Ecoglo International Ltd Company Profile

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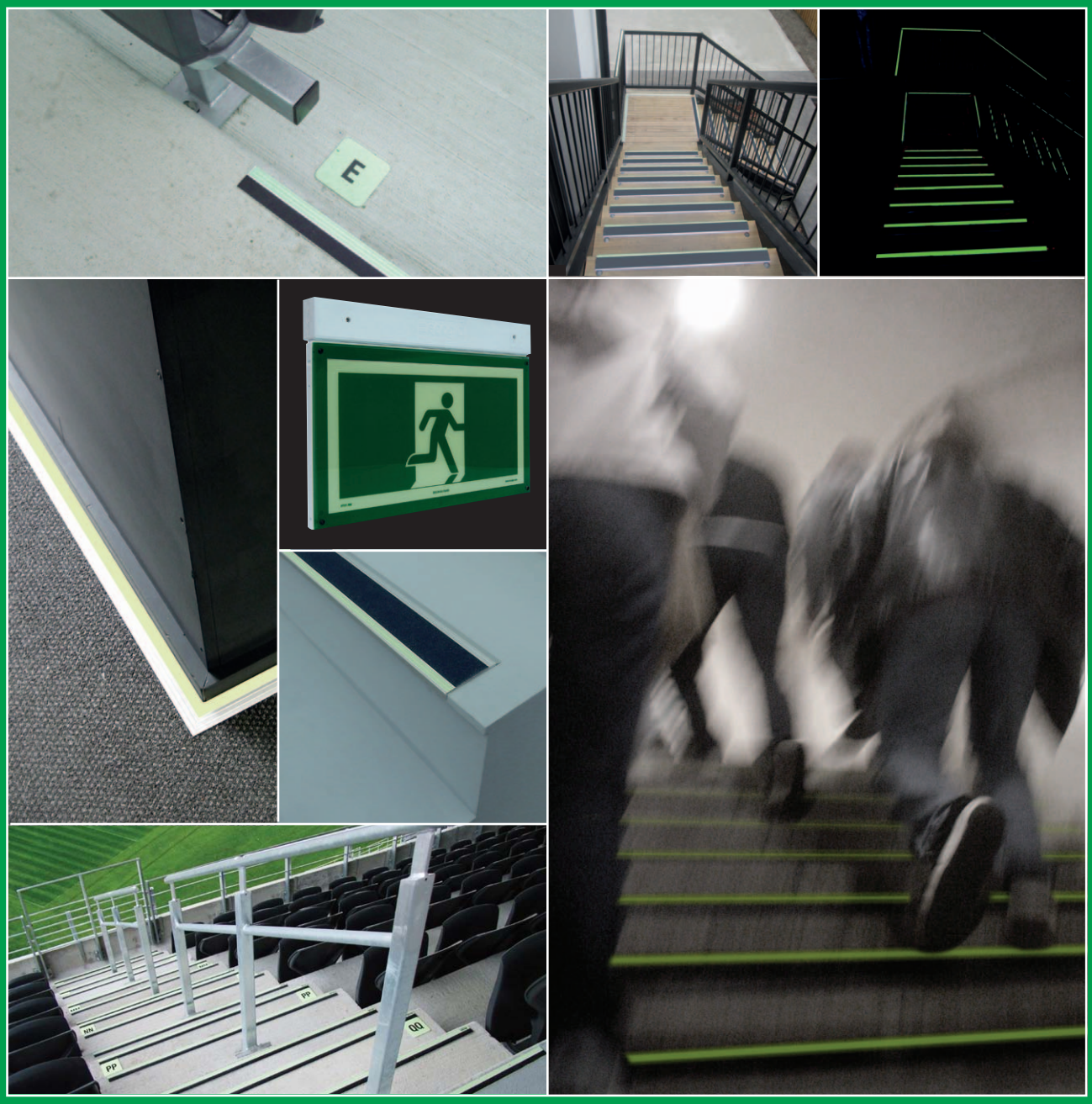

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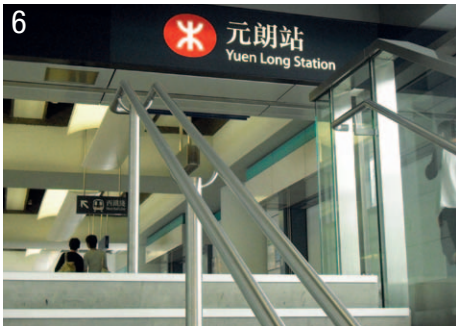
Completed Projects Using Ecoglo Products



1. Supreme Court, Singapore
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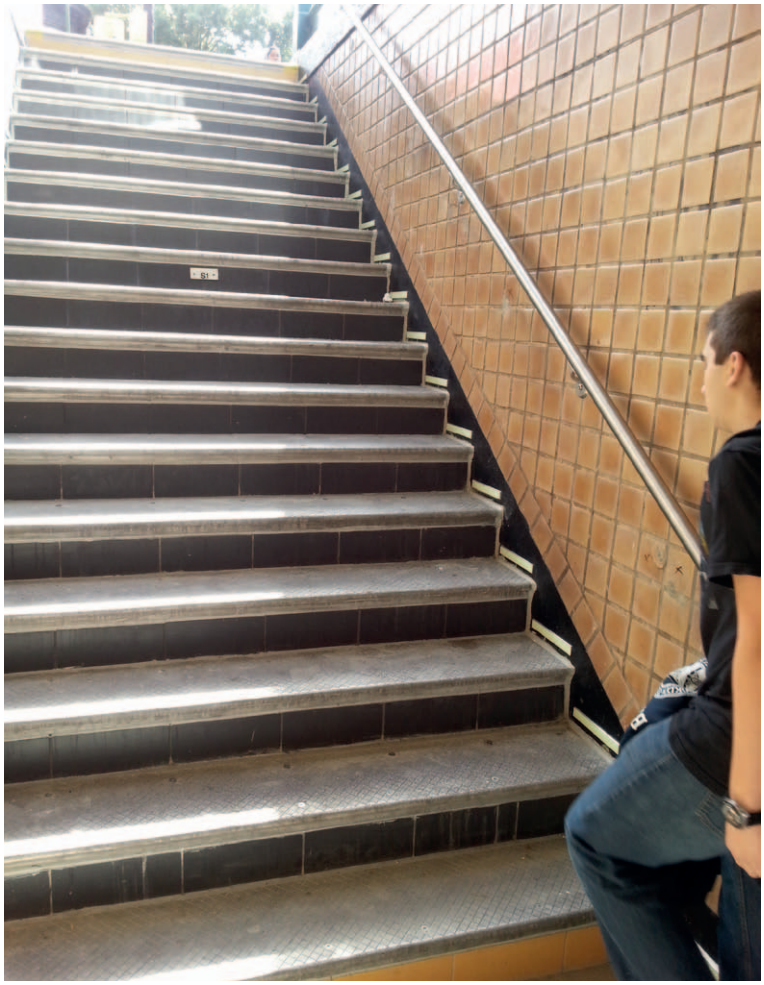
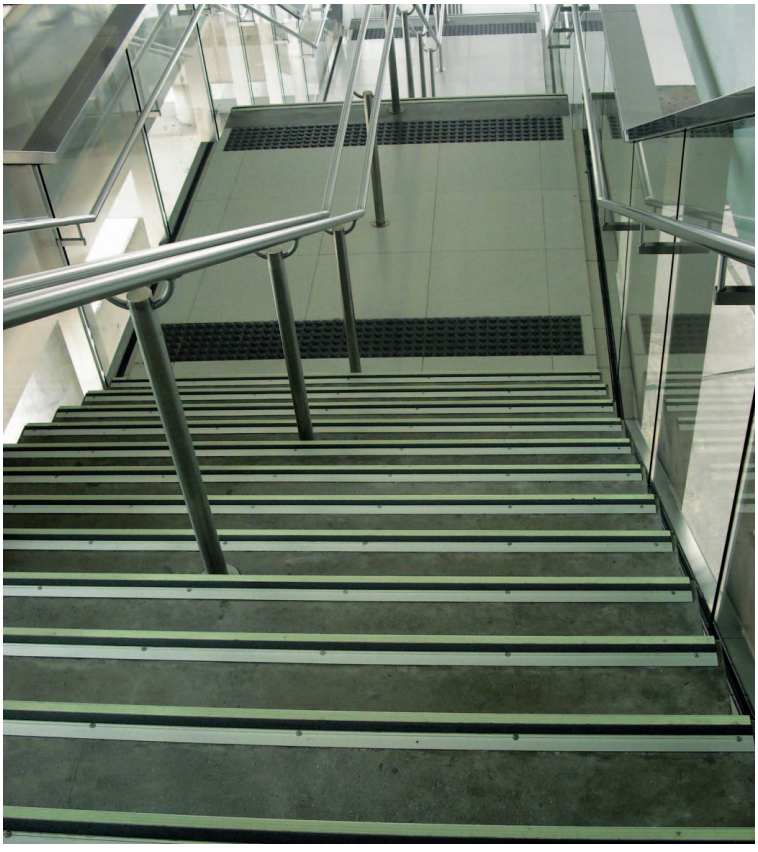
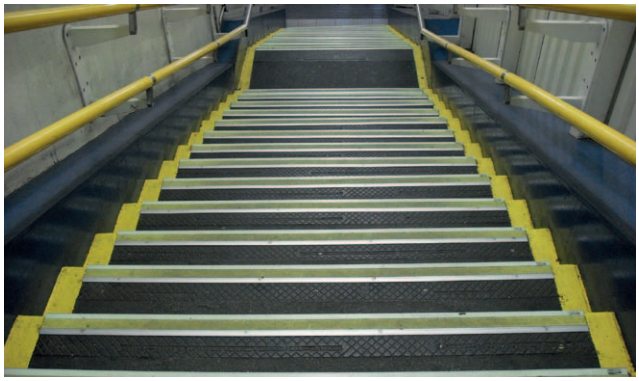
Ecoglo International Transit Projects



