRM process.

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Strategic Initiative to Preserve Three-Year Code Adoption Cycle Puts Consumer Safety First

Deana M. Dennis, Manager, State Government Relations
Vince Baclawski, Senior Technical Director, Codes and Standards
Paul Abernathy, NEMA Southern Field Representative
Don Iverson, NEMA Midwest Field Representative
Mike Stone, NEMA West Coast Field Representative

At its July 2012 meeting, NEMA's Board of Governors approved Preservation of the Three-Year Code Adoption Cycle as a new strategic initiative (SI) for 2013. This SI advocates for the immediate and direct adoption and enforcement of the most current edition of model electrical, life safety, energy, and building codes at the state-level. It combines the expertise of NEMA's Communications, Government Relations, and Technical Policy departments, including the Field Representative program.

Model building codes are updated every three years through a national consensus-based process to ensure that requirements take into account the latest advancements in safety and technology. NEMA believes that maintaining a three-year code adoption cycle—for all sectors of the built environment—is the best way to ensure an even standard for safety whether in the home, the workplace, school, places of commerce, or healthcare facilities. The initiative was created in response to efforts within Michigan and Pennsylvania in the last few years to extend the adoption cycle to a six-year period.

Timely code adoption impacts nearly all NEMA members; a delay in adoption means a delay in market access for products required by model codes. More importantly, delaying code adoption postpones the ability of consumers to use new or improved electrical and life safety advancements as well as products, technology, and materials that achieve greater energy efficiency.

In July 2012, the NEMA Codes and Standards Committee established the Task Force on State Code Adoptions to serve as the driving vehicle for the initiative. So far, four states—Connecticut, Illinois, North Carolina, and Washington—have introduced legislative proposals aimed at extending the building code adoption cycle to a period of six years or more.

Despite the amount of legislative activity, the SI continues to make progress in each of these states through collaborating with our industry partners and other stakeholders including the Electrical Code Coalition, the Coalition for Current Safety Codes, ESFI, NFPA, ICC, IBEW, IEC, IAEI, NASFM, NAED, and other associations committed to electrical safety; engaging NEMA's members to be active constituent advocates; and educating policymakers on the benefits of building codes including timely adoption and strong enforcement of the codes.

Representatives from 11 NEMA member companies comprise the Task Force on State Code Adoptions. Since this is an SI, all NEMA members are welcome (and encouraged) to join. Contact Vince Baclawski (*vin_baclawski@nema.org*) or Deana Dennis (*deana.dennis@nema.org*) for information on having your company represented.

CONNECTICUT

In late January, a proposed bill to extend the state's building code adoption cycle to a period of six years was introduced by the Public Safety & Security Joint Legislative Committee of the Connecticut General Assembly. A proposed bill, which is simply a concept without legislative language attached, was primarily supported by the state's homebuilders association.

On February 7, the committee held a hearing in which NEMA, along with several coalition partners, testified against it. In early March, the proposed bill became an actual bill, HB six524. It contains the six-year language we were advocating against.

At the onset, NEMA got in gear by contracting a local lobbyist to help support our efforts. We were able to work with the state's IBEW and IEC chapters along with a few of NEMA's Connecticut-based members and the state's fire marshal association to leverage our collaboration with the committee co-chairs who began to see this measure as problematic.

Due in part to our formidable coalition, the homebuilders were willing to let go of the six-year provision and we received indication from the co-chairs that they would be willing to remove it from the bill. When the committee held a hearing on March 18, NEMA, a member company, and a few coalition partners attended. While we chose not to testify at that point, we made inroads with several committee members, which ultimately made the difference—on March 21, the committee removed the six-year provision from the bill and voted it out.

ILLINOIS
In early March, NEMA learned of a legislative proposal that had been reintroduced from last year in the Illinois House of Representatives. HB 1331 would extend the adoption cycle for the state's residential energy code to a period of no more than six years. Because of the Illinois legislative deadline, the committee scheduled the bill for hearing on March 20.

NEMA submitted testimony to the House Energy Committee in advance of the hearing and contacted the bill's sponsor to express our concerns with the measure. During the hearing, the committee voted the bill out 10–2, which means it will likely go to the House floor next.

NEMA is in the process of engaging its 33 members who have facilities in the state to weigh in with their local legislators. We are also working with the International Code Council and local environmental and energy-efficiency advocacy groups, including the Midwestern Energy Efficiency Alliance.

NORTH CAROLINA
Over the past few months, rumors have circulated throughout the North Carolina building code community that the traditional three-year code adoption process was being challenged by the North Carolina Home Builders Association.

In February, those rumors became reality when HB 120 was introduced. The legislation aims to extend the code (including the provisions related to the *National Electrical Code*®) adoption cycle for one- and two-family dwellings to a period of six years. Right away, the bill was fast-tracked to the House Regulatory Reform Subcommittee on Local Government for hearing on March 6. NEMA Southern Field Representative Paul Abernathy attended but was not permitted to testify. The committee voted out the measure the same day. The bill then went to the floor of the House of Representatives where it was passed on March 11 by a vote of 99–18.

Immediately prior to the committee hearing and floor vote, NEMA mobilized some of its members in North Carolina. Four of them agreed to contact their legislators in opposition to HB 120. Unfortunately, it appears that the politics within the state have overridden any of the merits of our argument and that of our coalition partners in the state.

NEMA continues to urge its members to engage as we now take this fight to the Senate Commerce Committee.

WASHINGTON
In January, legislation was introduced in the Washington Senate that seeks to extend the adoption cycle for the state's building codes (ICC codes only) to six years. The bill has been championed by state's biggest homebuilder and real estate groups that claim that the three-year code cycle imposes unnecessary costs on local governments and consumers.

SB 5378 was voted out of the Governmental Operations Committee on February 12 and was sent to the senate floor on March 7, where it was passed by a vote of 33–14. Prior arrival on the senate floor, NEMA contracted an in-state lobbyist to help support our efforts on the ground. Our intelligence at the time indicated that the Republican-controlled senate (which only became GOP-controlled when a handful of Democrats defected) would likely pass the bill but that the real chance of getting the measure defeated would be in the Democrat-controlled house.

NEMA immediately began to work on the House Local Government Committee in advance of its March 20 hearing, at which NEMA was one of 21 parties to testify. Ultimately, and in our favor, the committee chose not to act on the bill during the hearing. It also chose not to act during its session the following day.

The House Committee Chair has indicated to NEMA's lobbyist that he is not interested in moving this bill forward. We will work to keep the pressure on and hope that this bill stalls in committee and does not advance any further.

This report is a cooperative effort of NEMA Government Relations and Technical Policy departments.

› What about Michigan's Residential Code?

In December 2012, the Michigan state legislature voted to extend the residential code adoption cycle to a period of up to six years (HB 4561). After much debate and opposition by a large constituency of code advocates, including NEMA, the state ultimately decided to preserve the three-year cycle for the commercial construction sector.

The state recently held a public hearing for adoption of the 2011 *National Electrical Code® (NEC)* for commercial structures. But something is missing—adoption of the *Michigan Residential Code (MRC)*. HB 4561 requires the state to begin the *MRC* adoption process. In previous code adoption cycles, the Bureau of Construction Codes typically appointed the same committee members for residential code as they did for commercial and multi-family structures. This practice appears to be changing. There is growing concern that politicians will appoint those positions, creating a potential hazard that costs will prevail over electrical safety.

The significant impact may be on the backs of Michigan's home buyers. If the state fails to remain current by updating *MRC* every three years, the effects will range from family safety to energy savings. Sources indicate that adherence to the most recent energy code equals a savings of nearly $1,000 per year per home owner.

Don Iverson, NEMA Midwest Field Representative | *don.iverson@nema.org*

Now and then. Current ASIC technology (left) employs literally thousands of transistors that enable self-monitoring, interconnection, and the ability for the battery to last more than a year. Early smoke alarms (right) had about one hundred components and a few transistors. Photo courtesy of Jarden Safety

Smoke Alarms—Phenomenal Life Safety Bargain

Isaac Papier, Vice President Industry Relations, Honeywell Life Safety

Today's smoke alarms are truly phenomenal life safety devices. For a modest investment of a few dollars, a homeowner is provided with years of lifesaving early fire detection and alarm notification to facilitate timely occupant evacuation in the event of a threatening fire. Statistics have shown (Reference to NFPA statistics) that the introduction of smoke alarms has reduced residential fire fatalities by 50 percent.

Today's smoke alarms are the product of many years of ongoing extensive research, development, and innovation that made possible a highly reliable, sophisticated, advanced technology device at a bargain price.

Smoke detector technology development can be traced back to the early 1920s. These early detectors were large contraptions intended for shipboard use in order to trigger the discharge of fire suppression in cargo holds. It was not until the early 1940s that the rudiments of today's ionization detectors first appeared. Unlike modern detectors that utilize a minuscule radioactive source, these detectors utilized a high voltage to ionize the air in the detection chamber. While these detectors were not suitable for a residential application, they quickly demonstrated their effectiveness in commercial and industrial application and their technology led the way for development of the modern smoke alarm.

The first major innovation in smoke detector development during the early 1960s was the replacement of the high voltage by a radioactive source known as Americium 241and the use of a transistor to monitor the detection chamber. This permitted operation at a low voltage (24V) and led directly to the development of the first smoke alarm in 1965.

