Setting Standards for Excellence

February 14, 2003

Andrew Fanara
Energy Star Product Development
U.S. EPA
1200 Pennsylvania Ave., NW
MC 6202J
Washington, DC 20460

Re: ENERGY STAR ™ Program Requirements for Exit Signs, Draft 2 – Eligibility Criteria –Version 3.0

Dear Mr. Fanara,

The Emergency Lighting Section of the National Electrical Manufacturers Association (NEMA) appreciates the opportunity to comment on this second draft eligibility criteria document for the ENERGY STAR program for exit signs.

As you know, NEMA is the leading trade association representing the interests of U.S. electroindustry manufacturers, whose worldwide annual sales exceed $120 billion. Founded in 1926 and headquartered near Washington, D.C., our 450 member companies manufacture products used in the generation, transmission and distribution, control, and end-use of electricity, including illuminated exit signs.

Members of NEMA's Emergency Lighting Section represent over 70 percent of the U.S. market for exit signs. NEMA supports the ENERGY STAR program for Exit Signs and we are advocating incorporation of Version 2.0 specifications as mandated standards in the Energy Bill to be considered in the 108th Congress. We understand that when these standards become effective requirements (projected for January 1, 2005), ENERGY STAR will need to go beyond these values. However, the second draft document opens the door to several if not all NEMA members reconsidering their participation in the program.

Our comments are keyed to the following specific numbered sections of Draft 2 and the issues raised therein:

1) Definitions

A. Exit Sign

Transparent and Mirrored Backgrounds

We welcome and support removal of the restriction that signs may not have transparent or mirrored backgrounds.

National Electrical
Manufacturers Association
www.nema.org
1300 North 17th Street, Suite 1847
Rosslyn, VA 22209
(703) 841-3200
FAX (703) 841-5900

"Integral Light Source" and Analytical Measurements of Visibility

We oppose the removal of the requirement that an exit sign must include an integral light source. Accordingly, we also oppose the removal of definitions related to the analytical measurement of visibility: Luminance, Luminance Contrast, Average Luminance, Minimum Luminance and Luminance Uniformity Ratio.

To promote safety the Emergency Lighting Section of NEMA supports measurable minimum visibility standards, based on research and applied to all exit signs, regardless of technology -- while saving energy.

In fact, the definition of Exit Sign included in Draft 2 ("The sign is designed to remain illuminated via an emergency power source upon failure of the normal power supply…") would require that all lights that contribute to the charging of a photoluminescent (PL) exit sign (to 5 foot-candles on the face of the sign) remain illuminated at all times while the building is occupied and be connected to reliable, not-controlled circuit(s).

Of course, this requirement runs counter to the efforts of the ENERGY STAR Buildings program to promote energy saving lighting controls, including dimmers and occupancy sensors.

ENERGY STAR received comments in response to Draft 1 containing an unsubstantiated assertion that the majority of buildings have sufficient ambient light to provide 5 foot candles of external illumination to charge a PL sign. Comments also asserted that a PL sign is capable of remaining "visible" for a minimum of 90 minutes and that a separate light source is not needed to charge a PL sign. All UL Listed signs are labeled with a requirement that they be reliably illuminated at all times by 5 foot-candles. And, in energy efficient lighting installations, lighting is directed to work surfaces and floors, not over doorways where exit signs are required. This can leave that area illuminated to levels far less than the UL requirement of 5 foot-candles. In normal installations, an additional illumination source is required for a PL sign but not provided nor specified by the sign maker.

Specifically, if PL exit signs are to rely on ambient building light for charging purposes, then all of the light sources making up the ambient light environment are to be considered essential to the proper charging of the exit sign and therefore the ambient lighting must be (per the UL 924 Standard) "…an external illumination source that is deemed reliable and is supplied by a circuit not controlled by automatic timers or sensors, and whose controls are accessible only to authorized personnel; …and to be energized at all times during building occupancy."

Of course, this requirement runs counter to the efforts of the ENERGY STAR Buildings program to promote energy saving lighting controls, including dimmers and occupancy sensors.