New York City Transit - 7th Avenue Station, Brooklyn



MTR Corporation, Hong Kong - Yeung Long Station



London Underground - Shepherds Bush Market Station

Marine Coastal Expressway - Singapore

Toronto Transit Commision - Bloor Street Station

Tokyo Subway

Cahill Tunnel - Sydney

Ecoglo International Ltd (EIL) Background

EIL is a New Zealand owned company with over 130 shareholders and regulated by the New Zealand Financial Markets Authority. Its head office and manufacturing plant are located in Christchurch, New Zealand. Established in 1997, Ecoglo designs and manufactures photoluminescent (PL) exit signs and emergency visibility products using High Temperature Curing (HTC) technology to integrally bond the photoluminescent polymers to the aluminium base. This results in products with very high light storage capabilities and unparalleled durability.

Performance solutions can be engineered to meet emergency visibility requirements in performance based building codes worldwide. Ecoglo offers products to meet NFPA 101 Life Safety Code Solutions and IFC Solutions which includes our patented HTC product set alongside a range of PVC tapes and products.

By harvesting sunlight or recycling the existing light in a building, Ecoglo PL products provide sustainable and cost effective building solutions. The solutions are fail-safe, operate immediately and will last the life of a building (PL characteristics are warranted for 30 years for indoor use).

Research and development has focused on refining Ecoglo's patented manufacturing process to create products that have superior durability, rapid charging and predictable visibility. This development programme has led to the design and manufacture of a range of emergency exit signs – including the recently launched Hybrid Sign – and evacuation route products. The recently patented LED/PL hybrid exit sign is a breakthrough in power usage and storage.

Ecoglo products can be seen in many renowned international facilities, including Melbourne Cricket Ground, New York's Jazz at Lincoln Center, Toronto's Eaton Centre, London's Bond St Underground Station and Dubai's 160 floor Burj Khalifa.

Notable facilities using Ecoglo exit signage include Toronto's Union Station, Qudos Bank Arena (formerly Sydney Olympics 2000 Arena) and Christchurch Hospital Acute Services Building.

Building codes around the world are recognising the contribution that such products make, not only to effective and economical emergency visibility systems, but also to the environment. Countries that have already adopted this technology into their respective building codes include the USA, Canada, Australia, Japan and New Zealand.

Note: *All reference to Ecoglo exit signs and products in this manual means Ecoglo HTC products, unless otherwise indicated.*

Photoluminescence Technical Background

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What is photoluminescence?

- The ability of a material to be charged up by light and then glow for a long time after the charging light has been turned off.
- Made from mined earth elements and commonly known as PL.
- Absorbs light and UV rays then re-emits as visible light.
- The light that charges the PL can be either artificial or natural light.

Another term used instead of photoluminescence is 'long afterglow phosphorescence', because the only difference between a phosphor, as used on the surface of many electrical lamps (eg fluorescent, most LED, and most metal halide), and a photoluminescent material, is the time delay between receiving incident radiation and the emission of the useful light. For normal phosphors the time delay is normally measured in fractions of a second, whereas with photoluminescent phosphors the delay ranges from fractions of a second through to hours and even days. It is this feature which is utilized to make materials that glow for a useful time after normal lighting is extinguished. The brightness and the time of the useful glow depend on the properties of the photoluminescent material itself, as well as the type of light that is being used to 'charge' the phosphor, the brightness of that charging light, and the charging time.

How does it work?

Photoluminescent material is made of chemical compounds, referred to as photoluminescent pigment phosphors. The photoluminescent pigments consist of crystals of aggregated elements and other agents that are extracted from the earth. The crystals are phosphorescent in that they emit light. This is due to the excitation they undergo when exposed to a light source, their ability to convert light photons to energy and then to store and re-emit this energy as visible light.

After the crystals have been charged by a light source, the light can be cut off and the crystals will remain excited and continue to emit light. As time progresses, the energy stored in the crystals will continuously exhaust until complete depletion. Photoluminescent material can be simply recharged by re-exposing it to light.

Photoluminescent pigments are usually encased in flexible or rigid strata or dispersed in a liquid such as paint.

Ecoglo photoluminescent material

Ecoglo tested many different pigments before selecting the specific pigment used in our products.
Ecoglo uses photoluminescent pigments that are based on strontium aluminate. Strontium aluminate produces the brightest pigments.

What type of light is suitable to charge photoluminescent material (PLM)?

- PLM is typically charged up by wavelengths from 315nm (nanometers) through to 475nm, i.e. mid-blue through to UV through-window-glass.
- Any lights with a colour temperature of 4000K or greater are good charging sources.

White electric lamps are specified by colour temperature.

- A low colour temperature (2700K-3500K) produces noticeably yellow light, often called 'warm white'.
- A medium colour temperature (3500K-5000K) produces less yellow light, often called 'cool white'.
- A high colour temperature (5000K-6500K) produces a non-yellow light, often called 'daylight' (the sun in the middle of the day provides light at around 6500K).

Low colour temperature lamps usually do not have as much emission in the 315-475nm range as medium and high colour temperature lights, so are not as good at charging PLM. Conversely, high colour temperature lamps are normally very good at charging PLM.