Early Development of Smoke Alarms

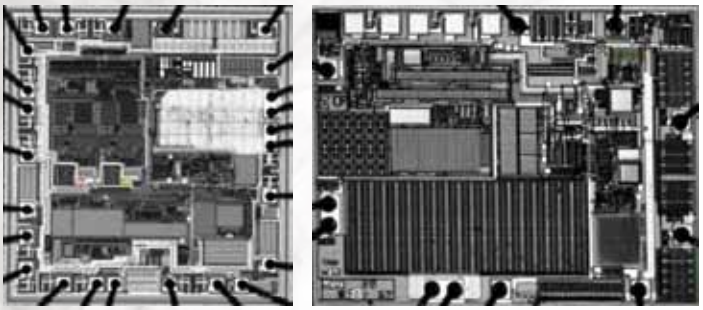
The first smoke alarm that made widespread installation in residences highly feasible appeared in the latter half of the 1960s. This was a photoelectric detector with an electromechanical sounder and an incandescent lamp for a light source. While a number of transistors were used to monitor the detection chamber and control the smoke alarm functions, the incandescent lamp light source and electromechanical sounder required considerable—a specialty, very expensive battery was required.

By today's standards, these first-generation detectors were crude electromechanical devices made up of a detection chamber and myriad of discrete electrical/electronic components. But their availability led to considerable research that concluded that smoke detectors had greater potential to improve life safety than heat detectors. This conclusion has been reaffirmed for ionization and photoelectric detectors numerous times over the years.

Early adoption of smoke alarms was a slow process partly because of the lack of public education and probably just as significant, the cost. Early smoke alarms were low-volume handmade devices made up of numerous discrete electronic components. The price hovered around $300—about $2,000 in today's dollars!

Numerous technology advances have been incorporated into smoke alarms over the years that have significantly enhanced performance, reliability, power consumption, and cost:

- Replacement of the incandescent light source in photoelectric smoke alarms provided several benefits including lowered power consumption, increased reliability and detector life, and the ability to "tune" the response to specific smoke particulate size distribution.
- Introduction of the field effect transistor in ionization smoke alarms significantly reduced the size of the radioactive source, enhanced stability, and reduced power consumption.
- Replacement of the electromechanical alarm sounder with a solid-state piezoelectric disc led to major power savings, enhanced reliability, and smaller smoke alarms.
- The power savings provided by the changes noted above permitted the use of a standard 9V battery in place of an expensive specialty battery.
- Development of application-specific integrated circuits (ASIC). This change was a major factor for cost reduction, functionality enhancement, reliability enhancement, and power consumption reduction. While the first smoke alarms had about one hundred components and a few transistors, ASICs contain literally thousands of transistors enabling self-monitoring, interconnection, and the ability for the battery to last more than a year.



Circuit board from the first generation chamber (left) and smoke alarm ASIC surface (right). Courtesy of Microchip

Current Technology

Research has shown that most homes in the U.S. are equipped with at least one smoke alarm. Unfortunately, this research has also revealed that many of these installed alarms are inoperative because of dead or missing batteries. The introduction of lithium ion batteries, coupled with technological advancement that significantly reduced power consumption, has resulted in the introduction of the 10-year sealed smoke alarm. The 10-year life specification, which was carefully chosen because that time span coincides with the National Fire Protection Association's recommendation, ensures that a highly reliable life safety alarm is always present in the home. Considering that these current technology alarms retail for $30 to $40 and last for 10 years, it becomes apparent how big a life-safety bargain they are.

Many fire safety specialists advocate the installation of both photoelectric and ionization smoke alarms because these have performance advantages in a smoldering versus a flaming fire. Because one never knows where a fire might start, the best protection is provided by installing one of each. The recent introduction of multi-sensor photo/ion detectors eliminates the need for two separate devices.

Carbon monoxide (CO), a colorless, odorless gas that is produced in fuel-burning appliances has been labeled the silent killer (see page xx). CO alarms share much of their technology with smoke detectors. Therefore, the introduction of combination smoke/CO alarms is a natural outgrowth. Here again, the consumer is provided a highly sophisticated life-safety device that is the product of many years of technological evolution at an economical price.

Looking to the Future

Research is underway to develop multi-criteria detectors that employ multiple sensors and computer logic to detect the very early attributes of a fire while providing enhanced resistance to phenomena that may trigger an unwanted alarm. While these devices are a number of years away, when they do arrive they will provide enhanced detection and resistance to unwanted alarms and, yes, they will continue to be a bargain.

Smoke alarms are wonderful low-cost life safety devices that have proven themselves to be an essential element of every occupancy. Since their introduction, they have saved countless lives. But in order for them to provide their essential service, it is critical that:

- they be properly installed
- they are properly maintained, including regular replacement of batteries
- the smoke alarm battery is never borrowed for another use

Smoke alarms are highly reliable devices with a limited life of 10 years and it is essential that these devices be replaced after 10 years of use. Many newer smoke alarms incorporate a non-replaceable 10-year battery. These devices will provide an end of life indication when it's time to replace. Be safe.

Mr. Papier serves on NFPA 72 Technical Committee, NFPA 101 Life Safety Code Correlating Committee, National Premise Security Code Committee NFPA 730/31, Air Conditioning Technical Committee NFPA 90A & B, The Security Industry Association Standards Council, U.S. TAG to ISO TC 21/SC3. He is also chairman of the NEMA 3SB Signaling Section Research Committee and NEMA C&S Committee.

AFCIs—Making an Impact on Fire Prevention

Thomas A. Domitrovich, PE, LEED AP BD+C, National Application Engineer, Eaton Corporation Electrical Group

Those who create new technologies to address electrical safety needs, in most cases, have to wait quite a long time waiting for evidence that their technology bears fruit. Typically, manufacturers are never there to witness firsthand their products saving lives. On occasion there is a glimpse into a success when the story is shared, but after the fact. As manufacturers, we grab on to these little gold nuggets and share them internally and externally through case studies or other venues. They concretely express the value message of our products in the market and there is no greater value than that of saving lives.

These successes help earn respect in our markets. After all, no matter how much research, development, and testing is put into a product, consumer use and public opinion ultimately determine whether new ideas succeed—especially when it comes to safety. Favorable opinions on the fire prevention technology known as arc-fault circuit interrupters (AFCIs) has grown steadily among homeowners, electrical contractors, fire prevention organizations, and consumer protection groups since AFCIs became part of the *National Electrical Code® (NEC)* in 1999.

> "The National Association of State Fire Marshals strongly supports the broad adoption of AFCI technology through national, state, and local building codes. AFCIs are the most welcome addition to fire prevention in decades. AFCIs promise to save hundreds of lives every year." —National Association of State Fire Marshals
>
> "Preventing a fire before it starts is the best way to protect your family. Arc-fault circuit interrupters are one of the most important advancements in electrical fire protection for the home."—Electrical Safety Foundation International

Back then, few statistics were available on the fire prevention potential of AFCI circuit breaker switches, which trip to warn of dangerous unintentional arc faults caused by damaged electrical cords or worn wires behind walls. But now, statistics are emerging from a variety of credible sources that electrical fires are on the decline. This is happening as AFCI usage has increased and confidence is now building that the growing installation of this technology is helping to prevent electrical fires and save lives.

Increased AFCI Use, Decreased Electrical Fires

This marks the 14th year *NEC* has required the installation of AFCIs in new and remodeled homes where branch-circuit wiring is modified, replaced, or extended. During this time, *NEC* has expanded mandated usage of AFCIs from bedroom receptacles to living areas, including family rooms, dining rooms, living rooms, parlors, libraries, dens, bedrooms, sunrooms, recreational rooms, closets, hallways, or similar rooms or areas. AFCIs warn homeowners of dangerous unintentional arc faults by shutting down power before an electrical fire can begin.

A 2012 report by the National Fire Protection Association Fire Analysis and Research Division shows a significant drop from 55,000 to 45,000 fires in the U.S. resulting from electrical malfunction between 2002 and 2009. Additionally, it was found that between 2006 and 2010, home fires from electrical distribution and lighting equipment also declined from 25,000 to around 20,000. Clearly, the total number of fires annually is on the decline.

Interestingly, the studies identified the most frequent cause of home fires during this period to be wiring or related equipment, followed by lamps, light fixtures, cords, and plugs. These are all areas where AFCIs can detect arc faults and de-energize the system before an electrical fire can start. As non-AFCI circuits

are replaced, this technology promises more reductions in fires in older homes.

In 2011, the U.S. Fire Administration issued a report that reviewed fires involving residential building electrical malfunctions between 2006 and 2010. The data indicated:

- 18 percent decrease in these types of fires
- 4 percent drop in deaths
- 3 percent decline in overall dollar loss from property damage

For prominent fire prevention groups and others, there is a growing belief that the statistics are proof that AFCIs have been a contributing factor in helping decrease the number of electrical fires and associated deaths, injuries, and property loss.

The Promising Future of AFCIs

While AFCIs have come a long way, there is abundant potential to help prevent additional electrical fires. A U.S. Consumer Product Safety Commission (CPSC) survey indicated that around 85 percent of electrical distribution fires occur in homes 20 years old or older. *NEC*-mandated installation of AFCIs only applies to newer or renovated homes. The CPSC study concluded that if the older homes surveyed had AFCI fire prevention technology, more than 50 percent of the fires involving them would likely have been prevented.

> AFCIs have been a contributing factor in helping decrease the number of electrical fires and associated deaths, injuries, and property loss.

While some states have been slow to update their building codes, many are bringing their electrical codes in line with *NEC* standards. Homeowners are also becoming increasingly aware of AFCI fire prevention technology and its affordability.

