

Light Pollution, a Growing Environmental, Safety and Health Hazard for Residents of Strathfield



Submission on the Strathfield Draft Vision 2020

June 2005

Kenneth Cooke
89 Albyn Road
Strathfield
kencooke@optushome.com.au
<http://www.cooke.id.au>

Cover Photograph by Kenneth Cooke

The parking area of the Australian Catholic University, Strathfield Campus. There are dozens of these unshaded glass globes on high poles through the grounds of the university - "light bombs". Half of their lights shines uselessly upwards into the sky. Much of the remainder causes uncomfortable and unsafe glare to pedestrians and motorists. Notice the pink colouring of the sky seen through the trees. This photograph was taken late in the evening and the sky was overcast. The pink colour represents the city lights reflected by the clouds.

Light Pollution

Light pollution is a rapidly increasing environmental problem in the urban landscape which has well documented deleterious implications for the visual environment, human health, wildlife and flora. Yet it is a hazard which is not often recognised by local government authorities. This submission is addressed to Strathfield Municipal Council's Draft Vision 2020 key direction...

Sustainable development – embracing sustainable development principles, so that our growth delivers a balance of social, environmental and economic outcomes for our community.

Across the whole of metropolitan Sydney and for hundreds of kilometres beyond, the night sky is adversely affected everywhere by light pollution resulting from careless, ignorant, selfish and wasteful lighting practices. The measured rate of increase is approximately a doubling of sky brightness every decade. This is unsustainable.

If we do nothing about it, within our lifetimes we will be well on the way to all-night artificial twilight over much of the state.[ASV]

Light pollution affects our health

It is a profligate waste of energy

It compromises our safety and security

Light pollution is obscuring our view of the universe

Light pollution affects our flora and wildlife



Picture by Kenneth Cooke

What is light pollution?

Any artificial lighting that has the potential to cause adverse effects to humans, the ecosystem or the visual environment. Artificial night lighting is increasing exponentially and nearly all settlement areas are characterised by a typical urban sky glow. This is a form of environmental pollution (light pollution or light smog).

Light pollution can be classified as glare, light trespass and sky glow.

Glare is the uncomfortable brightness of a light source when viewed by the eye. Glare dazzles the eye and never helps visibility. A good rule of thumb is "if you can see the light source (bulb) from a distance the light is a bad one."

Light spill (or "light trespass") refers to light shining onto neighbour's properties, reducing privacy and hindering sleep. It is often the result of "over-lighting".

Sky glow results from waste light that is beamed above the horizontal. It wastes energy, wastes dollars and washes out our view of a major part of the environment - and our heritage - the night sky.

The causes

Stray lighting emitted by ***poorly designed and badly installed*** night time lighting. This would include;

- Street lighting.
- Advertising and business lighting.
- Residential outdoor lighting.
- Decorative and garden lighting.
- Security lighting.
- Sporting field lighting.

Poorly designed lighting without proper shading or badly installed allows light to spill outside of its intended area. While some light is unavoidably reflected upward from illuminated surfaces, much of it spills outside the area that it is meant to illuminate creating glare, light trespass and sky glow.



This old style, twin fluorescent, street light is ubiquitous in the Strathfield Municipality. It is totally unshaded so that about 40% of its light output shines uselessly skyward.

Energy Australia is in the process of replacing these old street lights with new, shaded, mercury vapour lamps which, it is claimed will reduce upward spill of light by 80%. The mercury vapour lamp is still probably a second best choice. It is not the most efficient lamp available and it emits strongly in the blue end of the spectrum. Blue light is the worst form of light pollution since it has a greater deleterious effect on human health, wildlife and insects and has a greater effect on the visibility of stars in the night sky. This particular light fitting is not of the “full cut off” type and still allows a significant amount of its output to spill into the sky. The T5 fluorescent lamps and the new metal halide lamps offer superior energy efficiency and service life. I believe that the T5 lamps are under consideration by the Southern Sydney Regional Organisation of Councils (SSROC) of which Strathfield is a member.





Residential decorative and “status” lighting is becoming commonplace in Strathfield. Some of it is discrete and thoughtfully designed and installed but much of it is poorly designed, cheap and nasty. At left is an example of a house in Chalmers Road, Strathfield with several of bright, unshaded lights along the fence. The glare from this lighting arrangement trespasses onto nearby properties and contributes substantially to night time sky glow. Picture by Kenneth Cooke.