International standards such as ASTM E2073 Standard Test Method for Photopic Luminance of Photoluminescent Markings, and UL924 Exit Signs specify a fluorescent charging lamp of approximately 4000K colour temperature. This is typical of most office, commercial, and industrial lighting. Current technology LED lamps usually do not have any UV emissions, but their emissions in the violet-blue region (400-475nm) are sufficient for useful charging of PLM, especially those of medium and high colour temperatures.

Photoluminescent material must remain sufficiently charged to operate effectively, so there must always be enough light, be it ambient or controlled, to ensure the products will always operate when required.

Applications

Photoluminescent material can be used in an infinite number of applications where a long lasting light source is required. All photoluminescent materials must have a charging source whether that be direct, indirect, natural or artificial light. Photoluminescent material cannot be used in areas where there is no light to charge the material.

In emergency black-out situations resulting from power failures, fires or other emergencies, photoluminescent materials help safe evacuation by guiding and directing people to safer locations. Photoluminescent products can be used in conjunction with or instead of other egress systems.

In dim or low light conditions photoluminescent products provide high visibility allowing for safe and efficient movement of people.

Photoluminescent material also helps prevent slips and falls in light, dark and dim conditions.

History of Photoluminescence

Photoluminescent material was first used in remote locations such as military installations, ships, offshore oil platforms, aircraft and trains, tunnels and the underground power plant industry.

Following the bombing of the New York World Trade Center in 1993, where thousands of office workers had to evacuate in total darkness, a photoluminescent system was installed in all the stairwells of the complex. This installation proved invaluable during the attacks on 11 September, 2001.

Consequently, on May 31, 2005, New York City passed Local Law 26 which required all existing or new high-rise office buildings in New York City to install a photoluminescent system by July 2006. Many other building codes have followed suit and now require photoluminescent safety markings as a means of better defining escape routes.

Lessons learned from past tragedies and the known benefits of photoluminescent systems have led to the development of requirements, technical standards and installation guides. Each standard proposes different installation set-ups, for example, the exact width of photoluminescent material on steps, walls, floors or handrails may be specified.

You Should Know…

What is the photoluminescent pigment used by Ecoglo?

Where does it come from?

What are the applications of photoluminescent pigment?

Did the World Trade Center have a photoluminescent system in 2001?

Are photoluminescent systems mandated around the world?

Terminology

A lay person may have a basic understanding of photoluminescence but may either use incorrect terminology to describe the process or afford incorrect characteristics to the process.

The following definitions may help you explain clearly the differences between photoluminescence and other terms.

Luminous/Luminescence

Emitting or reflecting usually steady, suffused or glowing light.

Fluorescent

Luminescence that is caused by the absorption of radiation at one wavelength followed by near immediate re-radiation, usually at a different wavelength, that ceases almost at once the incident radiation stops.

Phosphorescence

Luminescence that is caused by the absorption of radiation and continues for a noticeable time after these radiations have stopped.
This term is interchangeable with photoluminescent. Ecoglo chooses to always use the term photoluminescent to reduce confusion.

Reflective

When lay people refer to reflective qualities they usually are referring to retro-reflective light which is when light is thrown back at the same angle it was received. Photoluminescent material is luminous whereas electric lighting illuminates an area. The terms are explained in more detail below.

Luminance

The optical brightness of a light source. It is measured for photoluminescent material in millicandelas (mcd) per unit area. The foot-Lambert (fL) is also in common use (1 fL = 3.426 cd/m2) in nonmetric units.

Illuminance

The amount of light that falls on an object. It is measured in lumens* per square foot (foot-candles) or lumens per square metre (lux or lx). One lumen per square foot is 1 foot-candle and 1 lumen per square metre is 1 lux. Therefore, 10.76 lux equals 1 foot-candle.

*Lumen

Lumen is a unit that measures the number of photons a light source emits.

Electrical Light

Electrical lighting “throws” light which illuminates the objects in an area. The amount of light that falls on an object is called the Illuminance. An office environment might have 500 lux on the top of a desk, the back seats in an arena might have 30 - 100 lux. Direct sunlight can be several thousand lux.

Photoluminescent Material

Photoluminescent materials are usually not bright enough to be used to illuminate an area. However their brightness is sufficient to make them visually distinct from their surroundings. This brightness is called their luminance and the unit of measure is the millicandela per square metre (mcd/m2).

Around the world, emergency lighting generally requires between 0.2 and 20 lux in the egress space. This is assumed to be enough light to highlight obstacles and the pathway.
Many codes, including New York City, IFC and NFPA 101 Life Safety Code specify a minimum luminance of 5 mcd at 90 minutes.

The Human Eye and Visibility

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The visual process consists of the formation of an optical image on the retina, conversion of the image into nerve impulses and transmission of these impulses to the brain.

The retina at the rear of the eye contains photosensitive elements that convert light into nerve pulses. There are two main types of detector cells in the retina – cone and rod cells.

Cones and Rods

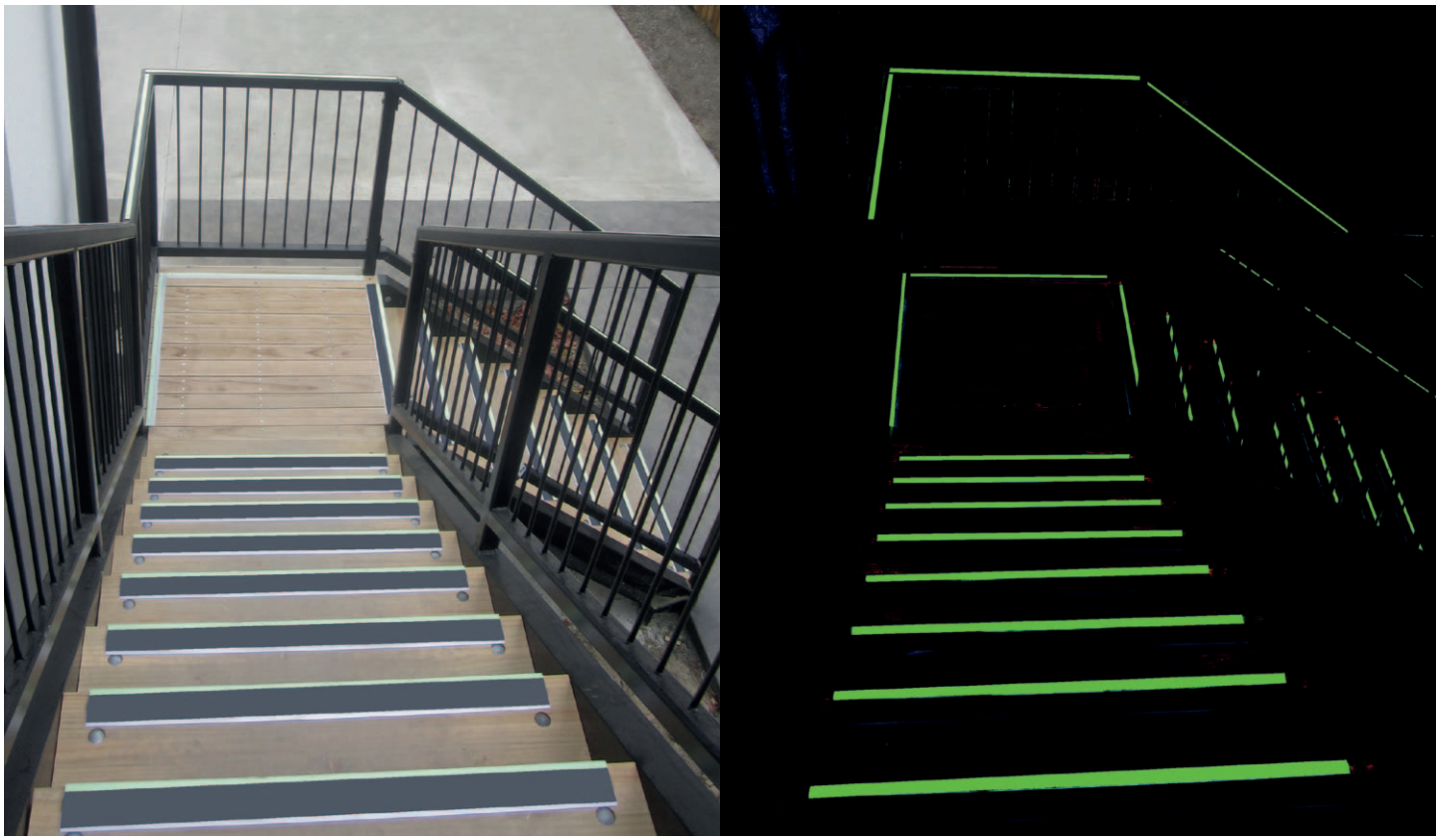
Under bright conditions the cone cell receptors of the retina operate; this is called photopic vision. The detective threshold for these cones is 1mcd/m2.