AFCIs are a shining example of fire prevention technology and highlight our industry, which dedicates itself to providing safe electrical service to the public during National Electrical Safety Month and throughout the year. For more information on AFCIs, please visit *www.afcisafety.org.*

Mr. Domitrovich chairs the NEMA Low Voltage Distribution Section (LVDE) AFCI Task Force.

Courtesy NEMA Low Voltage Distribution Section AFCI Task Force

New Technologies and the Challenge They Pose to Building Fire Alarm Systems

Jeff Van Keuren, Engineering Leader, Compliance Detection & Alarm, Edwards

Building Fire Alarm Systems, courtesy of Edwards

In today's world of instant access to information and low-cost connectivity, owners of building fire alarm systems are investigating options to integrate or connect to buildings' fire alarm systems, thus utilizing a network infrastructure.

The building fire alarm system's purpose is to indicate the existence of heat, fire, smoke, or other emergencies within the building. The word "indicate" means to notify the occupants so that they take the proper steps to move to safety. As manufacturers of building fire alarm systems, Edwards is often asked about integration options as well as current industry and regulatory developments. Here are a couple of them.

Why can't I use my own business network infrastructure to interconnect the building fire alarm system(s)?

In theory, it is possible as long as the following NFPA 72[1] criteria are met:

23.8.2.6.1 All signal control and transport equipment (such as routers and servers) located in a critical fire alarm or emergency control function interface device signaling path shall be listed for fire alarm service, when the following conditions are met:

1. *The equipment meets the performance requirements of 10.3.5.*

- The network components shall be capable of operating:
  - At 85 percent and at 110 percent of the nameplate primary (main) and secondary (standby) input voltage(s)
  - At ambient temperatures of 0°C (32°F) and 49°C (120°F)
  - At a relative humidity of 85 percent and an ambient temperature of 30°C (86°F)

2. *The equipment is provided with primary and secondary power and monitored for integrity as required in Section 10.6, 10.6.9, Section 10.19, and Section 12.6.*

- Key highlights are:
  - Equipment must be provided with a primary and secondary source of supply.
  - Supply sources are required to be monitored at the point of connection.
  - Failure of either supply must result in a trouble signal.
  - An uninterruptable power supply is allowed as long as it is connected and monitored in the same manner as the building fire control panel.
  - Monitoring shall not be required for the output of an engine-driven generator that is part of the secondary power supply, provided that the generator is tested in accordance with Chapter 14.
  - Where the digital alarm communicator transmitter is powered from a protected premises fire alarm system control unit, power failure indication shall be in accordance with 10.6.9.1. and be delayed by 60 to 180 minutes before transmission to the supervising station.
  - All means of interconnecting equipment, devices, appliances, and wiring connections shall be monitored for the integrity of the interconnecting conductors or equivalent path so that the occurrence of a single open or a single ground-fault condition in the installation conductors or other signaling channels is automatically indicated within 200 seconds.
  - Shorts between conductors are not required to be monitored for integrity, unless it is on a notification appliance circuit, specified as class X or a two-way telephone communication circuit.

3. *All programming and configuration ensure a fire alarm system actuation time as required in 23.8.1.1.*

- Actuation of alarm notification appliances or emergency voice communications, emergency control function interface devices, and annunciation at the protected premises shall occur within 10 seconds after activation of an initiating device.

[1] NFPA 72 *National Fire Alarm and Signaling Code*, National Fire Protection Association, Revised 2013

4. *System bandwidth is monitored to confirm that all communications between equipment that is critical to the operation of the fire alarm system or emergency control function interface devices take place within 10 seconds; failure shall be indicated within 200 seconds.*

5. *Failure of any equipment that is critical to the operation of the fire alarm system or emergency control function interface devices is indicated at the master fire alarm control unit within 200 seconds.*

In most cases, it is not practical to meet all of these requirements on the entire building's network infrastructure. In order for network infrastructure products to be listed as part of building's fire alarm system they must have the same level of performance and reliability.

Products used in the business network infrastructure are not required to be tested for any performance outside the guidelines of the Federal Communications Commission (FCC). Many of these products are voluntarily tested unlike the mandatory testing (listing) of a building fire alarm system. Information technology equipment (ITE) products are typically tested by third parties, such as UL and ETL, for compliance to product standards. ITE standards are strictly product safety standards.

Another area of concern is the portability of the building's network infrastructure. What happens to the alarm system when tenants move? Do they take part of the fire alarm system with them, thus disabling the building fire alarm system? What happens when the network infrastructure is changed or upgraded? The system may require retesting per the following:

14.4.2.5 Changes to the system's executive software shall require a 10 percent functional test of the system including a test of at least one device on each input and output circuit to verify critical system functions such as notification appliances, control functions, and off-premises reporting.

What is changing to give the owner more choices? The NFPA 72 Technical Committee on Signaling Systems for the Protection of Life and Property has put together a task group of industry experts to work through these problems and will write proposals to update the code this cycle. The proposals will be a first step in clarifying the options customers have regarding networking their building fire alarm systems.

Why can't I use my own computer to monitor and control my building fire alarm systems?

10.3.1 Equipment constructed and installed in conformity with this Code shall be listed for the purpose for which it is used.

Again, like the building's network infrastructure discussed earlier, the computer is considered part of the building's fire alarm system and must be tested and listed to the same requirements of the building's fire alarm system. As with the other pieces of the building's network infrastructure, work is underway to allow flexibility in the use of this equipment.

12.6.5 Monitoring for integrity shall not be required for connections to and between supplementary system components, provided that a single open, ground-fault, or short-circuit conditions of the supplementary equipment or interconnecting means, or both, do not affect the required operation of the fire alarm and/or signaling system.

Supplementary system components may include a computer used to monitor—not control—the building fire alarm system. It should not be relied on in the course of a life safety event. In many cases, this is acceptable for system monitoring of status changes and getting reports to aid in proper maintenance.

Additionally, proposals have been put forth to UL 864 Control Units and Accessories for Fire Alarm Systems to allow for the use of redundant or fault tolerant systems in supervising stations only, but could lay the ground work for use in protective premise systems as more work and study is done.

What's Next?

What is important to note is that there is ongoing work in this area. In the past, building fire systems were installed and maintained exclusively by fire professionals with very little connectivity to the outside world. The role of the building fire system is now expanding to include other life safety functions that require interaction with other building systems such as security; mass notification; and heating, ventilation, and air-conditioning systems.

The building network infrastructure needs to be a part of the solution and must perform at a level of reliability to ensure all of the occupants are protected in the instance of a life threatening event. People with expertise in building fire systems, other life safety systems, and information technology need to understand each other's role in this process so we can all move forward.

Mr. Van Keuren is responsible for the global product compliance strategies at Edwards and the detection and alarm businesses at UTC Climate, Controls & Security.

Protecting Low-Power Outdoor Electronics

Stuart Wood, Design Engineer, BEAR Power Supplies

Low-power electronic devices are increasingly found outdoors, e.g., video surveillance systems, radio frequency (RF) repeaters, and low-power monitors on wind turbines. These devices require lightning surge protection appropriate to their environment while meeting constraints on cost and size.

IEEE C62.41.2 *Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits* outlines surge threat levels based on where equipment is located. Category A is indoors, away from the electrical service entrance. Category B is indoors, on short branch lines nearer the service entrance. Equipment in Category A and B is protected from lightning surges by commercial surge protection devices (SPDs) at the building service entrance.

Category C covers the area from just inside the service entrance to the line transformer on the distribution network. This category is divided into "low exposure" and "high exposure" depending on factors including the type and amount of lightning exposure expected. Commercial SPDs may be used to protect individual Category C devices, but they are generally too large and expensive to incorporate into the enclosure for a remote monitor, RF repeater, surveillance camera, or similar device. High-energy surge protection must be part of the system design for effective protection of these devices.

Surge protection should take into account exposure levels and the source of surges. IEEE C62.41.2 presents guidelines for developing design parameters and tests.

Clamping devices include metal oxide varistors (MOVs) and silicon avalanche diodes. A clamping device begins conducting when the voltage across it exceeds its rated level. It extinguishes, or stops conducting, when the voltage drops below the clamping threshold. Crowbar devices begin conducting when the voltage across it exceeds its rated level, but it continues conducting as long as current flows. A "follow-on" current continues to flow after the transient has passed. Because this follow-on current can shorten the life of the device, we typically incorporate additional circuitry to release the current after one or more zero crossings when using a crowbar device.

For Category A equipment, simply placing a MOV across the line is common and offers excellent protection. A MOV has low let-through voltage, meaning it begins conducting shortly after a transient's leading edge exceeds the dc breakdown voltage (see Figure 1). A MOV presents no issues with follow-on current. For Category B and C equipment, gas discharge tubes (GDTs) outperform MOVs at suppressing high-energy transients that must be protected against in this category. However, GDTs have poor let-through voltage and follow-on current characteristics (also Figure 1).

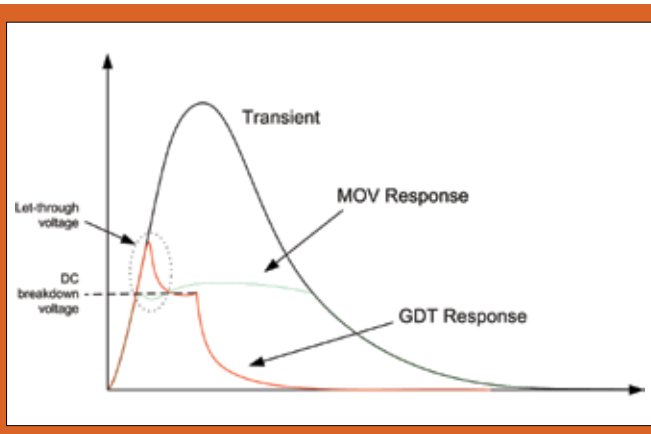


Figure 1. Let-through voltage for a MOV and GDT in response to a transient.

