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Illuminating the way to safety

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Hospitals, and senior living facilities can be treacherous places in the event of a fire or smoke emergency. Patients and residents occupy strange, unfamiliar surroundings. Long corridors punctuated with myriad doors and crowded with moveable machines and busy personnel rushing between rooms form an obstacle course that must be judiciously negotiated during a crisis.

The paramount goal during a fire and smoke emergency is to move occupants swiftly from danger to safety in an orderly manner. Providing a visible path of egress in a darkened, smoke-laden environment is key to preventing casualties. When fleeing occupants are able to locate and follow a clearly marked exit pathway, they feel more confident they will escape, and they are more likely to remain calm and rational.

Photoluminescent pathway marking

The installation of a non-electric photoluminescent low-location pathway marking system positioned near the floor is one proven method to help control the response to a fire or smoke emergency and prevent the situation from disintegrating into disorder and chaos. Photoluminescent markings glow clearly in total darkness and illuminate the evacuation route when the egress pathway is darkened by smoke or a power failure.

The photoluminescent pathway marking system activates automatically when the lights are extinguished or dimmed and functions free of any human, mechanical or electrical intervention -- even if all electric and battery power sources fail. Moreover, photoluminescent products are non-radioactive, nontoxic, environmentally friendly and explosion-proof.

How photoluminescent products work

Photoluminescence employs light to energize unique mineral crystals found in nature. When exposed to light, these crystals absorb and store light energy. The crystals slowly and continuously release this light energy and emit a luminous 'glow', even when the lights dim or go out. Photoluminescent crystals are combined with materials to make glow-in-the-dark pigments used in the manufacture of safety signage and pathway marking products.

Photoluminescent pigments date back to the 1940s, but not until the 1990s were pigments developed that emit a glow bright enough and of sufficient duration to be used effectively in safety signage and pathway marking systems. Some photoluminescent products are still made with low-luminance novelty-grade pigments and inappropriately marketed for safety applications.

Photoluminescent technology research is ongoing and evolutionary. Leading edge products commercially available today are made with even newer pigments that glow with far greater intensity and for much longer duration than their predecessors of two to three years ago. Some of these pigments can glow for more than twenty hours.

Photoluminescent safety product characteristics and advantages

Safety-grade photoluminescent products emit visible light for at least eight hours after all light has been extinguished. So, even if the lights were turned off hours earlier, photoluminescent signs and pathway markings are still glowing when the moment arrives to locate the nearest escape route to flee the building.

Safety-grade photoluminescent products re-charge in 15 to 20 minutes when light is restored. Unlike conventional emergency lighting, photoluminescent pathway markers require no batteries or hard-wired electric power source.

The useful life of photoluminescent products can span eight to ten years. The photoluminescent pigment will always glow. Only the signs and markers wear out.

Photoluminescent products are manufactured in strict conformance with applicable building codes and regulations. In addition to a standard smooth surface, the signs can be made in raised tactile and Braille formats to comply with Americans With Disabilities Act (ADA) requirements.

Photoluminescent system components are easy and quick to apply and, once installed, are virtually maintenance free. There are no electric circuits to install and repair and no dead batteries to drain, recharge or replace.

Additionally, photoluminescent products are inexpensive and cost-effective over time, especially vis-a-vis electric- and battery-powered appliances that consume power and require costly ongoing maintenance. The costs for glow-in-the-dark photoluminescent signs and markers are roughly equivalent to comparably sized non-luminous, non-electric materials.

Fire and smoke emergency scenario

Many serious fires in hospitals and senior living facilities have occurred during the past twenty years. Most injuries and fatalities documented following these fires were found to have resulted from smoke inhalation, not blocked escape routes or exposure to heat or burning. While sprinkler systems can help extinguish or control a fire, they do not prevent the spread or inhalation of smoke.