Under conditions of very low light levels the rod cells are the receptors using scotopic vision. The threshold for rods is 0.001 mcd/m2. Increase in light sensitivity with time is more of a step function than a continuous one, due to the existence of these two distinct systems.

For roughly the first five to fifteen minutes under dark conditions, the cone system is still the more sensitive system, therefore it prevails. However, after a certain period, the rod system takes over, because it becomes more sensitive than the cone system.

The time of the switch between the rod and the cone systems depends on the wavelength of the lights as well as the initial and dark adaptation conditions.

Visibility is also affected by an individual's ability to see in the dark. In particular older people see a lot less in dark or in dim light than younger people.



Implications for way finding systems

Cone cells perceive colour whereas rod cells do not. Rod cells transmit information that can be perceived as a continuum of light. People can follow a continuous band of this type of light.

With photoluminescent way-finding systems an image of the pathway is created by outlining such elements as steps, landings, handrails and obstacles. By outlining the space you define the space. In addition simple information that conveys a message at every point where a decision needs to be made is required, for example a change in floor level or a change in direction.

All doors within an exit route such as smoke doors should be highlighted so that they are recognisable.

The criteria therefore in the design of any photoluminescent wayfinding system is the recognition of the exit route, the direction to be followed to a place of safety and the marking of any obstructions or hazards along the way.

You should Know

What unit of measure is used to describe the brightness of photoluminescent products?

What level of lux could be in a typical room?

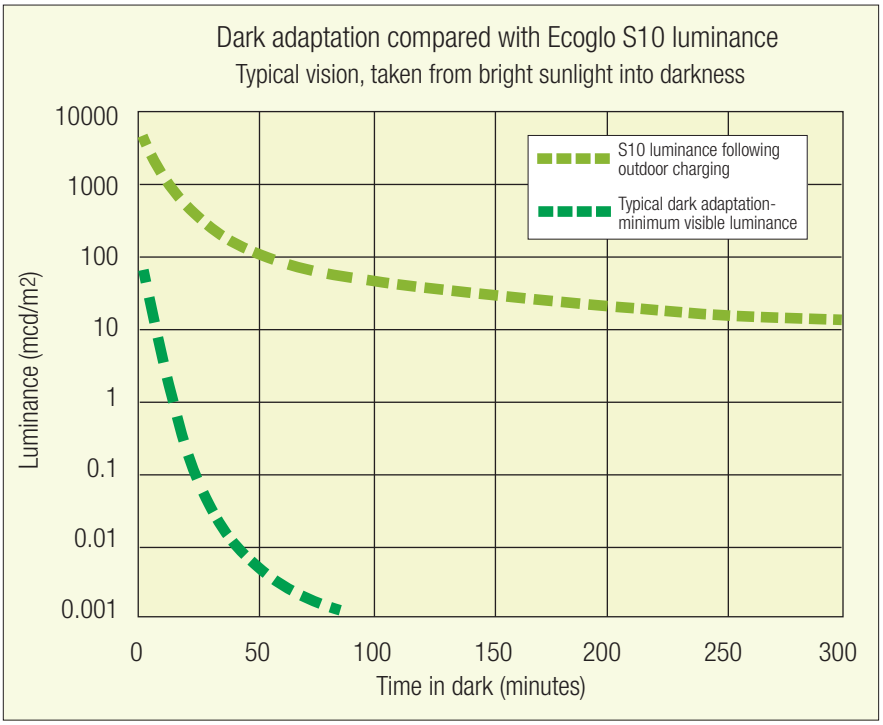
What unit of measure is used to describe products that throw light?

What minimum luminance is acceptable after 90 minutes of darkness in the NYC, IFC and NFPA 101 Life Safety Codes for emergency lighting?

How does dark adaptation affect a person's ability to see photoluminescent products?

How does the design of a photoluminescent system differ to a traditional emergency lighting system?

What is the difference between fluorescent light and photoluminescent light?



Why Ecoglo?

The benefits of photoluminescent products are clear when compared to other alternatives, being both inexpensive and easy to install.

Ecoglo photoluminescent products are cost-effective, sustainable, durable and failsafe.

The following benefits support this statement:

- Utilise ambient light in most cases, meaning little to no power usage;
- No replacement parts, ie no batteries or lamps, so no hazardous waste;
- Made from recycled aluminium which can be recycled at the end of its useful life;
- Extremely durable – warranted for 30 years indoors and 15 years outdoors;
- Operate instantly each time the power fails.

Ecoglo PL products - like most PL products - by their simple nature and design, cost a fraction of any electrical alternative resulting in huge savings in capital costs. However, unlike many other PL products, Ecoglo HTC products are extremely durable, so should not require replacement during the facility's lifetime. This is backed up by Ecoglo's extensive warranty.

Add to this the ongoing savings generated from Ecoglo products. There are no costly batteries or lamps to replace, therefore no batteries or lamps to dispose of. This not only saves money but protects the environment .

Requiring nothing more than a regular wipe down with a cloth to remove any dust or debris, Ecoglo products are virtually maintenance free so will continue to generate savings throughout their lifetime and should easily last the life of any facility.

Ecoglo have a range of photoluminescent materials from grades S5 to S25, each with differing brightness. This allows different grades of PLM to be used for different purposes.

(See results of recent testing on page 14).

Note: *The photoluminescence in Hybrid signs is warranted for 10 years, but warranty on other components of the sign differ.*
Hybrid signs are not designed for use outdoors.

Ecoglo FAQ's

Q Do they need electrical light installed near them?

A No, they are designed to utilise the existing light in the building, be it daylight or electrical. Outdoors, daylight is sufficient to ensure they will work 24/7.

Q How long do they last?

A A minimum of 30 years indoors before there would be any measurable change in performance, and a minimum of 15 years outdoors.

Q What maintenance is required?

A Make sure they are cleaned of dust or dirt build up. Ecoglo recommends checks are carried out regularly and at least once every 12 months to ensure products are still functioning as at installation.

Q How reliable are they?

A They have no moving parts or components that will need replacing. As long as they are installed where there are normal indoor light levels, and they are kept reasonably clean, and not physically damaged, they will be visible in an emergency for the time required for at least 30 years.

Q Where can they be used?

A Ecoglo products can be used anywhere they can be sufficiently charged when someone may need to use them. Our products are used globally in hospitals, educational facilities, apartment blocks, office blocks, hotels, retail spaces, factories, warehouses, theatres, sports stadiums and many other types of building.