Combining a GDT in series with a MOV solves these problems—the MOV can be used as a limiter for follow-on current to the GDT (see Figure 2). The combination circuit enables use of lower-voltage MOVs, which handle more current for a given energy rating than higher voltage MOVs do.

Silicon avalanche diodes can be used as secondary protection. While they don't have sufficient energy handling capability to be used as primary protection, they are effective at handling fast transients and have no follow-on current. The ac line filter can be used to separate the primary and secondary protection, slowing down and reducing amplitude of let-through voltage.

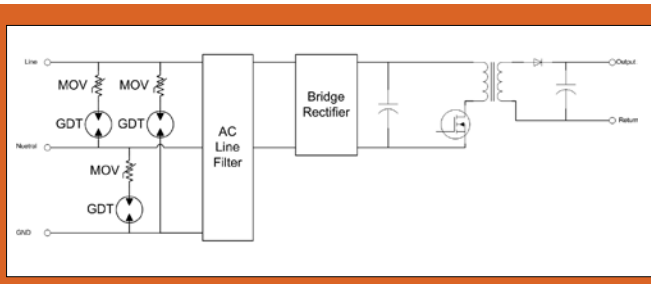


Figure 2. Combination protection circuit using MOVs and GDTs. Charts courtesy of BEAR Power Supplies

MOVs and GDTs degrade with each surge. Most manufacturers suggest replacing SPDs after ten surges, but Category C devices are often deployed in hard-to-reach locations.

Choosing components with high ratings for energy, current, and lifetime helps reduce the need for repair, but adds significantly to the system cost. Protection techniques involving intelligent combination of devices and use of the line filter deliver long-lasting surge protection for Category C equipment while keeping component costs within budgets.

Mr. Wood has more than 20 years in engineering design.

NEMA SPD Survey Substantiates Their Role as Electrical Safety Devices

Andi Haa, Vice Chair NEMA Low Voltage Surge Protective Device Section (5VS), and Consultant to Surge Suppression Incorporated

Surge protective devices (SPDs) are often thought of as add-on ancillary devices. Only recently have engineers come to regard these devices as critical components in the design of a complete electrical system.

SPDs protect electrical and electronic equipment from surges, transients, or spikes generated internally and externally. Normal and abnormal power grid operations, as well as facility operations, can and do create transient events on the electrical system. These transients can cause damage to unprotected equipment. So, should that be a safety issue? Damaged or destroyed equipment is only a financial loss, right? Wrong.

Worldwide, SPDs protect critical equipment that directly impacts safety:

- Residential as well as industrial systems with SPDs in place often protect items such as smoke and fire alarms.
- Residential as well as industrial and governmental systems with SPDs in place provide protection for emergency generators, security gates, security cameras, etc.
- With the advent of the Smart Grid, the addition of electronically based monitoring, analysis, control, and communication equipment requires SPDs to ensure continued operation.

NEMA 5VS, the Low Voltage Surge Protective Device Section, is keenly aware of the critical safety aspects of SPD installation. However, we wanted to see if the rest of the world understands this need. Recently, NEMA conducted a survey regarding surge damage occurring in facilities managers' properties and by default, the knowledge base regarding SPDs. Albeit a small sampling of 75 completed surveys, the results spoke volumes:

- Everyone knows about plug-in SPDs; 96 percent reported using these devices. The majority are used to protect computers and related equipment.
- Nearly 51 percent indicated having and using surge protection other than wall-mounted or cord-connected.
- Surprisingly, more than 49 percent of the facilities/property/maintenance managers do not have permanently connected surge protectors or similar equipment.

Figures 1 and 2 demonstrate survey responses.

Equipment that was either damaged or destroyed as a result of surge events included:

- Security Systems (34%)
- Fire Alarm Systems (25%)
- Emergency Lighting Systems (25%)
- Ground Fault Circuit Interrupters (22%)

The mitigation of damage to electrical and electronic equipment not only prevents down time, damage, and loss of safety-to-life equipment, but it is achievable. NEMA 5VS is striving to provide education and tools for understanding the need for and proper application of SPDs.

Learn more at *nemasurge.com*

Ms. Haa, a certified quality systems auditor, is a member of IEEE and serves on various standards panels.

What type of damage has occurred?

Answers	Percentage
Catastrophic failure or damage of electrical or electronic equipment due to a lightning event or voltage surge	18.7%
Premature failure of electrical or electronic equipment	26.7%
Unexplained process interruption	46.7%
Lock-up of computer or industrial process systems	24.0%
Insulation failure on electric motors or transformers	10.7%
None of the above	33.3%

Figure 1. Types of damage

What equipment do they protect?

- Computer equipment – 83.3%
- Non-computer equipment – 59.7%
- Other – 1.4%

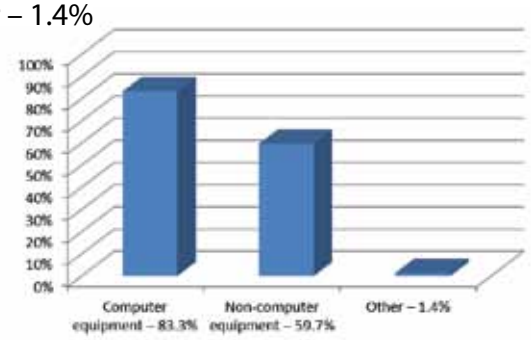


Figure 2. Illustration of types of equipment that survey participants protected with SPDs

A Systematic Approach to Arc-Flash Mitigation

Brent D. Henry, PE, U.S. Engineering Manager—Power Systems Engineering, Electrical Engineering Services & Systems, Eaton

Aidan M. Graham, PE, Northeast & Southeast Zone Manager—Power Distribution Services, Electrical Engineering Services & Systems, Eaton

The electric industry has made significant progress in raising awareness on electrical safety issues, especially surrounding arc flash. While this progress is a step in the right direction, there is still an opportunity to enhance safety practices that protect personnel and reduce the risk of injury.

Prevention and mitigation of arc-flash hazards and associated injuries requires a systematic approach including identifying hazards, raising awareness, and training; reducing hazards by design; and minimizing risk with technology and safe work practices.

To be effective, electrical safety programs should provide personnel with sufficient procedures, tools, work methods, and personal protective equipment (PPE) to accomplish their jobs in a safe manner. This includes planning each project or task, anticipating potential workplace hazards, and using safe work practices to minimize risks.

An arc-flash hazard analysis provides critical information to help personnel make decisions that support safe practices by quantifying the incident energy and arc-flash boundary (distance a worker may be exposed to while interacting with a piece of equipment). This information is typically presented on a warning label that is applied to equipment so that personnel can determine the PPE required while working inside the radius of the arc-flash boundary distance. The work does not end with the label on the equipment. It is essential that engineers, operators, electricians, or anyone else who may access the electrical equipment be qualified through proper training. This includes a thorough understanding of the site safety program and safe work practices, knowledge of the equipment itself, and use of proper techniques and controls to minimize arc-flash safety risks.

Photo courtesy Eaton Electric

Understanding and quantifying hazards is a step toward enhancing safety. Mitigating hazards by design is equally important. Strategies to lower available incident energy primarily focus on three key areas:

- reducing the available short-circuit current
- minimizing protective device clearing time during arcing faults
- increasing the working distance between personnel and the potentially arcing equipment

Reducing the energy available requires a systematic approach unique to each location, incorporating one or a combination of the following strategies.

REDUCE AVAILABLE FAULT CURRENT

Typical methods to reduce available fault current include installation of current-limiting reactors; use of multiple small transformers or high impedance transformers, and interlocks to prevent paralleling sources of power.

MINIMIZE PROTECTIVE DEVICE CLEARING TIME

Arc-flash energy is directly proportional to the amount of time a worker is exposed to a fault. This must be balanced with system reliability and selectivity. Methods include implementation of an arc-flash reduction maintenance system; addition of differential protection; overcurrent protection upgrades, including electronic trip units; and current-limiting circuit breakers and fuses.

EXTEND WORKING DISTANCE

Incorporating remote operation into safe work practices limits the exposure personnel face while performing routine operations and maintenance. Methods include remote racking of power circuit breakers and motor control center buckets; and remote monitoring, control, and diagnostics.

Technology improvements that reduce or redirect arc-flash energy—maintenance programs, predictive diagnostics, and system design changes—all provide a path to reducing the exposure to arc-flash hazards. Examples include maintenance programs and personnel training, arc-resistant switchgear and enhanced motor control centers, partial discharge detection, and high resistant grounding systems.

The electrical industry continues to make great strides to raise awareness of potential hazards, develop new technology designed with safety in mind, and create options to reduce risk. Yet, safety practices need to be adjusted to an organization's specific requirements and circumstances. There is not a one-size fits all approach to safety. Organizations with robust services groups are providing on-the-ground support, expertise, and the systematic approach that is required to enhance safety and reinforce reliable operations.

Mr. Henry and Mr. Graham are members of IEEE.

Emergency Lighting Shows the Way

Eric Bailey, Senior Mechanical Engineer, Philips Chloride, Philips Lighting North America

Emergency lighting is designed to let people know where safe passage from a building exists and how to get there. Lack of emergency lighting causes confusion, panic, and potential personal injury.