Building fires often release dense toxic smoke that impedes the vision and weakens the decision-making capability of fleeing occupants, disorienting and trapping them as they try to escape. Fire- and smoke-related problems are compounded in hospitals and senior living facilities where patients and residents suffer from varying degrees of physical and mental impairment. Physical impairment can result in reduced mobility. Mental impairment often leaves people confused and incapacitated. The inhalation of combustion by-products during a fire introduces dangerous levels of carbon monoxide and carbon dioxide to the bloodstream, eroding the body's oxygen absorption capacity, thereby further diminishing motor speed and function. Patients and residents may have either a poor understanding of the need to egress or be unable to evacuate without assistance.

Complicating a confused situation is the natural human impulse to head towards familiar exit paths and doors, even though the best exit may be closer or in a different direction. Rational decisions to utilize the nearest exit route are facilitated by the posting of accurate egress information. Photoluminescent pathway markings greatly enhance the ability of occupants --including patients, residents and staff-- to make informed evacuation decisions.

NFPA 101 Life Safety Code

The Joint Commission on the Accreditation of Healthcare Organizations requires accredited facilities to be in compliance with the National Fire Protection Association (NFPA) 101 Life Safety Code. Relevant provisions of the Code mandate the following:

- **5-9.2.5** --"The emergency lighting system shall be either continuously in operation or shall be capable of repeated automatic operation without manual intervention".
- **5-10.1.2***--"Exits shall be marked by an approved sign readily visible from any direction of exit access".
- **5-10.1.4***--"Access to exits shall be marked by approved, readily visible signs in all cases where the exit or way to reach it is not readily apparent to the occupants. Sign placement shall be such that no point in the exit access corridor is more than 100 ft (30 m) from the nearest sign".
- **5-10.1.7***--"Where floor proximity egress path marking is required, a listed and approved floor proximity egress path marking system that is internally illuminated shall be installed within 8 inches (20.3 cm) of the floor. The system shall provide a visible delineation of the path of travel along the designated exit access and shall be essentially continuous, except as interrupted by doorways, hallways, corridors or other such architectural features. The system shall operate

continuously or at any time the building fire alarm system is activated".

Photoluminescent versus conventional emergency egress systems

Critical, operative phrases in the Fire Safety Code are "continuously in operation", "capable of repeated automatic operation without manual intervention" and "readily visible from any direction of access".

Conventional safety lighting systems employ hard-wired electric- and battery-powered lights and illuminated "EXIT" signs positioned high on walls and above doors. Unless diligently and thoroughly maintained --the Life Safety Code mandates inspection and maintenance every thirty days-- the units frequently malfunction, disabled by dead batteries, vibration, dust, and moisture. Even when the units function properly, emergency conditions often render them ineffective. During a fire, smoke rises and obscures the lights and signs, making them invisible and useless to both fleeing occupants and firefighters.

Unlike conventional systems, photoluminescent low-location signs and pathway markings always glow and remain "continuously in operation." Because they re-charge by force of a *natural* phenomenon immediately after light is restored, they are "capable of repeated automatic operation without manual intervention". And because they can be seen in a smoke-laden environment, they are "readily visible from any direction of access" to people forced to crouch down and crawl to safety beneath the smoke.

Photoluminescent technology is superior to electrically powered alternatives for a "floor proximity egress path marking system" as described in the NFPA Fire Safety Code. A photoluminescent system is impervious to mechanical failure while a hard-wired electrical system installed "within 8 inches (20.3 cm) of the floor" is readily vulnerable to damage, rendering this type of system impractical for low-level application.

Typical photoluminescent system installation

A combination of non-electric photoluminescent strips, signs and directional symbols strategically placed where they are easily seen provides visual guidance for safe, rapid, orderly movement of fleeing occupants. The glowing luminous pathway evokes comfort and alleviates confusion and panic in fire and smoke-laden conditions. Providing a visible path of egress is the key to preventing casualties.

A model photoluminescent pathway marking system provides adequate and accurate information for building residents and staff to make informed evacuation decisions. The primary purpose of the system is to lead occupants away from the immediate area of the fire to an area of refuge and then to safe locations outside the building through various exit doors and passageways. In hospitals and senior living facilities, special consideration must be given to mobility- and sight-impaired individuals.