Q Can they be used outdoors?

A Yes, Ecoglo products are designed to meet the rigours of long term outdoor exposure in even the harshest environments.

Ecoglo Technical Advantages

Although Ecoglo are not the only manufacturers of photoluminescent products patents are held on the products and on the unique manufacturing process. The technical advantage over other manufacturing methods is detailed below.

Luminance

Ecoglo

Ecoglo HTC products are manufactured using a patented process that is only used by Ecoglo. This tightly controlled application embeds the photoluminescent particles in a clear durable polymer.

The physical nature of the dry powder embedding process and the optical properties of the polymer ensure maximum efficiency of the photoluminescent particles to absorb useful wavelengths from a natural or artificial light source. This light then re-emits from the product towards viewers eyes.

Ecoglo products use a custom produced photoluminescent pigment which has greater longevity of glow than all the other pigments (over 100) which Ecoglo has sampled.
Ecoglo uses dry powder for maximum luminance and consistency of luminance properties.

Non-Ecoglo

Note: A widely used alternative process employed by other manufacturers uses liquid formulations that carry the photoluminescent particles.
Liquid formulations can suffer from settling out of the dense photoluminescent particles resulting in inconsistent luminance properties.

Visibility

Ecoglo

All Ecoglo products are engineered to provide greater visibility than relevant codes and standards currently require. Photoluminescent visibility is affected by more than just brightness ('Luminance'). The other factor is contrast against adjacent surfaces.

Contrast against adjacent surfaces is the critical parameter for visibility on a step edge.

Ecoglo step edge products incorporate a black anti-slip strip that provides excellent luminance contrast and colour contrast to the photoluminescent strip, so the step edge is clearly visible in all lighting conditions: dark conditions, light conditions and twilight or dim conditions.

This means the Ecoglo products are visible from a greater distance and for a longer time after the lights go out.

Due to the custom pigment used and the manufacturing process Ecoglo photoluminescent products perform well even after short duration exposure to light. Outdoors they will remain visible all night. For indoor applications Ecoglo has determined the time required to charge the photoluminescent component based on the type of lights used, the brightness of those lights and the length of time required for the photoluminescent component to remain visible.

Durability of Photoluminescence

Ecoglo

Ecoglo uses a patented process for maximum durability whereby dry powder is baked at 180 degrees Celsius onto aluminium. Using powder means the polymer we use is "long chain" which is extremely strong once bonded.

The Ecoglo range has been subjected to accelerated UV/weathering exposure and proven to be highly resistant to the effects of weathering and UV. Testing has been extended from the usual 1000 hour or 2000 hour test, out to 6000 hours, which can be interpreted to be similar to around 30 years of outdoor exposure.

At 6000 hours exposure, while there is noticeable loss of gloss of the top surface, the loss in photoluminescent brightness is less than can be detected by the human eye (measured reduction of 5-8%).
The unique ridges in the photoluminescent strips protect the glowing areas from most abrasive wear, and other incidental abuse.

Non-Ecoglo

Note: PVC based products have reduced durability and may turn brown during weathering exposure after a short time.

Installed Durability

Ecoglo

The manufacture of all Ecoglo products involves the integral bonding of the photoluminescent layer to a rigid aluminium substrate, so delamination or peeling does not occur. Rigid products spread any applied loads over a greater area of installation adhesive.

Ecoglo signage uniquely incorporates an integrally bonded anti-graffiti protective top coat over the print when necessary. This also protects the print from abrasive wear. Because this top layer bonds into the substrate, there is no chance of delamination or peeling.

Ecoglo bonds onto rigid aluminium and applies a protective top coat, if the situation requires it, for greater installed durability.

Non-Ecoglo

Note: Flexible base products, such as PVC, vinyl and acrylic are more prone to coming loose because the installation adhesive is more highly stressed. For outdoor use, protective film which is not integrally bonded is only as good as the quality of the adhesive.

Slip Resistance

Ecoglo

Ecoglo high quality anti-slip material provides all weather slip resistance. The unique ridges in the Ecoglo photoluminescent strips provide additional slip resistance.

Non-Ecoglo

Note: Smooth surface PL products do not provide slip resistance.

You Should Know...

Are there competitor products on the market today?

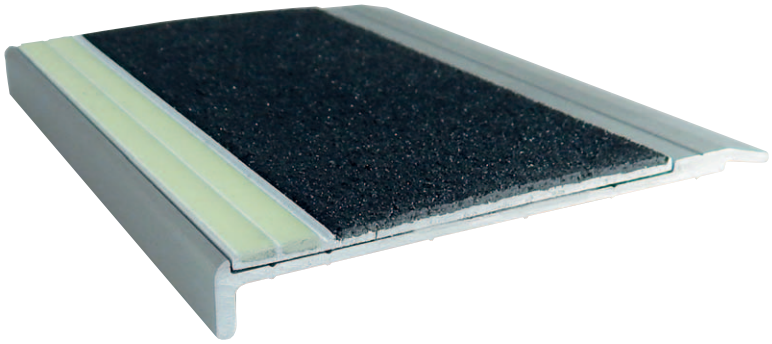
What is unique about the Ecoglo manufacturing process?

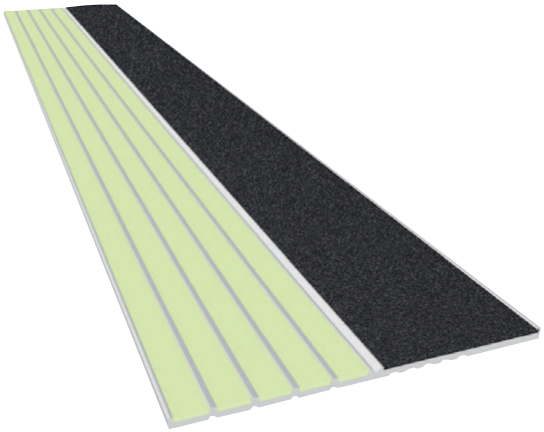
How does Ecoglo ensure maximum visibility from the photoluminescent products?

How does Ecoglo ensure consistent luminosity?

How does the manufacturing process ensure high durability?

What purpose do the ridges in the photoluminescent component provide?





Testing of Ecoglo Products

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All Ecoglo products are subjected to internationally accredited independent and in-house testing to ensure they continue to meet relevant standards.

All Ecoglo Emergency Visibility products are tested to UL 1994 Standard for Luminous Egress Path Marking Systems specifications.

All Ecoglo S20 Grade Emergency Exit Signs are tested in accordance with UL 924 Standard for Emergency Lighting and Power Equipment.

Luminance tests are regularly performed on different grades of Ecoglo photoluminescent material (PLM). The results of the latest independent test are on the following page.

Listed below are further tests which have been performed on Ecoglo products.

- UV Resistance – Loss of luminance after 1000 hours of accelerated weathering (UV) exposure in accordance with ASTM G-155 Cycle 1 Xenon-Arc Test Apparatus for Exposure of Non-metallic Materials: < 10%
- Salt Spray Resistance – ASTM B117 Standard Practice for Operating Salt Spray (Fog) Apparatus: Pass
- Washability – ASTM D4828 Standard Test Methods for Practical Washability of Organic Coatings: Pass
- Rate of Burning – ASTM D635 Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position: Pass
- Surface Flammability – ASTM E162 Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source: Pass
- Toxicity – Bombardier Toxic Gas Generation Test SMP800-C: Pass
- Radioactivity – ASTM D3648 Standard Practices for the Measurement of Radioactivity: Pass
- Anti-slip Properties – UL 410 Standard for Slip Resistance for Floor Surface Materials; AS/NZS 4586-2004 Classification: Dry: F Wet: V Ramp: R12; AS 4586-2013 Classification: P5

Luminance of Different Grades of Ecoglo Photoluminescent Material (PLM)

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The results displayed in Tables 2 and 3 were collected via independent luminance testing carried out on different grades of Ecoglo PLM in September 2018, while the information in Table 1 is from the Photoluminescent Safety Products Association's (PSPA) latest material classification system (with Class A being the minimum requirement).