Although we think of emergency lighting in times of disaster like a tornado or fire, emergency lighting is used regularly on beautiful, sunny days. All it takes is a transformer substation to fail, a construction crew to cut through an underground feeder line, or an automotive accident taking down a power pole and an entire building can be thrown into complete darkness.

For example, when the power fails, people in restrooms are in complete darkness. Restrooms rarely have any windows or even visibility to the interior of the building where emergency lighting might exist. Yet they are often overlooked. Because of the way codes are written, restrooms are not necessarily required to have emergency lighting installed. Good common sense must be used when developing an emergency lighting design plan. In this instance, fluorescent emergency lighting ballasts with a 90-minute duration could be easily installed into existing fixtures.

Emergency lighting is clearly a life-safety product. Building codes (e.g., NFPA 101 *Life Safety Code*® and *International Building Code*®) require its installation and specify its maintenance.

Building codes require exit signs along the emergency egress path no further apart than their listed maximum viewing distance to the point of exit discharge. Computer software has facilitated this by allowing theoretical layout performance calculations to be made early in the design process. It may surprise people how many designs with good intentions based on past experience do not meet minimum qualifications.

It is important to evaluate the performance of equipment when designing emergency lighting installations. Units can vary greatly on the amount of usable light they provide. Choose equipment that will satisfy code in the most cost-effective and energy-efficient method possible. It is also important to check local codes and standards as they vary.

Threatening to upset the balance of emergency lighting cost/benefit is regulations intended to limit battery charge energy imposed by entities at state and federal level. Because of emergency lighting's critical nature, Underwriters Laboratory developed and maintains UL Standard 924. All emergency lighting equipment in the U.S. is designed to it.

Legislation must take into account the more stringent life safety equipment requirements. Failure to recognize this could actually increase energy usage by forcing larger batteries to account for the inadequacies of the charge circuit or by requiring that more equipment of lesser power demand and less light output to accomplish what one unit could have done for less total energy.

Clearly marked exit signs can be integrated with modern design elements. Photo courtesy of Philips Lighting North America

The emergency lighting industry has not been waiting for legislation to improve efficiencies of equipment. Emergency lighting was one of the first industries to utilize LEDs as a means of illumination. This reduced power from 40W or 17W per sign to current levels of 5W or less per sign. Egress path lighting is moving toward LED lighting as its primary source of illumination. This will also reduce power demand, for instance, by replacing a 20W lamp with an equivalent LED lamp of 7W.

Once installed, the building owner is responsible for ensuring that minimum requirements continue to be met. Code requires that emergency lighting be checked every month. This is a quick check to make sure the units transfer, the batteries are able to keep the sign and/or pathway illuminated, and that lamps are not in need of replacement.

Annually, units must undergo a 90-minute full rating test. If they do not function throughout this period, they need to be repaired or replaced. The results of these tests must be recorded and kept on record. This is not dissimilar to the routine inspections and logging performed on fire extinguishers. Equipment is available which performs testing automatically, greatly reducing maintenance time and identifying any system deficiency as soon as it happens.

So the next time power fails and you find yourself with a guiding light to get you out of the building, thank the emergency lightning industry for keeping you safe.

Mr. Bailey is actively engaged in the design and development of emergency lighting products. He has served as chair of NEMA's Emergency Lighting Section.

National Electrical Safety Month Spotlights Electrical Safety Leaders

Brett Brenner, President, Electrical Safety Foundation International (ESFI)

Since 1994, ESFI has promoted electrical safety across North America and is highly regarded by industry, media, and consumer safety partners for constantly reinvigorating the electrical safety message. Each May, ESFI sponsors National Electrical Safety Month (NESM) and spearheads a campaign to raise awareness about electrical safety and potential home electrical hazards. This endeavor, as well as public awareness platforms and educational materials, would not be possible without the support of partner organizations. In honor of NESM, ESFI spotlights the industry leaders who assist the foundation in furthering its mission of reducing electrically-related fatalities, injuries, and property loss.

Consumer Product Safety Commission (CPSC)

Andrew Trotta

"CPSC is committed to protecting consumers and families from products that pose a fire, electrical, chemical, or mechanical hazard. This is achieved by developing and enforcing mandatory standards, recalling products that pose a threat to public safety, and developing awareness campaigns about potential hazards associated with consumer products."

—Andrew Trotta, Electrical Engineer, CPSC and Member, ESFI's Board of Directors

CPSC is charged with protecting the public from unreasonable risks of injury or death associated with the thousands of consumer products under its jurisdiction by identifying and preventing electrical hazards. CPSC further demonstrates its dedication to electrical safety through its joint efforts with ESFI to educate and protect families from electrical hazards in and around the home.

Pass & Seymour Legrand

Pat Davin

"Legrand's Pass & Seymour wiring devices have been providing customers with innovative and unmatched electrical solutions since the 1890s. We pioneered the first GFCI receptacle in 1971, and have continued to raise the industry standard for electrical safety with our state-of-the art product lines of residential, commercial, and industrial wiring devices and accessories."

—Pat Davin, Vice President/Brand General Manager, Pass & Seymour Legrand and Member, ESFI's Board of Directors

Legrand is a global specialist in products and systems for electrical installations and information networks, offering solutions for use in residential, commercial, and industrial buildings. Legrand proudly supports ESFI and strives to create safety devices that are in line with ESFI's mission of reducing electrically related injuries, fatalities, and property loss.

National Fire Protection Association (NFPA)

Lorraine Carli

"It is vital that NFPA remains on the forefront on electrical safety issues as the producer of the *National Electrical Code®* (*NEC*). NFPA proudly sponsors lifesaving campaigns and training programs, and aligning with ESFI allows us to reinforce the safe electrical practices that serve as the guiding premise for the *NEC*."

—Lorraine Carli, Vice President of Communications, NFPA and Member, ESFI's Board of Directors

The world's leading advocate of fire prevention and an authoritative source on public safety, NFPA develops, publishes, and disseminates consensus codes and standards intended to minimize the possibility and effects of fire and other risks. The *NEC*, which is adopted and used in all 50 states, serves as the benchmark for safe electrical design, installation, and inspection.

2013 NATIONAL ELECTRICAL SAFETY MONTH
Electrical Safety for All Ages. ESFI

The NESM 2013 *Electrical Safety Advocate Guide* provides the resources necessary to encourage electrically safe practices among all ages.

Visit *esfi.org/NESM*

- Learn about the NESM 2013 campaign.
- Become an electrical safety advocate.
- Find resources for older adults, children, homeowners, consumers, and the workplace.
- Download the *Implementation Guide* and *Outreach Guide*.
- Plan and execute a NESM event.

Using Generators Safely

While May is National Electrical Safety Month, it also leads into the onset of hurricane season when heavy rains and severe winds often result in power outages. As a consequence, many people chose portable generators as a temporary source of power.

Portable generators can be powerful tools, but they can also be dangerous—even deadly—if not installed and operated safely. Hazards include carbon monoxide (CO) poisoning, electric shock or electrocution, and fires. There were 542 generator-related CO deaths between 1999 and 2009, according to the U.S. Consumer Product Safety Commission; 85 percent of them occurred in and around the home. Portable generators caused at least 12 CO-related deaths in the wake of Superstorm Sandy.

Understanding the dangers associated with portable generators and practicing good safety habits could save your life. ESFI has several generator safety resources including FAQs, fact sheets, a virtual demonstration, and a public service announcement at *http://esfi.org/index.cfm/pid/11406/cdid/10816*:

- ESFI recommends that generators be installed by qualified, licensed electricians.
- Do not connect a generator directly to household wiring without the use of a transfer switch.
- Make sure your home has either a battery-operated or battery back-up CO alarm. Test the batteries monthly.
- Never operate a generator inside your home or in any other even-partially enclosed space. Open doors, windows, or fans will not prevent CO from building up.
- Locate the generator as far from the house as possible, away from doors, windows, and vents. Keep the generator a safe distance from your neighbors' homes as well.
- Do not operate the generator in wet conditions. Use it on a dry surface under an open, canopy-like structure.
- Do not overload the generator. Keep the load to no more than the recommended wattage.
- Plug appliances directly into the generator or use a heavy-duty, outdoor-rated extension cord.
- Turn off all appliances before shutting it down.
- Turn the generator off and let it cool down before adding fuel.
- Keep children away from generators at all times.
- Use a generator only to power essential equipment.

Julie Chavanne, Communications Manager, ESFI | *julie.chavanne@esfi.org*

Re-Imagining Safer Power Systems in Education Facilities Industry

Rightsizing Electrical Power Systems

Mike Anthony, Senior Electrical Engineer, University of Michigan

Joe Andre, *National Electrical Code*® Representative

Competing requirements of electrical safety and economy will edge closer to optimal resolution in a change to the 2014 revision to the *National Electrical Code (NEC)*.[1] Contingent upon the presence of an energy management system that controls lighting load—a feature that is common in many commercial buildings—engineers may reduce power chain capacity to follow the lower lighting power densities mandated by energy codes.

The difference between what *NEC* requires for circuit capacity and what energy codes permit for lighting load is not small (see Table 1). Assuming that lighting load is 30–35 percent of total demand—possible reductions run an average of 15 percent for medium-voltage transformers and 60 percent for low-voltage transformers—and all related elements in the power chain.

The change was driven by a consortium of colleges and universities led by the University of Michigan that recognized the growing divergence between *NEC* power chain design rules and lower power densities because of energy-efficient end-use equipment.[2] Transformers downstream from the utility service that must conform to the *NEC* will run closer to rated capacity—above 50 percent. Questions remain about the degree to which power chain under-loading for more than a half century has permitted maintenance requirements to be ignored.