As shown in NEMA's June 2001 White Paper on Exit Sign Brightness for Visibility and Safety (copy attached), testing done by CSA, an independent OSHA accredited Nationally

Recognized Testing Laboratory (NTRL) found the best performance by a PL exit sign after 90 minutes to be 0.018 cd/m^2, or only 1/1626 as bright as an internally illuminated sign.

As noted on page 3 of the White Paper, NFPA 101, Life Safety Code, 2000 requires that the face of a PL sign "shall be continually illuminated while the building is occupied….The charging illumination shall be a reliable light source as determined by the AHJ [authority having jurisdiction]."

2) Qualifying Products

NFPA 101, Life Safety Code, and the related standard UL 924, Emergency Lighting and Power Equipment, have eliminated minimum illuminance requirements for exit signs raising serious concerns for the prompt and safe egress from building environments in case of an emergency. Specifically, NFPA 101 and UL 924 have removed analytical measurements to establish minimum visibility requirements in favor of a subjective test that allows 5 minutes for the human eye to adapt to darkness. Will an individual have 5 minutes in an emergency to allow for dark adaptation? This shift poses serious safety concerns.

In its Oct. 24, 2002, comments on the first draft of Version 3.0, UL asserted that "UL 924 is the nationally recognized Standard." In fact, UL 924 is not a consensus-based standard. UL has proposed UL 924 as an American National Standard, but it has failed to gain such recognition because the standard clearly has not achieved the necessary consensus of a balance of interests. In addition to UL 924, building codes around the U.S. cite CSA Standard C141, which includes analytical measurements of visibility.

As noted above, to promote safety the Emergency Lighting Section of NEMA supports measurable minimum visibility standards, based on research and applied to all exit signs, regardless of technology. By removing the luminance requirements in this draft, the Listing by UL represents a significant reduction in the performance requirements.

A. Specifications for Qualifying Products

Luminance Depreciation

NEMA applauds ENERGY STAR's acceptance of a standard statement of luminance depreciation for all products and manufacturers.

Input Power Demand

NEMA opposes the proposal to restrict input power demand to 3 watts or less per sign. As noted in Draft 2, there is a correlation between lowered energy consumption and product reliability. Requiring 3 watts or less per sign may result in a smaller portion of exit signs qualifying for the Energy Star, but will result in a great reduction in performance and life.

Moreover, the energy that would be saved by moving from 5 watts to 3 watts or less is not significant enough to justify the shift.

With safety in mind, the trend in the marketplace is to provide greater – not lower – levels of illumination. Customers may not want to buy an Energy Star exit sign if it is too dim to provide the illumination needed in an emergency.

Product Listing

As noted above, UL 924 is not an American national standard and does not include objective analytical minimum visibility requirements. As a result, simply requiring an exit sign to be listed to UL 924 would not ensure that a product will provide the luminance and reliability characteristics that consumers require.

4) Effective Date

NEMA members support an effective date of 12 months following finalization of the Version 3.0 specification.

Exit signs are a safety product. ENERGY STAR has acknowledged "the importance of assuring the safety of these products" and that "any sign that qualifies for the ENERGY STAR must be effective and reliable in addition to energy efficient." ENERGY STAR has a responsibility to refrain from promoting purchase of products that do not meet customers' core needs.

Thank you for your consideration of these comments. We look forward to working with you further to improve Version 3.0.

Sincerely,

Craig Updyke
Government Affairs Representative

attachment: as indicated

A NEMA Lighting Systems Division Document

Exit Sign Brightness For Visibility and Safety

Prepared by

The Emergency Lighting Section
National Electrical Manufacturers Association
1300 North 17th Street, Suite 1847
Rosslyn, Virginia 22209
June 4, 2001

Introduction

The purpose of this paper is to promote safety through a review of the brightness of exit sign technologies. NFPA 101, *Life Safety Code,* and the related standard UL 924, *Emergency Lighting and Power Equipment,* have eliminated minimum illuminance requirements for exit signs raising serious concerns for the prompt and safe egress from building environments in case of an emergency.

