

LEDs and other innovative energy saving lighting technologies (e.g. fluorescents) are rapidly entering the marketplace and present themselves for application to emergency notification appliances. The existing requirements for the performance and application of visible notification appliances are based on relatively short duration, high peak intensity flashing lights – strobe lights. NFPA 72, *National Fire Alarm and Signaling Code*, and referenced listing standards define a method for calculating the equivalent or effective intensity of a flashing light source. The calculation method is subjective and does not produce an exact comparison and is intended only to approximate the perceived brightness for direct viewing of the light source. It has worked because all of the lights approved using the standard have all had relatively similar and short pulse durations. Thus, the peak intensities have been relatively similar.

The objective of this project was to develop methods and criteria to evaluate performance of light sources used in emergency notification appliances for inclusion in NFPA 72. Therefore, this report recommends specifications for both direct and indirect signaling as well as identifies gaps in the available information. The work was conducted by the Lighting Research Center at Rensselaer Polytechnic Institute.

The review of research on visual signaling appliances for emergency notification, on visual signal lights for roadway, aviation and related applications, and on vision science, in conjunction with the overview of standards for visual signals for emergency applications and for other applications, have resulted in several preliminary conclusions regarding appropriate specifications for such visual signals:

- Present requirements for visual signals may not be sufficient for waking individuals, particularly those who might be hard of hearing (as opposed to those who are totally deaf) and those who might be impaired by alcohol consumption.
- Effective intensity values across light sources with very different temporal profiles will result in very different maximum illumination on room surfaces, which may result in different levels of detection performance in the visual periphery and under indirect viewing.
- Maximum luminous intensity from a flashing signal light may be a more predictive measure of detection performance under indirect viewing conditions. Some research on the minimum change in illumination that is detectable may provide a starting point for specifications of maximum intensity values for indirect viewing.
- When ambient light levels are high, indirect viewing becomes much more difficult, and perhaps is less important in detecting the visual signaling appliance compared with direct viewing. This might affect optimal placement of visual signaling appliances in rooms or spaces. For example, performance-based designs might not be as effective in large daylighted warehouses where there could be aisles without directly visible appliances and indirect viewing of the appliances might be ineffective. Indirect viewing issues could be further investigated for such scenarios including outdoor applications with high ambient light levels.
- Requirements for white/clear light source color in applications with sleeping individuals may restrict the amount of light transmitted by the eyelid compared to amber light.

- Currently, ambient light levels are not discussed within NFPA 72. Ambient light levels can significantly affect the conspicuity of visual signaling appliances, especially for outdoor applications and in daylighted spaces where the signal-to-noise ratio is low. Previous requirements (NFPA 1989) included the ambient light levels in different conditions, which were subsequently removed. Further investigation can be done to identify how to adjust the current intensity requirements to ensure they accommodate high ambient light levels.
- There can be nonconformities between different formulations of intensity requirements. Assuming a particular design meets the room size and ceiling-height-based intensity requirements, the same design will not necessarily meet the performance-based intensity requirements. Further investigation could be done to harmonize the intensity requirements using these methods.