Even though the Article 220 technical committee approved this concept 12–1 in the comment stage, this is one of the most disruptive changes to the *NEC* in decades and it is wise to move slowly as it is integrated into the culture of our industry.

Despite concern for fire safety, many benefits accrue which offset the concern:

- A "lossy" medium voltage 1000kVA substation installed in the 1980s that sees peaks below 400kVA can be replaced with a 750kVA substation with safer primary switches and secondary gear.
- Some medium voltage services can be replaced with a 480V–800A service that is smaller and safer. That would be five watts per square foot in a 100,000 square foot building with 20 percent spare capacity and a 0.95 power factor.

Occupancy	NEC	ASHRAE	IECC
Office	3.5	0.82	0.90
Hospital	2.0	1.05	1.10
School	3.0	0.87	0.99

Table 1. Comparison of NEC *minimum circuit sizing requirements (in volt-amperes per square foot) for lighting loads with ASHRAE 90.1 and International Energy Conservation Code power density limits (in watts per square foot)*

Just the Tip of the Iceberg?

Joe Andre, NEMA Representative on the International Energy Conservation Code

NEC Table 220.12 is based on electrical utility data that has been with us since the 1960s. Even as energy codes ratchet lighting power densities down—along with more efficient HVAC equipment, more sophisticated and accurate controls, and a host of additional measures on the horizon—the energy code enforcement issue is not being addressed.

The Department of Energy (DOE) has put states and local jurisdictions on notice that if enforcement is not a priority, it is prepared to bring it under a federal program. DOE has already distributed a significant amount of money to assist local jurisdictions in enforcement of energy codes. Taking into account just the disparity in lighting density between the *NEC* and the *International Energy Conservation Code*, the electrical energy saved is astounding.

Take the lighting for a typical 50,000 square foot office building: Per the current *NEC*, Table 220.12, that building requires a calculation of 3.5VA/square foot for general purpose lighting, for a total calculated lighting load of 175,000VA.

Under the energy code, that exact same building, at a maximum installed general lighting density of .90VA/square foot, totals 45,500VA. No matter how you distribute it, the number is significant. Now apply that discrepancy to the millions of square

- Reduced transformer no-load losses will be on the order of $43,800 per 10,000kVA connected.
- While relatively rare, smaller 480/208V distribution transformers for lighting only can be reduced up to 60 percent. This changes the size and cooling of electrical "closets" and radically reduces incident energy in distribution switchgear.
- Expansion of the scope of building renovations to include larger scale electrical feeder and switchgear rehabilitations. For example, a 1,000-foot 400A legacy feeder that costs about $6,300 using copper could now be built as a 300A aluminum feeder for about $1,700.

This is an important moment for the education facilities industry. We need large scale buy-in from all stakeholders to support data necessary to inform re-conception of commercial building power systems. (See "Just the Tip of the Iceberg?" on page 27.)

Fire Protection Research

One of the largest sustainability accomplishments for the $1.2 trillion U.S. education facilities industry has come from its $250 billion facilities construction, operations, and maintenance side. Its results demonstrate improved safety and stronger energy economics for the largest occupancy class in the U.S.

Data presented to the Article 220 committee by the University of Michigan consortia was derived from readily available service metering statistics throughout the education facilities industry. Other proposals to reduce to the 180VA per outlet rule for 220.14 and to offer HVAC-related demand factors for buildings with multiple HVAC units were rejected for lack of technical substantiation. Accordingly, a proposal was made to the Fire Protection Research Foundation (NFPA's research affiliate) to gather enough data to inform future proposals.

That project is tentatively looking for about $1.5 million of research funding, possibly shared among users, manufacturers, and other stakeholders. According to Casey Grant, the foundation's research director, "The goal of the proposed research effort will be to provide statistically significant load data for a variety of occupancy and loading types to provide a technical basis for considering revisions to the feeder and branch circuit design requirements in the *NEC*."

According to the American College & University Presidents' Climate Commitment, this is a sustainability windfall for the U.S. education facilities industry on the order of $1 to $10 billion. College and university campuses—with the full range of occupancy classes not unlike a small city—is the ideal "study unit" for continuation of research into infrastructure for cities of the future.

The NFPA Research Foundation project promises that good things might get done in the 2017 *NEC* for the right reasons—at least doubling the gain in safety and economy already won.

Mr. Anthony is a leading voice in electro-technology spending in the U.S. education facilities industry. Mr. Andre has served on the NEC *Code-Making Panels and represents NEMA on the International Energy Conservation Code.*

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[1] 2014 *National Electrical Code® Report on Proposals* (2-228 Log #2914) and *Report on Comments* (2-119b Log #1068). National Fire Protection Association, Quincy, MA

[2] "Rightsizing Electrical Power Systems In Large Commercial Facilities", Michael A. Anthony, James R. Harvey, Thomas G. Harman, IEEE Industrial & Commercial Power Systems Society, May 2013. IEEE Paper No: 978-1-4673-5242-0/12

feet of office space being built every year and the savings are staggering.

The monitoring of energy use in real time will allow building operators, managers, and owners to accurately control energy use. As LED technology advances and becomes more feasible, the energy consumption of a given building will be even lower. The expanding requirements for building commissioning and making sure that everything is installed and operating as designed and per code should give further assurances that the building of today will not require the kind of energy demand that buildings did decades ago.

There are ancillary benefits to reducing the calculated electrical load of a building—lower arc flash and smaller equipment, rooms, and spaces. The meticulous work of the University of Michigan–led consortia was a turning point. We must recognize that the difference between the *NEC* calculation and the energy code lighting density is not a tangible load: the *NEC* calculation is used to size service equipment, conductors, feeders, sub-panels, and the like.

There are no rules in the *NEC* mandating installation of that much lighting or most other general loads. Loads are determined by what is connected and operating at any given time. Compliance to the energy code will result in the reduced actual loading of the electrical system.

The State of Washington has had an allowance in its electrical code for more than 20 years and there has not been a single incident or report of equipment overloading in all of that time.

Amperes—Not Volts—Kill

Chrissy L. S. George, NEMA Communications

Did you know that when it comes to electricity, amperes are what cause injuries and not voltage? It's a common misconception, especially for the layperson.

Simply put, an ampere is electric current. Voltage is the pressure which pushes amperes through a conductor. Without voltage, you can't have amperage (current flow).

Think of a bird on a wire. It lands on a utility wire that may be energized at 2.4 kV or higher and nothing happens even though there is current flowing through the wire on which it sits. For the bird to receive an electric shock (current flow through the body), it would have to reach out its wing to touch something grounded or another energized conductor. For example, utility lines in California have been modified to help protect the California condor, which has a wing span that can reach ten feet. If the condor were to touch just one wire, there would be no complete path for current flow through the bird. However, if the huge wingspan brings the condor into contact with more than one conductor it would complete the path.

Working in the electrical industry can be a dangerous job. Electrical safety is of the utmost importance for those working on or near exposed energized conductors and circuit parts. There are many occupations that can expose individuals to these environmental factors including but not limited to electricians, HVAC technicians, elevator constructors, and linemen. All must be trained to a qualified status to prevent injury.

The severity of an electric shock varies by amperage. For example, an electrical shock of 3 milliamps (mA) is painful, but it won't kill you because you can let go of the source of the shock (e.g., a hot wire). However, if current flows through the body (electric shock) at 10 mA or higher, the body may not be able to let go.

"Because of the strength of current, the muscles tightly contract. This typically results in a fatality if the individual cannot fall away and break the circuit," said Jim Dollard, safety coordinator at IBEW Local 98 in Philadelphia, Pennsylvania, and member of NFPA 70E, which publishes *Electrical Safety in the Workplace*.

The effects of electric shock scale inversely with body mass. According to NEMA's Ground Fault Circuit Interrupter Section, difficulty in breathing and fibrillation begins for children and small adults at 30 mA; at 50 mA, heart paralysis, burning of tissue, and the possibility of death begins for adults.

It's not just those in the industry than can get shocked, burned, or even die from electric shock.

When a home isn't protected with ground-fault circuit interrupters (GFCI), the risk of electric shock increases. GFCIs are safety devices designed to prevent electric shock by breaking the circuit when there is a current flow outside of the circuit, which is called a ground fault. GFCI protection is required by the *National Electrical Code*® in dwelling unit bathrooms, kitchen countertops, outdoors, and in other areas conducive to electric shock, especially where water may be present.

"There are millions of homes in the U.S. that don't have GFCIs in all locations where they are required today," said Mr. Dollard. "These lifesaving devices can be purchased at any home improvement retailer. Once installed, they should be tested once a month."

*Ms. George (*chrissy.skudera@nema.org*), an assistant editor/writer in NEMA Communications, is a regular contributor to* ei *magazine and has taught writing classes at several Washington, D.C.-area colleges.*

The Electrical Safety Foundation International provides resources focused on GFCI safety including a virtual demonstration describing how to properly test the device.

Visit *esfi.org* for more information.

› FDA to Issue Guidance on Regulatory Environment for Mobile Medical Applications, Health Information Technology

One of the most important trends in healthcare today is the emergence, rapid growth, and proliferation of mobile medical applications (apps), which enable portably accessed information via iPads or smartphones.

Apps cover an enormous range of health-related areas. There are some that patients use to manage personal health conditions (e.g., monitoring blood pressure or glucose levels). Others provide information to users on maintaining good health practices, such as diet and exercise. Some sophisticated medical apps are even used—under certain specified conditions—for visualization of patient images.