This document will provide a brief background on life safety codes and standards requirements, then review exit sign technologies relative to brightness, summarize visibility research results, and finally set forth recommendations for the visibility of exit signs to promote safety.

Background

Table 1 below provides a comparison of current code requirements for marking the means of egress by exit signs. Notice from the table that the 2000 Edition of the *Life Safety Code*, in Section 7.10.7.2, now defers to UL 924 for visibility requirements for internally illuminated signs: "The illumination levels on the face of the photoluminescent sign shall be in accordance with its listing." The 1997 Edition, in Section 5-10.3.3, Exception No. 2, had measurable visibility requirements: "Listed self-luminous or electroluminescent signs that provide evenly illuminated letters shall have a minimum luminance of 0.06 foot-lamberts (0.21 cd/sq m) as measured by a color-corrected photometer." Thus, the minimum analytical luminance level of 0.06 fL (0.21 cd/m^2), associated with visibility from a minimum of 100 feet, has been removed from NFPA 101, and the burden of acceptance has shifted away from the NFPA code to UL 924.

In "UL Bulletin, November 22, 2000, Subject 924," Underwriters Laboratories Incorporated, furthermore, presented a proposal that would shift the burden of approval

Table 1. Comparison of Current Code Requirements for Marking the Means of Egress by Exit Signs

Subject:	NFPA 101, Life Safety Code, 2000	Standard Building Code, 1999	BOCA Code
Sign Placement	Such that no point in an exit access corridor is in excess of 100 ft from the nearest externally illuminated sign and is not in excess of the marked rating for internally illuminated signs.	Such that no point in an exit access is more than 100 ft from the nearest visible sign.	Such that any point in the exit access corridor shall not be more than 100 ft from the nearest visible sign.
Visibility	Approved sign that is readily visible from any direction of exit access.	Approved sign that is readily visible from any direction of exit access.	Readily visible.
General	Shall be illuminated by a reliable light source.	Suitably illuminated by a reliable light source.	
Continuous Illumination	During the time that the conditions of occupancy require that the means of egress be available for use.	All times that the building is occupied.	When the building is occupied.
Illumination Source	A source considered reliable by the AHJ.	Reliable	
Externally Illuminated Signs			
Size of Legend and Color	Letters 6 in X 2 in X 3/4 in (except I may be 3/4 in wide). Color not specified	Same as in the preceding column.	Letters 6 in X 2 in X 3/4 in (except I may be 3/4 in wide). Red letters on white background or other approved, distinguishable colors.
Directional Indicator	Chevron, readily identifiable as a directional indicator at a distance of 40 ft.	Not specified.	Arrow, size not specified.
Level of Illumination	Not less than 5 fc at the illuminated surface and shall have a contrast ratio of not less than 0.5.	Not less than 5 fc and shall employ a contrast ratio of not less than 0.5.	Minimum of 5 fc on the face and sign must have contrast not less than 0.5.
Internally Illuminated Signs			
Internal Light Source	Listed in accordance with UL 924	Visibility shall be equivalent of an externally illuminated sign. Exception—Tritium and EL signs which operate in the 5000-6000 Angstrom range and which provide evenly illuminated letters shall have a luminance not less than 0.06 fL.	Not mentioned. Exception for evenly illuminated self-luminous signs with minimum luminance of 0.06 fL.
Photoluminescent Signs	Face of sign shall be continually illuminated while the building is occupied. The illumination levels on the face shall be in accordance with its listing. The charging illumination shall be a reliable light source as determined by the AHJ. The charging light source shall be of a type specified in the product markings.	Not mentioned.	Not mentioned.

and acceptance away from measurable test results to a subjective test and to "the purchaser, installer, and involved AHJ" [Authority Having Jurisdiction]. The Bulletin stated:

> "With the change to NFPA 101, UL proposes that the associated performance criteria (the observation visibility test) be acknowledged as a sufficient means to determine compliance. Additionally, signs of any appropriate technology should be permitted the opportunity to attain Listing via this method. The proposal of Appendix A therefore eliminates the 0.06 fL minimum analytical luminance requirement (40.11.1) and permits Listing based solely on compliance with the observation visibility test in both low ambient light and total darkness. No review is considered necessary for signs previously Listed, based on observation visibility testing in low ambient light (but not in total darkness) and found to provide the minimum 0.06 fL analytical luminance level."