TABLE 1 **PSPA Classification Table showing luminance of different classes of PLM after being exposed to 1000 lux for a period of 5 minutes.**

AFTER NUMBER OF MINUTES	LUMINANCE mcd/m2						
	CLASS						
	A	B	C	D	E	F	G
2	108	210	690	1100	1800	2300	3000
10	25	50	140	260	400	520	650
30	7	15	45	85	120	155	190
60	3	7	20	35	55	70	80

Note: Class A is minimum requirement with Classes B – G having increasingly superior levels of luminance and decay times.

TABLE 2 **Showing luminance of different grades of Ecoglo PLM after exposure to 1000 lux for a period of 5 minutes.**

TIME AFTER REMOVAL OF CHARGING SOURCE (Mins)	LUMINANCE mcd/m2				
	GRADE				
	S5	S10	S15	S20	S25
2	2179	2559	3505	4284	4861
5	860	1019	1468	1794	2160
10	413	491	714	871	1087
20	192	227	3344	405	517
30	120	142	210	252	327
60	52.4	62.0	93.4	107.5	144.4
120	22.4	25.8	39.8	44.6	61.1
180	13.7	15.5	23.3	26.6	36.5
240	9.1	10.7	16.3	18.8	25.1
300	6.9	8.0	12.2	14.1	18.7
480	3.7	4.3	6.5	7.5	10.3
600	2.7	3.0	4.8	5.7	7.8

Conditions:
Charging source:
150W Xenon Lamp
Exposure:
1000 lux for period of 5 minutes

The results show the following:

Ecoglo S5 Grade PLM easily exceeds PSPA Class D.

Ecoglo S10 Grade PLM easily exceeds PSPA Class E.

Ecoglo S15 Grade PLM easily exceeds PSPA Class F.

Ecoglo S20 and S25 Grade PLM easily exceed PSPA Class G.

TABLE 3 **Showing luminance of different grades of Ecoglo PLM after exposure to 5000 lux for a period of 60 minutes.**

TIME AFTER REMOVAL OF CHARGING SOURCE (Mins)	LUMINANCE mcd/m2				
	GRADE				
	S5	S10	S15	S20	S25
2	2058	2504	3930	4971	6556
5	794	944	1522	2006	2772
10	379	452	725	956	1362
20	178	212	339	453	656
30	114	136	216	289	422
60	52.3	62.2	98.5	132.9	195.3
120	23.0	27.8	43.4	60.0	89.2
180	14.0	17.2	26.5	35.8	55.9
240	9.7	11.6	18.8	25.5	38.7
300	7.3	8.5	14.4	19.5	28.9
480	4.1	5.0	8.3	10.8	15.8
600	3.2	3.8	6.5	8.5	12.1

Conditions:
Charging source:
20W Fluorescent Lamp
Exposure:
5000 lux for period of 60 minutes

Note: 5000 lux equates to the least amount of daylight PLM is likely to be exposed to.
These luminance results show the minimum performance that can be expected of these Ecoglo materials when installed outdoors, even if covered by a roof overhang of up to 4 metres.

Many studies comparing different types of emergency lighting with photoluminescent systems have found photoluminescent material to be an acceptable alternative to conventional emergency lighting and, as such, many building codes now include photoluminescent products as supplementary to, or an alternative to, conventional emergency lighting.

Findings have also indicated that PL material performs particularly well when installed in stairwells. It has likewise been found that way-finding systems with low level lighting performed better than conventional emergency lighting.

Other noted advantages of photoluminescent material is its easy installation in new or existing buildings, its cost-effectiveness and low maintenance.

Clearly, the use of Ecoglo products has many practical advantages. They enhance emergency evacuation systems and provide both indoor and outdoor visibility 24 hours a day, while also playing a vital life saving role in smoke filled areas. In addition, they provide superior step edge contrast to prevent everyday slips and falls, and provide non-distracting aisle lighting.

Photoluminescent Path Marking

eg IFC and NFPA 101 Specifications

Step Edge Products

An advantage Ecoglo products deliver is that they provide visual definition of the step edge not only in dark 'lights-out' conditions, but also in everyday conditions, as Ecoglo products provide contrast between the step edge and the rest of the tread. This helps direct people to an exit while also reducing slips and falls. Another advantage is the anti-slip material integrated into Ecoglo Step Edge products. This is also key to preventing slips and falls on steps and makes for safe and swift evacuation in an emergency.

An alternative solution to marking a step is to paint a line along the leading edge. However, due to the high impact of foot traffic on steps paint quickly wears away and frequent repainting is required. Although initially Ecoglo products cost more than paint, within a short period of time they have paid off their investment by eliminating the ongoing maintenance cost. And Ecoglo products have the added advantage, over paint, of visibility in all conditions.

Handrail Markers and Guidance Strips

Ecoglo Handrail Markers highlight handrails very clearly in dark environments aiding safe egress in emergency or blackout conditions. Ecoglo Guidance Strips are extremely versatile and can be used in many applications, eg step edging, perimeter demarcation, door hardware marking, while remaining very robust.

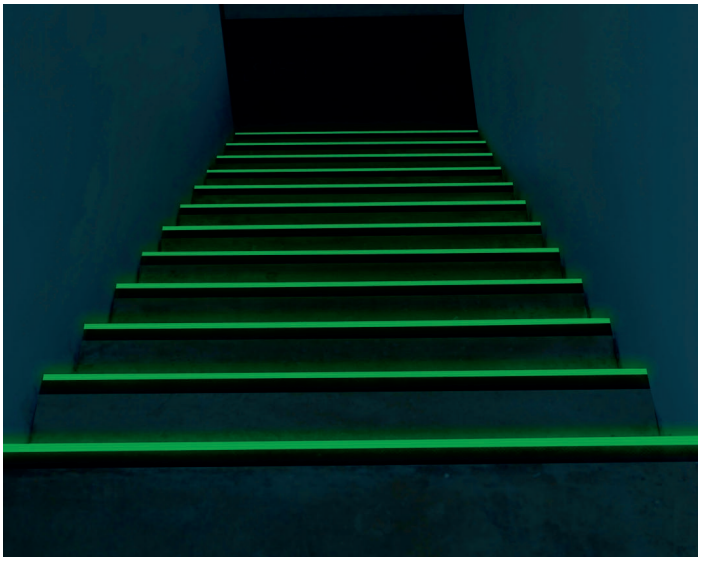
Alternative products, such as PVC, may perform the same function, but do not have the durability of Ecoglo HTC products, are not tactile and, while cheaper, will require regular replacement which negates any initial savings.

Emergency Exit Signs and Door Handle Markers

Ecoglo S5 Exit Signs and Door Handle Markers are made from aluminium, so are extremely durable, unlike PVC or vinyl equivalents.

No Ecoglo - Lights On

With Ecoglo - Lights On



With Ecoglo - Lights Off

Visibility in Smoke

Evacuees need to see that an exit path is visible for several metres for them to travel along it. When the smoke density is high, the only way to show the exit path for a useful distance is with low level continuous marking. High mounted emergency lights can easily be totally extinguished by dark smoke, or provide no useful information in thick white smoke. Viewing distance, not power or luminance, is the crucial factor at high smoke density.