Photoluminescent glow-in-the-dark emergency signs and markers are placed in corridors, stairways, passageways and back-of-house rooms and areas. They are typically positioned just above or on the floor, below the level where smoke accumulates, and well beneath illuminated exit signs and overhead lights affixed high on walls and above doors. Overhead signs and lights tend to become obscured by rising smoke.

Photoluminescent signs and markers are also appropriate for a variety of non-emergency applications in patient and resident rooms.

Occupant side of building corridors

In the occupant side of building corridors, the following criteria should be met:

- **P**hotoluminescent strips and guidance symbols placed at regular intervals should mark all evacuation routes.
- **P**hotoluminescent signs and markers should identify fire extinguishers, fire hoses, alarms, telephones, first aid kits and first aid stations. Other signs should reveal conflict areas and stationary and portable obstructions that can impede evacuation and injure fleeing occupants.
- **P**hotoluminescent code-compliant "FIRE EVACUATION MAP" signs positioned by the elevators and supplementary signs posted as required along evacuation routes should delineate exit doors. Doors that are not exits should be marked as well.
- **P**hotoluminescent code-compliant stairway signs in tactile and Braille format should be placed on the occupant side of exit doors.
- **P**hotoluminescent exit signs should be placed on the interior side of staff office doors and patient and resident room doors.

Emergency evacuation stairwells

In emergency evacuation stairwells, the following criteria should be met:

- **I**n an emergency, the potential for accidents is greater in fire stairs and stairwells. A continuous photoluminescent stairwell escape route should be installed from top to bottom.
- Photoluminescent signs affixed to all doors that exit out of stairwells should include the stairwell letter, floor number and "re-entry" or "no re-entry" information. These signs should be provided

in ADA code-compliant tactile and Braille format as well.

- Photoluminescent strips should illuminate every handrail, banister and floor landing.
- Photoluminescent markers should be applied on every stair to afford sight lines and depth perception as well as to guide fleeing occupants in the direction of egress.
- Photoluminescent strips should be placed across the leading edges of the steps at each floor landing to alert occupants they have reached the next landing.
- Standpipes, fire hoses, alarms, telephones and first aid kits should be identified with dedicated photoluminescent signs.
- Photoluminescent signs indicating direction of egress should be placed at every stairwell landing.
- A photoluminescent strip should be applied around the frame of the exit door leading from each floor landing.

Back-of-house rooms and areas

Back-of-house rooms and areas typically include basements, mechanical and machine rooms, heat and water equipment rooms, laundries, telephone equipment and switchgear rooms, walk-in refrigerators and freezers, storage rooms, offices and loading docks.

Photoluminescent signs and markers should reveal routes of egress and identify stationary and moveable equipment and other obstructions in back-of-house areas normally available to staff, but off-limits to patients, residents and visitors. As in other building locations, emergency equipment such as fire extinguishers and hoses, telephones and first aid kits should be identified with dedicated photoluminescent signs.

Non-emergency applications for patient and resident rooms:

Photoluminescent glow-in-the-dark products created specifically for application in patient and resident rooms are helpful at night when the lights are out. Luminous signs and markers are used to identify and mark bathrooms, toilets and sinks, bedpans and urinals, nightstands and patient charts. Obstructions such as portable and stationary medical equipment should be marked to help avoid accidents.

Conclusion

A well designed low-location photoluminescent sign and marking system provides a cost-effective

means to enhance conventional electrically-powered emergency evacuation signs and lights. Photoluminescent systems glow clearly in total darkness and activate automatically when the lights are extinguished or dimmed and function free of any human, mechanical or electrical intervention. Moreover, they remain visible in smoke-laden conditions when above-the-door signs and lights often become obscured. Photoluminescent systems provide sufficient information for evacuees to act rationally and make confident, informed decisions in crisis situations.

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