The Food and Drug Administration (FDA) has been working for several years on developing and issuing a final guidance document on mobile medical apps. The purpose of such guidance is to inform manufacturers and other entities how FDA intends to apply its regulatory authorities to specified software applications intended for use on mobile medical apps.

MITA was one of more than 500 organizations that submitted comments on the draft guidance in October 2011. FDA faces a daunting challenge in constructing a regulatory framework in this area, given the breadth and complexity of the range of mobile medical apps, the difficulty in determining what mobile apps should or should not be regulated, and how certain apps should be regulated.

Mobile medical apps are a subset of health information technology (HIT). While there are no universally agreed upon definitions, HIT has been broadly defined as including computer hardware and software that applies to the storage, retrieval, sharing, and use of healthcare information and data.

HIT enables the clinician to have readily accessible information on each patient when and where needed. MITA member companies have been marketing picture archiving and communications systems (PACS) to customers for years. Use of PACS to share images and medical imaging information electronically has played and continues to play an essential role in providing information to physicians to aid in diagnosis and treatment.

REGULATION COMPLICATES IMPLEMENTATION

As a result of the enactment of the FDA *Safety and Innovation Act* (FDASIA), Section 618, the regulation of HIT has captured center stage for MITA medical imaging informatics companies. That act requires that FDA, in consultation with the Federal Trade Commission (FTC), Federal Communications Commission (FCC), and Office of the National Coordinator of Health Information Technology (ONC), prepare a report to Congress by the end of 2013 on a proposed regulatory framework for the regulation of HIT, including mobile medical apps.

More specifically, this report must contain:

> "…a proposed strategy and recommendations on an appropriate risk-based regulatory framework pertaining to health information technology, including mobile medical applications, that promotes innovation, protects patient safety, and avoids regulatory duplication."

This is an extremely complex task, due in part to the lack of generally agreed upon definitions of "HIT" and "mobile medical applications." The world of HIT and medical apps is dynamic as new applications come into use. Regardless of what eventually emerges with respect to HIT, regulations will have significant implications for MITA companies.

Questions that affect MITA members include:

- How should HIT and mobile medical applications be defined?
- In the context of HIT and mobile medical applications, will FDA define the app as a medical device, which will then be subject to FDA regulation?
- What role will FDA, FTC, ONC, and FCC play in regulation?

MITA is grappling with these issues and will submit written comments to FDA soon. This is a continuation of MITA's active participation on HIT issues over the past several years.

Under FDASIA, FDA is authorized to create a multi-stakeholder group to provide input and recommendations on the application of Section 618 to the regulation of HIT. FDA has called for volunteer organizations to serve on this stakeholder group. MITA has submitted its application to participate. Selections of chosen organizations are expected next month.

MITA has been and continues to be a strong advocate for maintaining the current 510(k) product clearance process to enable companies to bring their products to market.

MITA also has been an active participant in representing industry interests on HIT issues and will continue to do so to preserve and maintain the current role of FDA in the product clearance process—and avoid duplication of existing regulations—to enable the benefits of innovative HIT products brought to patients.

Richard M. Eaton, MITA Director of Industry Programs | ***reaton@medicalimaging.org***

2013 ARPA-E Energy Innovation Summit Expands Policy Focus

The fourth annual Department of Energy Advanced Research Projects Agency (ARPA-E) Energy Innovation Summit took place in February outside Washington, D.C. More than 2,500 attendees from industry, academia, investment firms, and government came together for what was an impressive and high-profile program. Keynote speakers included Secretary of Energy Steven Chu; New York City Mayor Michael Bloomberg; former Governor Mitch Daniels; Elon Musk, Tesla Motors and Space-X CEO; and T. Boone Pickens, businessman and financier. But the true guests were applicants and project awardees.

ARPA-E is modeled after its more familiar Department of Defense counterpart (DARPA) and serves to fund high-risk energy and clean technology research which might otherwise go unrealized, as well as support American ingenuity to solve the nation's energy problems. It provides funding for game-changing ideas in grid-scale storage, power electronics, electric vehicle batteries, building efficiency, advanced carbon capture, and electrofuels. ARPA-E champions projects which it is unable to support through funding, but which still hold great promise. The tone of the summit reflected this.

One session, "Breaking through the Grid-Lock," explored the problems and possible solutions for increasing quantities of distributed energy resources deployed on the grid and underscored many of NEMA's goals. Dr. David Sun (Chief Scientist, Network Management Solutions, Alstom Grid); Dr. Jeffrey Taft (Chief Architect, Cisco Connected Energy Networks); and Geisha Williams (Executive Vice President, Electric Operations, PG&E) discussed challenges that utilities face as rate-payers shift from purchasers of electricity to entities that both provide and use electricity.

The session used California—an area of very high rooftop solar penetration—as representative of where other areas in the U.S. will be in a few years. Utilities there recognize that they must change their economic model to ensure fairness. Affluent areas are more likely to have solar PV cells installed and accordingly, lower electricity costs as they roll back monthly bills through net metering. Yet, customers in these areas still rely on the utility for service during times of inadequate sun, nighttime, and high demand. The result is that a higher percentage of customers without distributed generation assets are subsidizing the cost of the entire grid infrastructure for those with distributed generation assets by paying higher bills.

At the same time, as a growing percentage of generation assets become decentralized, utilities increasingly lose control, which in turn lowers reliability—a universally undesirable side effect. Distribution utilities recognize that to successfully integrate distributed generation assets, they must work with Smart Grid equipment manufacturers and providers of data analytics to manage thousands of dual electricity providers and consumers to ensure that supply matches demand, among other concerns.

While all parties on stage were are in agreement that new models involving energy management systems, data analysis services, and utilities must emerge to win the global clean energy race, there is a lack of consensus on what the best models should be. So far in its existence, ARPA-E has invested $770 million in 285 projects. Many investments are highly-touted successes, but even through failure, learning occurs. That tone encourages U.S. energy policy to shift away from hesitancy to change and toward acceptance of a new, cleaner, and more reliable energy future.

Ryan Franks, NEMA Program Manager | *ryan.franks@nema.org*

enLightenAmerica Lights Up NFMT Show

Ron Runkles (far left), NEMA Lighting, discussed enLightenAmerica with Larry Schmidt and David Errigo (far right) of LumenOptix at the NFMT Show in Baltimore in March. Photos by Maria Northup

› Rising Water—R U Ready?

Addressing Water-Damaged Electrical Equipment

With spring thaw comes spring flooding. Snowmelt and spring rains flow into rivers, increasing water levels and causing flooding in low-lying areas. If your home or business floods, do you know how to treat water-damaged electrical equipment?

When this happens, electrical infrastructure and safe use of electricity becomes a concern. Evaluating flood-damaged electrical equipment is instrumental in re-establishing a safe and reliable electrical system.

Learn whether to repair or replace by reading NEMA's *Water-Damaged Electrical Equipment* or by listening to the podcast *Properly Evaluating Water-Damaged Electrical Infrastructure.*

These are excellent resources for communities and electrical professionals who must address electrical equipment that has been damaged by water.

Alan A. Manche, Director, Industry Standards, Schneider Electric

› NEMA Offers Resources that Promote Electrical Safety

STANDARDS

- *SB 1 Quality Informational Guide for Automatic Fire Detection and Alarm Systems*
- SB 2 *Training Manual on Fire Alarm Systems*
- *SB 3 Interconnection Circuitry of Noncoded Remote Station Protective Signaling Systems*
- SB 7 *Applications Guide for Carbon Monoxide Alarms and Detectors*
- *SB 10 Audio Standard for Nurse Call Systems*
- SB 11 *Guide for Proper Use of System Smoke Detectors*
- SB 13 *Guide for Proper Use of Smoke Detectors in Duct Applications*
- *SB 19 Installation Guide for Nurse Call Systems*
- *SB 28 Product Safety Guide for Developing Documentation for Fire Alarm Systems and Equipment*
- *SB 30 Fire Service Annunciator and Interface*
- SB 40 *Communications Systems for Life-Safety in Schools*
- SB 50 *Emergency Communications Audio Intelligibility Application Guide*

BROCHURES

- *Are the Life Safety Products in your Home up-to-date?*
- *What Every School Needs for Emergency Communications*

PODCASTS

- *Smoke Detector and Alarm series*
- *Carbon Monoxide series*
- *Iowa State Fire Marshal Discusses Statewide Smoke Alarm Installation Program*

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› CANENA Annual Meeting Features Regional Standardization Focused on Canada

CANENA—the Council for Harmonization of Electrotechnical Standards of the Nations of the Americas—celebrated 20 years of progress at its recent annual general meeting in Montreal. The theme of the meeting, putting regional standardization in a global context, focused on Canada.

In a plenary address, Micael Girard, vice president policy and stakeholder relations of Standards Council Canada (SCC), stressed that SCC is committed to promoting standardization as a means of achieving public policy objectives while meeting the needs of key stakeholders. He identified a near-term goal of improving the way standards are incorporated by reference in regulations, which addresses the problem of making static references that become outdated when standards are revised. New legislation has been introduced in Canada that will correct this.

SCC is also focused on creating standards or regulations that do not create technical barriers to trade. Particular attention was given to regulatory cooperation and the ongoing work of the U.S.–Canada Regulatory Cooperation Council. Focusing specifically on electrotechnology, Mr. Girard noted that the industry is well positioned with an extensive history of successfully harmonizing standards.