Very high performance of guiding people in smoke may be provided by photoluminescent path marking systems. Ecoglo design optimum egress systems for smoky conditions by providing continuous marking and directional signage less than 1 metre above the floor level, independent of electrical power. These systems have long operational times, require only simple maintenance and are low cost.

Outdoor Emergency Visibility (or Daylit Visibility)

The high durability and UV resistance of Ecoglo's photoluminescent products work outdoors all through the night in a naturally dark environment. Ecoglo S10 grade products are charged outdoors even on an overcast day.

Outdoor and daylit stairwells, pedestrian foot bridges and stairways in transit infrastructure, as well as outdoor stadiums and similar settings, are all prime examples of facilities that will be served well by Ecoglo step products, handrail markers and guidance strips – the advantages of which have already been outlined.

When Ecoglo is used outdoors in a city environment and the area is well lit by city lights the glow will not be very noticeable. But in crowd situations, where the crowd stops the light getting to the walking surface, the photoluminescent markings will show up strongly and aid safe movement.

Ecoglo combination step products (eg E2-071) work particularly well when the light is dim (eg 0.1 lux) and people are still moving about. In dim light there is the potential to trip over unseen objects. As the background surfaces will not be especially dark the anti-slip material in Ecoglo step products provide the contrast needed to make the photoluminescent strip highly visible preventing people from slipping or tripping.

All exit routes and pathways should be clear of any obstructions and any permanent obstacles marked with PL markings. However, there is always the potential for there to be temporary or sporadic obstructions. An independent test carried out in December 2017 by Jensen Hughes using Ecoglo PL markings concluded that such obstructions are clearly visible when only PL markings are used as a path marking system in stairwells.

Ecoglo signage works best in very dark environments.

Ecoglo outdoor emergency visibility products are extremely versatile, sustainable, easy to install and cost-effective, unlike electrical alternatives. Ecoglo products are also more durable, sustainable and cost-effective than other types of PL materials, eg PVC based products which quickly degrade with UV exposure.

Emergency Exit Signs

Ecoglo offer a range of S20 grade signs which are independently tested in accordance with UL 924 specifications.

Ecoglo emergency exit signs can be used in Performance Solutions to meet the performance requirements of building codes such as IFC and NFPA 101, and any other performance based building codes which recognise UL 924.

Standard PL Exit Signs

Ecoglo Standard Signs are extremely durable, easy to install with negligible maintenance and no power requirements.

Architectural Exit Signs

Ecoglo Architectural Exit Signs offer all the features of the standard exit sign but are finished in a sleek, aesthetically pleasing design to complement any interior space.

Hybrid Exit Sign Ecoglo

Hybrid Exit Signs are the ultimate solution in emergency exit signage. Incorporating Ecoglo's patented photoluminescent technology with next generation LEDs, the hybrid sign is effective in all lighting scenarios but requires no battery backup.

All Ecoglo signs are cost-effective, sustainable and failsafe, unlike electrical alternatives which are expensive to install and maintain and rely on battery back up which can fail.

Common Objections to Photoluminescent Products

ecoglo® VISIBLY BETTER

While the following objections relate to signs, the objections and responses could just as easily refer to any PL emergency visibility product.

Luminance

Objection: A PLM sign with an approximate luminance of 30mcd/m2 must be a lot less safe than an internally illuminated sign with a luminance of 8cd/m2. This objection was put to Michael Shulman, Principal Engineer, Lighting, at Underwriters Laboratory in Fremont, California.

This is his response:

"Less bright does not equate to less safe. 99%+ of exit sign usage occurs during normal lighting conditions, in which case visibility is primarily dependent on contrast rather than brightness. The colours of a typical PL sign (whitish/yellow vs. green) provide for excellent contrast.

In a power outage condition where the ambient lighting is very reduced, a glowing PL sign (while of lower brightness than an electrical sign) exhibits high luminous contrast to its surrounding environment. And while the PL sign will degrade in brightness over time (as does an electrical sign), the human eye concurrently adapts to the darker environment with increased pupil dilation at a rate that retains a similar level of visibility."

Furthermore, the origins of common luminance minimums should be considered. The following extract is from a submission to the Canadian National Building Code Task Force on Exit Signs presented by Underwriters Laboratory in 2014.

How the measured luminance level requirements for exit signs were derived:

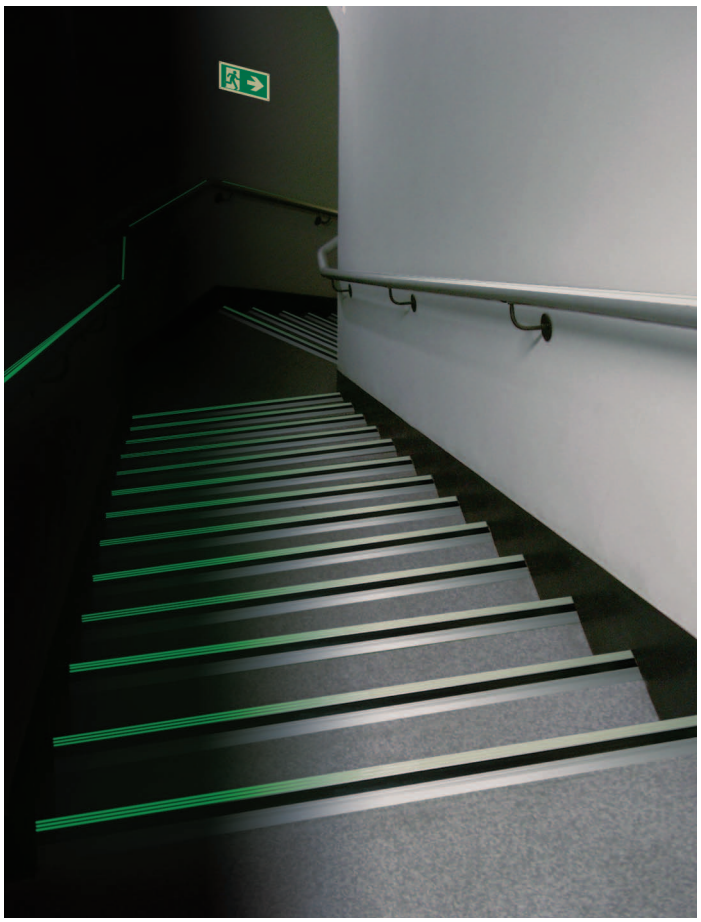
AC powered exit fixtures were originally evaluated to UL 57. In 1977, requirements were added to that standard related to the visibility of these signs (legend size, directional indicators, contrast visibility, and markings). Later that same year, similar requirements were proposed, and subsequently adopted, in UL 924, for battery-powered versions of these products. The contrast visibility test mounted the exit sign under test in a box, next to (but separated by a wall from) a painted metal (black legend on a white background) sign that was externally illuminated at 5 fc, per the requirement for such signs under NFPA 101. A single observer then compared the two signs "…by viewing them simultaneously through a photographic grey scale (Kodak No. 3 photographic step table), gradually increasing the density of the scale from the clear end to a point of greater density. Results should show that the reference sign fades from view first or that the candidate sign is equivalent or greater in visibility than the reference sign over the range of the scale." (UL 924, clause 32.4, 6th edition, 3-16-1984). This test became referred to as the "grey scale visibility test".
At that time, all internally illuminated signs, and the external illumination source, were incandescent.