Below is another example in Albyn road showing no less than nine “light bombs” along the front boundary fence and in the front garden. Glare from lighting such as these could affect road safety in addition to contributing unnecessarily to sky glow.



Picture by Kenneth Cooke

This sort of residential “status” lighting has become commonplace in Strathfield and new examples continue to crop up despite some weak lighting control regulations introduced by council into Strathfield DCP N0. 21 - Dwelling houses and Ancillary Structures. (In force from 1 December 1999).

2.8.2.4 Any external lighting is to be placed or shielded to prevent glare to adjoining properties.

6.1.9 Light fittings may be attached to fences which run along street frontages. Only small and discrete light fittings are to be used in such instances. Not more than 2 light fittings are to be installed per street frontage. Each fitting is to be maximum 60 watts.

Brilliantly lit advertising signs and commercial premises such as petrol filling stations and convenience stores are major sources of light pollution, light trespass, glare and visual unease. Illumination 'races' between commercial or advertising rivals generate 'ratcheting' responses and increasing environmental damage. [ASV-BC]



Sporting fields are commonly lit by large arrays of brilliant floodlights. This lighting is almost always badly installed such the light shines well outside of the area to be lit and often causes glare for up to several kilometres away. At right a typical sporting field. As seen from a distance.[SOLIS] This sky glow could have been almost completely prevented by proper installation of the lights. Photograph by Ken Peterson.

Advertising on billboards, bus shelters, pedestrian bridges and street signs is commonly brightly lit. Many billboards employ flood lights at the bottom, shining upwards with much of the light missing its intended target and instead causing an undesirable glow in the sky above. This can be avoided by placing the lights at the top. At right is an example of a bottom lit billboard spilling its light upwards. It show an obscene waste of energy, light pollution and adds greatly to greenhouse gas emissions. Picture by Ken Peterson from the Sydney Outdoor Lighting Improvement Society web page. [SOLIS]



The effects

Human Health

Apart from the obvious effect of sleep disturbance resulting in the trespass of outdoor lighting into bedroom windows, there is a growing suspicion amongst medical researchers that night time lighting may have much more serious consequences for human health.

Dr Stephen Pauley, a retired endocrinologist, has written a paper on health issues of light at night. *The hypothesis that the suppression of melatonin (MLT) by exposure to light at night (LAN) may be one reason for the higher rates of breast and colorectal cancers in the developed world deserves more attention. The literature supports raising this subject for awareness as a growing public health issue. Evidence now exists that indirectly links exposures to LAN to human breast and colorectal cancers in shift workers. The hypothesis begs an even larger question: has medical science overlooked the suppression of MLT by LAN as a contributor to the overall incidence of cancer?* [SP]

Professor Russel Reiter, of the University of Texas, said at the first International Scientific Conference on Childhood Leukaemia in London (8th September 2004) that... *exposure to light at night disrupts the body's circadian rhythms and suppresses nocturnal production of the hormone melatonin. As an antioxidant, in many studies melatonin has been shown to protect DNA from oxidative damage. Once damaged, DNA may mutate and carcinogenesis may occur, he said.*[RR]

Security and Safety

There is an almost universal misconception that lighting diminishes crime and increases security. In fact several government sponsored research projects in the United Kingdom and the United States of America have failed to demonstrate any benefit from lighting in the fight against crime. Studies that claim to show a beneficial effect have been convincingly shown to be flawed on closer analysis. [PM],[BC]

School districts across the United States have reduced the cost of vandalism by adopting a “Dark Campus” policy. All lights are turned off between 11pm and 6am. As well as reducing crime against school property they have achieved significant savings in their electricity bills.[IDA-is054]

Graffiti “artists” prefer their work to be seen by the public and given a choice between a dark unlit wall and a well lit wall, they will chose the latter.

Young women at brightly lit bus shelters at night report that they feel exposed to the unwanted gaze of passing traffic and would rather stand discretely in the shadows.

Perpetrators of crime need to see what they are doing, just like the rest of us and prefer to operate in well lit areas where they can also easily see if there is anyone watching them. A criminal using a torch in an unlit area is more likely to arouse suspicion than someone wandering around brazenly in an over lit area.

Misplaced or over bright lighting on our roadways can distract and confuse and the glare can impair visibility and adversely affect the safe use of roads



Lighting on a foot bridge spanning a main Road outside a school at Dural, in a semi rural area. The lighting is so bright that, in contrast, the area under the bridge appears pitch dark. The glare from these lights causes a dangerous situation since it impairs drivers vision to the area under the bridge. Picture by Ken Peterson, Sydney Outdoor Lighting Improvement Society

Loss of View

"The night sky is the world's largest national park with its stark beauty available to anyone who steps outside and looks up."