Jim Taggart, president and CEO of ElectroFederation Canada (EFC), provided an snapshot of the industry from the Canadian perspective, identifying current key issues and challenging economic conditions, including sustainability, electrical safety, counterfeit and unsafe products, trade policy and regulation, workforce development, harmonization of codes and standards, reduction of technical expertise in Canada, and industry consolidation.

He also identified specific activities within EFC: industry representation on codes and standards, advocacy on industry-related issues with all levels of government and trade policy, statistical market research and analysis programs, industry best practices education and training programs, timely updates on emerging issues and industry news, electrical safety and sustainability (particularly via ESFI Canada), and intellectual property rights and protection.

In a presentation prepared by NFPA Latin American representative Antonio Macias and delivered by NEMA Mexico Director Gustavo Dominguez, the status of electrical installation codes throughout Latin America was reviewed. Noteworthy is the fact that a formal installation code based on the U.S. National Electrical Code® is now firmly in position in Mexico, Costa Rica, Colombia, Ecuador, El Salvador, Nicaragua, Panama, and Venezuela.

Ongoing attention is being given to this subject by NFPA and NEMA, especially as part of NEMA's new Latin America Initiative, which targets 10 countries. The number one strategic objective of this latter project is the formal adoption of an electrical installation code and related product standards.

Cliff Rondeau of CSA described the successful harmonization and publication of four regional standards in support of electric vehicle charging stations within 18 months of identifying the need:

- NMX-J-677-ANCE/CSA C22.2 NO. 280-13/UL 2594 *Standard for Electric Vehicle Supply Equipment*
- NMX-J-668/1-ANCE/CSA C22.2 NO. 281.1-12/UL 2231–1 *Standard for Safety for Personnel Protection Systems for Electric Vehicle (EV) Supply Circuits: General Requirements*
- NMX-J-668/2-ANCE/CSA C22.2 NO. 281.2–12/UL 2231–2 *Standard for Safety for Personnel Protection Systems for Electric Vehicle (EV) Supply Circuits: Particular Requirements for Protection Devices for Use in Charging Systems*
- NMX-J-678-ANCE/CSA C22.2 No. 282-13/UL 2251 *Standard for Plugs, Receptacles, and Couplers for Electric Vehicles*

Gene Eckhart focused on NEMA's *Development of a Secure, Robust, and Reliable North American Smart Electrical Grid,* an ongoing project supported by the U.S. Department of Commerce Market Development Cooperator Program. He emphasized the strong growth of exports of Smart Grid products to Canada and Mexico—currently at an all-time high, exceeding $3 billion per year to each country.

In addition to boosting exports, the program fosters adoption of interoperable standards to ensure that transmission and distribution utilities in Canada, Mexico, and the U.S. can safely and reliably transmit power from one country to another.

Following the publication of the *NIST Framework and Roadmap for Smart Grid Interoperability Standards*, Release 2.0 in early 2012, the Federal Electricity Commission of Mexico announced its Smart Grid roadmap early, while Canada published the Canada Smart Grid Roadmap in October of 2012.

The objective of all the plans is to ensure that the Smart Grid products used in upgrades to the national grids result in an interoperable system. NEMA is working closely with its Canadian counterparts to keep abreast of this development.

Gene Eckhart, Senior Director for International Operations | *gene.eckhart@nema.org*

› Progress on NEMA's Latin America Initiative

As reported earlier in January, NEMA is well underway on the Latin America Initiative designed to build on the successful outreach we conducted in the region since 2007. This new program focuses on Latin American countries having free trade agreements with the U.S.—Chile, Colombia, Costa Rica, Dominican Republic, El Salvador, Guatemala, Honduras, Nicaragua, Panama, and Peru. The payoff is reflected in the export statistics: in 2012, exports of products within the scope of NEMA reached an all-time high of $2.1 billion. This represents steady growth of exports to this block of countries over the last four years.

Market access is great, but if there are no codes or standards in place to ensure product demand, it could disappear overnight, particularly when competitors worldwide are looking at the same market. For that reason the Latin America program aims to further develop emerging standards and conformity assessment infrastructure in the region:

- formal adoption of electrical installation codes that are based on the *National Electrical Code® (NEC)* in the target countries
- formal adoption of product standards harmonized with those used in North America by target countries
- formal adoption of energy codes and green building standards that are consistent with the latest versions available in the U.S.
- increased awareness and understanding by the governments and electrical communities in the target countries about the need for conformity assessment and inspection to ensure safe electrical installations
- heightened awareness about the proliferation of counterfeit products by the electrical community and local customs officials
- proactive encouragement of energy-efficiency regulations that are consistent with North American requirements

Here is a brief progress report to date:

- Eleven NEMA sections are funding this initiative.
- A steering committee has been formed consisting of at least one representative from each funding section.
- An initial "profile sheet" for reporting on each country has been developed and reviewed by the steering committee; the profile includes the status update on installation code, product standards, IEC standards activity, conformity assessment, inspection/verification, commercial building inventory, trade associations, and other country-related technical and/or professional organizations.
- Profile sheets are now being filled out with information we have developed over the past several years.
- Planning is underway to organize visits and meetings in the target countries in pursuit of the defined objectives.
- At the recent CANENA Annual General Meeting, the NFPA presentation indicated that the *NEC* is influencing the installation codes in eight Latin America countries.

A specific list of activities has been defined for the program, including regular meetings between NEMA staff and key officials in each of the target countries, to discuss and advance all the subjects included in the list of objectives. Organizations slated for meetings include standards development organizations; conformity assessment authorities; government officials, particularly commerce and energy, and customs officials to discuss intellectual property rights, and counterfeit products, and action plans; leading electrical distributors; member company representatives in country; and U.S. embassy officials.

In addition to regular networking and intelligence-gathering meetings, NEMA will organize and conduct technical seminars/workshops focusing on product systems to address electrical distribution and utilization issues such as overcurrent protection, bonding and grounding, cable management, etc. This differs from similar workshops held in previous years that focused on more general topics such as the electrical installation code, product standards, and testing, certification, and inspection. The new program will focus particularly on the products from the sections providing funding and feature teams consisting of representatives from several sections to address topics from a systems point of view.

Latin America continues to be a region that attracts electrical product manufacturers from the European Union and more recently, China. These global competitors look upon the region as a growth market, and strive to either displace U.S. technology or to eliminate any codes and standards, allowing for low-cost and unsafe products to proliferate in the market. Our continued presence serves to ensure that the region does not move away from being an attractive market for NEMA member companies.

Gene Eckhart, Senior Director for International Operations | *gene.eckhart@nema.org*

Economic Spotlight

What a Difference a Year Makes for Incandescent Lamps

NEMA's *incandescent lamp shipments index* showed a precipitous decline of 40.1 percent compared to the same period last year. The index reached a value of 49.3, a new record low for the series. Compact fluorescent lamp shipments dipped slightly during 2012 to an index value of 176, a change of 0.3 percent versus 2011. Halogen A-line lamps continued to make inroads as a viable alternative lamp source increasing by 88.3 percent over last year.

LINEAR FLUORESCENT LAMP SHIPMENTS WANE

NEMA's shipment *indexes for T5 and T8 liner fluorescent lamps* increased 2.1 and 15.1 percent in the fourth quarter of 2012 to reach 156.8 and 103.1, respectively. The quarterly gains did not offset decreases earlier in 2012. Shipments of T12 lamps showed the largest annual slide, dipping by 18.6 percent to 50—half the level of 2006. Similarly, the index for T12 lamps reached a new record low of 36.6, a decline of 1.1 percent during Q4.

HID LAMP SHIPMENT INDEXES REMAIN ON DECLINE

NEMA's *high intensity discharge (HID) lamp shipment indexes* declined for the second consecutive year during 2012. Mercury vapor lamps declined 9.6 percent to an index value of 44 signifying that shipments during 2012 were 44 percent of the 2006 base level. The index for sodium vapor lamp shipments fell 6.2 percent, landing at 75. Metal halide lamps posted an index reading of 80, declining by 4.9 percent for the year.

Tim Gill, Director of Economics | *tim_gill@nema.org*

NEMA'S Electroindustry Business Confidence Index (EBCI) for current North American conditions can be found at *www.nema.org/Apr13-EBCI.*

Learn More

- The NEMA Surge Protection Institute is an educational outreach effort—glossary, FAQs, reference materials, useful links, and more. It's all at *nemasurge.com.*
- Are the life safety products in your home up-to-date? You've upgraded your computer, car, and home entertainment equipment. Have you updated the devices that protect your family? Download a life-safety brochure at *www.lifesafetysolutionsonline.com*
- The National Fire Protection Association's Fire Sprinkler Initiative has created a presentation on the dangers of lightweight construction and the corresponding benefits of home fire sprinklers. Download it at the Fire Sprinkler Initiative page.
- NEMAcast is the podcast of the electroindustry. Hear what the experts have to say on:
  - *Iowa's Smoke Alarm Installation Program*
  - *Evaluating Water-Damaged Electrical Equipment*
  - *Carbon Monoxide*
  - *Smoke Detectors*
  - *Lighting*
  - *EV-Ready*
  - *The Role of PET Imaging in Diagnosing Alzheimer's Disease*

Coming in June

According to a recent survey, 74 percent of the U.S. is still not familiar with the Smart Grid. We hope to change that with June's *ei,* the fifth annual Smart Grid issue. With a theme of customer engagement, we'll look at:

- NEMA's continued leadership on critical policy issues, such as funding storm reconstruction
- Importance of establishing standards for Smart Grid interoperability
- Specific technology related to smart meters, microgrids, cybersecurity, energy storage, electric vehicles, etc.
- Case studies of customer engagement

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