In 1988, an alternative visibility test method was adopted that measured (using equipment) the luminance reflected off of a non-energized sign, at selected points on the legend, that was externally illuminated at 5 fc and compared these measured values against the luminance of the same sign when internally illuminated with no external illumination. This was referred to as the "luminance measurement visibility test". Contrast calculations were included, along with permutations for different sign legend types (with or without borders, of different widths and of different illumination levels relative to the legend).

At an April 1995 industry meeting, UL proposed to simplify the visibility test programs by replacing both of the 'comparative' tests (grey scale and luminance measurement) with a measurement approach that established a fixed minimum luminance level (8.57cd/m2). This luminance level was derived through a series of calculations that were based on the calculated luminance of the original black-on-white, 5 fc externally illuminated sign, and against which signs previously qualified under the grey scale test were certified. These new requirements were adopted and published in the 8th edition of UL 924. They remain to this day.

It is thus important to recognize that the luminance level requirements are based on the visibility of a non-energized sign externally illuminated at 5 fc, and not in any way the result of research to determine what level of luminance is necessary for adequate visibility. There is no claim or assertion that a sign externally illuminated at 5 fc, or a comparably visible internally illuminated sign, represents the minimum level of visibility necessary for the sign to properly function. It was, and remains, simply a level of illumination that appeared to work, back in the 1950s, so it was codified.

The 8cd/m2 luminance level is therefore an arbitrary figure rather than one based on human visibility factors.



Visibility in Smoke

Objection: A PLM sign does not work in smoke conditions and smoke is a foreseeable circumstance.

Once again Michael Shulman's response:
"No exit signs work in smoke. Smoke creates two concurrent conditions: first, it scatters all light making any exit sign just a faintly glowing object with no discernible legend or image. Second, it is an extreme irritant to the human eye and makes it virtually impossible to keep your eyes open at all (resulting in no visibility whatsoever). Smoke filled rooms and hallways can generally only be traversed by getting very low to the ground where, for a period of time, the smoke layer may not be complete. Floor proximity luminous path markings are the preferred tool to assist with building evacuation where smoke is likely to occur during the process.

It follows that signs that are mounted high up are more likely to be obscured by smoke than signs mounted lower down. Therefore, mounting signs as low as possible in a room ensures they have the least chance of being obscured by smoke.
The practicality of installation of electrical exit signs means that they are often mounted at, or just below, ceiling height. However, there are no such restrictions for photoluminescent signs, which can readily be installed low down and on many types of surface, including glazing."

Sign luminance does not overcome smoke which should be dealt with by the installation of low level signage.

Sign Charging

Objection: How do we know that a PL Exit Sign is charged?

Stringent testing is performed to determine suitable minimum charging conditions for Ecoglo PL exit signs. The tests are carried out on fully discharged photoluminescent material (typically 72 hrs or more in complete darkness).

In most situations, exit signs will not be left in complete darkness for such a long time and so will in the vast majority of cases always have some residual charge in them from previous exposure to light. Signs that are frequently exposed to even a small amount of light re-charge significantly more quickly than the test results indicate. Therefore, in most practical situations Ecoglo PL exit signs will be suitably charged.

It follows that most buildings which are occupied are likely to be lit, whether by daylight or artificial light, and therefore, any PL exit signs in use during this time will be continuously charging. It should be noted, however, that there are buildings which for long periods of time can be both occupied and in darkness, examples being theatres, cinemas, accommodation units and unlit stairwells. In such cases, PL exit signs may not be appropriate unless a suitable dedicated light source is also present.

Some hybrid PL exit signs have a fully integrated charging light source.

Long-life LED Signs

Objection: New technology LED exit signs will last 10 years anyway, why bother with PL exit signs?

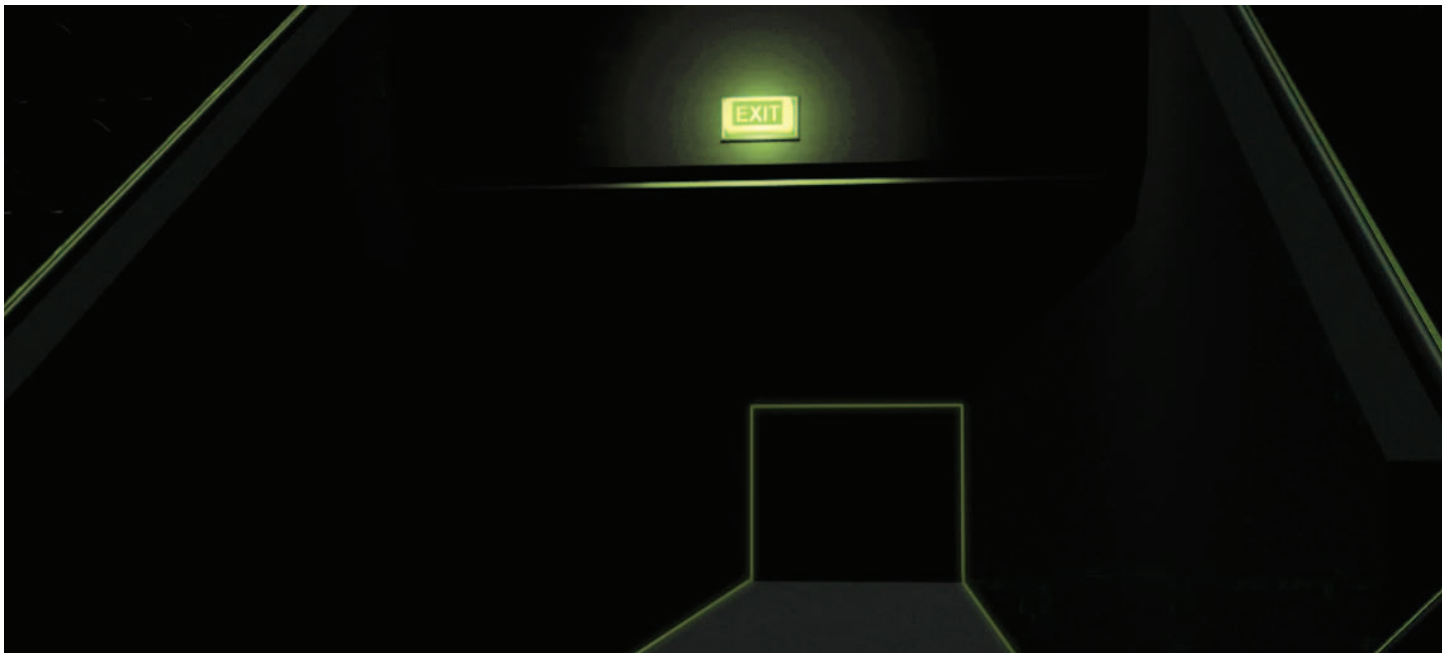
This assumption is based on marketing claims of the 'expected life' being 100,000 hours (approximately 10 years).
Almost all new technology LED exit signs will not last 10 years.
If the LEDs have been tested in a lab in accordance with TM-21, with an LM80 result of 90,000 hrs or greater, this means the LEDs will on average, in ideal conditions, lose no more than 20% initial brightness over that time IF THEY ARE STILL FUNCTIONING.

The TM-21 test is often misquoted as a 'life-time' test, but it is not intended to be used in this way. It is based on extrapolating data over 1-2 years of use and does not attempt to model in-service use.

In practice, the LED may fail, or the electronic driver may fail, or the electronic battery charging control may fail long before 10 years.
Our experience talking with building managers is that many new technology LED signs are failing within 2 years of being installed.

Also, non-PL signs rely on a battery, which often fails within 2-3 years. When the electronics or battery fail, the sign will not provide light in an emergency until it is fixed weeks or months later.

A PL exit sign won't fail.



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