HT 12: REDUCE OVERSIZED BATTERIES IN EMERGENCY LIGHTING

New York City Building Code
Proposal developed by the Lighting & Daylighting Committee

Summary

Issue:
Much emergency lighting is powered by batteries, which contain heavy metals and other hazardous substances. By mandating twice as much emergency illumination as the rest of the country, the NYC building code promotes excessively large battery systems.

Recommendation:
Reduce the required level of emergency lighting, thereby reducing battery size.

Proposed Legislation, Rule or Study

Amendments to the New York City Building Code:

1. Amend Section 1006.3.2 as follows:

1006.3.2 Performance of System. Emergency lighting facilities shall be arranged to provide initial illumination that is at least an average of [2 foot-candle (22 lux)] 1 foot-candle (1 lux) and a minimum at any point of [0.2 foot-candle (2.15 lux)] 0.1 foot-candle (1.1 lux) measured along the path of egress at floor level. Illumination levels shall be permitted to decline to 0.6 foot-candle (6.46 lux) average and a minimum at any point of 0.06 foot-candle (0.646 lux) at the end of the emergency lighting time duration. A maximum-to-minimum illumination uniformity ratio of 40 to 1 shall not be exceeded.

Supporting Information

Issue - Expanded
The vast majority of buildings in New York City rely on batteries to provide power for emergency lighting equipment when normal power fails. There are two basic technologies used for these batteries: lead-acid (also referred to as sealed lead-acid, sealed lead-calcium, valve-regulated lead acid, VRLA, or SLA), and nickel-cadmium (Ni-Cd). Lead-acid batteries are much more common because they are cheaper, but both are extremely toxic.

Children who ingest lead can suffer from damage to the brain and nervous system, behavior and learning problems, such as hyperactivity, slowed growth, hearing problems, and headaches. Adults can suffer from reproductive problems, high blood pressure and hypertension, nerve disorders, memory and concentration problems, and muscle and joint pain.

The United States EPA has found cadmium to potentially cause nausea, vomiting, diarrhea, muscle cramps, salivation, sensory disturbances, liver injury, convulsions, shock and renal failure when people are exposed to it at unsafe levels for relatively short periods of time. Long-term exposure has the potential to cause kidney, liver, bone and blood damage.

Ni-Cd rechargeable batteries were estimated to represent approximately 75 percent of the cadmium found in municipal solid waste in 1995. Lead-acid batteries represent approximately 65 percent of the lead found in municipal solid waste in 1995.

Sometimes the batteries used to power emergency lighting equipment are clustered together in a central location (often called a central inverter). Central inverters always use lead-acid batteries, and often contain in excess of 750 lbs. of lead. When they fail (after 10-15 years), they are usually recycled, partly because special handling is required for anything this heavy, and partly because the lead itself is valuable.

But central inverters are relatively rare. Much more often smaller batteries are installed within individual emergency light fixtures. These batteries are a mix of lead-acid and Ni-Cd. 2-4 lb. batteries are common in these installations, and they need to be replaced every 5-15 years. Even though these should be recycled, anecdotal evidence suggests that...
these are often disposed of as regular trash because they are smaller, and they fail one at a time, making it more difficult for building maintenance personnel to make special arrangements for their proper disposal.

The risk of contamination within buildings is unknown. Under ordinary operating conditions the toxic materials remain sealed within the emergency lighting units. However, if these units are damaged by physical abuse or fire they could leak out and contaminate a building interior.

These products are still on the market because there is no economical alternative. Nickel-metal hydride (NiMH) batteries are about 3 times as expensive as lead-acid, and lithium ion batteries are 6-8 times as expensive. Because of this increased cost, almost no emergency lighting manufacturers incorporate these technologies into their products. Despite all of this, if reducing light levels in egress areas were to compromise safety in buildings, it would be a bad idea. But there is no evidence to indicate that this will happen. On the contrary, New York City’s current code requires double the illuminance in the rest of the nation (see precedents listed below).

Our current understanding of vision indicates that there is almost no improvement in evacuation times when light levels are increased from 1 foot-candle to 2 foot-candles average illuminance. Rather, once the critical threshold of about 0.5 foot-candles is reached there is little benefit to increasing light levels further. The codes used in the rest of the nation are conservative in requiring 1 foot-candle of illumination.

Environmental & Health Benefits
Better enforcement of existing disposal laws and increased awareness among building maintenance personnel would help keep lead and cadmium out of landfills, but the best course of action is to reduce the quantity of toxic materials being installed in our buildings in the first place. There is a one-to-one relationship between the emergency light levels required by code and the number of batteries required to meet that light level. Halving emergency light level requirements will halve the amount of lead and cadmium installed in our buildings. All things being equal, this will halve the amount of these materials that eventually end up in our landfills.

Similarly, halving egress light levels will halve the amount of energy being used to illuminate means of egress. Since the lights in means of egress are currently required to operate 24 hours a day, 365 days a year, this adds up to a great many lights burning in empty corridors, stairwells, and parking garages around the city.

This proposal was found to have a low, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 1.

This proposal was found to have no significant positive health impact.

Cost & Savings
As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to lower capital costs if implemented.

Precedents
The National Fire Protection Association’s Life Safety Code (NFPA 101 – 2009) 7.9.2.1 states that, “Emergency lighting facilities shall be arranged to provide initial illumination that is not less than an average of 1 ft-candle (10.8 lux) and, at any point, not less than 0.1 ft-candle (1.1 lux) measured along the path of egress at floor level.” The following codes all use identical language:
- International Building Code (I.B.C. 2006) 1006.4
- Massachusetts State Building Code, 780 C.M.R. 1006.4, which is the building code for the City of Boston
- 2003 Seattle Building Code 1006.4.2

The New York City Building Code is based on the IBC 2006 and uses the same language as IBC 2006, but the values have been doubled.

LEED
Due to improved energy performance resulting from these measures, this proposal may assist in compliance with LEED prerequisites for Energy & Atmosphere under most of the rating systems.

These recommendations will also facilitate achieving LEED Energy and Atmosphere credits:
- LEED NC-EA cr.1 Optimize Energy Performance
- LEED EB-EA cr.1 Optimize Energy Performance
- LEED ND-GCT cr.2 Energy Efficiency in Buildings
• LEED for Schools EA cr.1 Optimize Energy Performance
• Additional credits under LEED pilot programs
These credits require exceeding the minimum standards established by the Energy and Atmosphere prerequisites.

LEED CI-EA cr.1.1 Optimize Energy Performance, Lighting Power, specifically addresses reducing lighting power throughout the entire tenant space. According to the LEED CI Reference Manual, for commercial interior projects, the reduction of interior lighting power stands to be the greatest energy conservation method available. Therefore, this proposal will have a significant positive impact on LEED certification.

Implementation and Market Availability
There are no known implementation issues for this proposal.

ENDNOTES:

4 ILLUMINATING ENGINEERING SOCIETY OF NORTH AMERICA, THE IESNA LIGHTING HANDBOOK, Ch. 29, Fig. 29-1 (Mark Stanley Ray ed., IESNA, 9th ed., 2000).