Thus, one of the three major codes listed in Table 1, NFPA 101, signals a shift away from analytical measurements to establish minimum visibility requirements to a subjective test that allows 5 minutes for dark adaptation. Will an individual have 5 minutes in an emergency to allow for dark adaptation? Is a subjective test really appropriate to promote safety? UL's proposed shift to a subjective test raises serious safety concerns.

Exit Sign Brightness

The Emergency Lighting Section contracted with the Canadian Standards Association, an OSHA accredited Nationally Recognized Testing Laboratory, to evaluate the brightness of exit signs employing different light sources. Table 2 below provides a summary of exit sign brightness for the technologies tested.

Table 2. Exit Sign Brightness.

	Cd/m^2		
Exit Sign/Time	**30 Minutes**	**60 Minutes**	**90 Minutes**
Photoluminescent Charged w/incandescent	0.036	0.030	0.017
Photoluminescent Charged w/fluorescent	0.040	0.024	0.018
Tritium	0.304	0.304	0.305
LED	36.49	35.94	29.27

The best performance provided by a photoluminescent exit sign was from the sign that had been charged with the fluorescent light source. After 30 minutes, the luminance provided by that sign was only about one-thousandth (1/1000 or 0.001) as bright as the LED exit sign. The tritium exit sign was about one-hundredth (1/100 or 0.01) as bright as the LED sign, but still ten times brighter than the best photoluminescent exit sign.

After 1 1/2 hours (90 minutes) the fluorescent-charged photoluminescent exit sign was only 1/1626 as bright as the LED sign. NFPA 101 requires a minimum of 90 minutes in emergency mode (Article 7.9.2). The tritium sign remained 17 times brighter than the photoluminescent exit sign after 90 minutes.

The exit sign brightness testing conducted for NEMA indicated a tremendous disparity in brightness between exit sign technologies. This raises serious safety concerns, especially in smoky or hazy conditions. Will the exit sign be visible?

Visibility Research

Dr. Belinda Collins of the National Institute of Standards and Technology[1] and Dr. Peter Boyce of the Lighting Research Center[2] have published their research, results, and conclusions from extensive testing in the area of exit sign visibility. Dr. Collins concludes that a minimum level of 10 cd/m^2 is required for reasonable visibility in both clear and smoky conditions. Dr. Boyce concludes that the luminance of an exit sign

[1] Belinda L. Collins and Mubarak S. Dahir, "Evaluation of Exit Signs in Clear and Smoke Conditions," U.S. Department of Commerce, Gaithersburg, MD (NISTIR 4399), August 1990.
[2] "Energy Star Purchasing," available from http://www.epa.gov/nrgystar/purchasing/6j_exitsigns.html, April 16, 2001.

should be 15 cd/m^2 (average) and 8.6 cd/m^2 (minimum). For over twenty years, UL and NFPA required a minimum luminance of 8.6 cd/m^2 for internally illuminated exit signs (and at least 5.0 fc for externally illuminated signs with a contrast ratio of not less than 0.5). That requirement is still accepted by the U.S. Environmental Protection Agency's Green Lights Program for Exit Signs as the minimum standard and by the Occupational, Safety, and Health Administration.

A Recommendation

In order to promote safety, the Emergency Lighting Section of NEMA supports a measurable minimum visibility standard, based on research and applied to all exit signs, regardless of technology. Thus, the Section recommends that externally illuminated signs be illuminated by not less than 5 foot-candles and employ a contrast ratio of not less than 0.5 and that the visibility of internally illuminated signs be equivalent to that of those illuminated externally. Therefore, internally illuminated signs should produce a minimum luminance of 8.6 cd/m^2. This will result in signs that are noticed quickly when needed and are clearly visible at 100 ft for a minimum of 90 minutes.