-- Geoff Chester, US Naval Observatory [IDA-Quotes]

Some will pay millions for a property with water views. The wondrous beauty of the night sky could be available to all of us free of charge were it not for its pollution by carelessly designed outdoor lighting.

The sky glow resulting from the spill of artificial light into the night sky obscures visibility of the celestial wonders, stars, constellations, galaxies and nebulae, for example. This wondrous vista is a part of our natural environment which should be preserved for the enjoyment of all. With a little thought given to proper design of night time outdoor lighting it could be available to all of us to view from our own back yards. Instead, it is estimated that only about 60 stars are now visible to the naked eye from the suburbs of Sydney compared with about 2,400 in a non light polluted sky. Only three out of the five main stars of the Southern Cross can now be seen from my own back yard in Strathfield. When I was a child growing up in Kingsgrove, another suburb of Sydney, the Milky Way was clearly visible. Today, most children in Australia will grow up never having seen it.

There is a great interest in astronomy by the general public and this is attested to by the attendances at public observing sessions, at times of special astronomical occurrences. Children in particular can get "turned on to" science by experiencing stars, planets, nebulae, and galaxies at first hand. However, as light pollution encroaches their own back yards many of these are difficult or impossible to experience.

A view of a dark and starry night should be a part of every ones life experience. Without it humanity is doomed to a false sense of its own importance. To contemplate the infinity of space gives us a healthy sense of humbleness.

"The night time sky has been a constant in the human experience. It has inspired countless myth, religion, art, literature, and science from every culture around the globe. It is the ultimate common ground for humanity that has been tragically taken for granted. Some who recreate on public lands specifically seek out the night sky with telescopes or simply a warm blanket and their own eyes; but perhaps for everyone the night sky is an integral component of a natural experience."

-- Chad Moore, National Park Service, USA [IDA-Quotes]

"The contemplation of celestial things will make a man both speak and think more sublimely and magnificently when he descends to human affairs." -- Marcus Cicero, 106-43 B.C.

"Growing up with light pollution is like never being allowed to hear music."

-- Fred Schaaf, Sky & Telescope, July 2001 Page 90.

If we do nothing about it, within our lifetimes we will be well on the way to all-night artificial twilight over much of the state. The upward flood of waste light is progressively destroying our view of the universe.

Loss of Amenity

Glare from artificial lighting may create adverse effects on adjoining land uses, and thereby affect the amenity values of property owners and visitors. These effects are usually more apparent at night.

Situations where glare may arise are sports field lighting, security lighting of premises, garden and status lighting and the illumination of advertising signs for example.

It is desirable to control the level of glare in zones particularly sensitive to glare nuisance such as the residential zones. Lighting design and improved orientation can considerably reduce the potential for glare.

Ecological consequences of night time lighting

From Simon and Babcock (1999) and other sources, it is variously known or claimed that light pollution and light trespass can adversely affect animals as well as plants, eg migratory birds navigate erroneously and the activities of nocturnal land mammals are claimed to be disturbed. In Victoria at least, experience in the specific case of upwardly directed floodlighting of trees is that ringtail and brushtail possums both become disoriented by the upwards pointing lights and stare at them with consequent temporary loss of vision. Given the high intensities often used and the known blue light hazard to animal eyes, it is quite possible that permanent photochemical retinal damage also occurs (ie blindness) in dazzled nocturnal tree-dwelling animals. It is also possible that night fliers such as owls and bats are similarly affected. One Melbourne suburban council (Whitehorse) decided in 1999 against uplighting of trees in a park because of possum dazzle and disorientation. [ASV-BC]

Many sea birds are nocturnal and move between land and sea at dusk or at night and as such are particularly vulnerable to artificial lighting. Once they are disoriented they are at risk of colliding with artificial structures. Artificial lighting is one of a suite of human impacts that together are contributing to the downward trend in distribution and abundance of the world's 300 species of sea birds. [MCCN]

While most of us might wish for insects in general to go away and leave us alone, their outright destruction would bring devastation to all life on Earth. Biodiversity is a requirement for the survival of our own species. Not only do we have to share the planet with insects, we need to be careful to avoid upsetting evolutionary dynamics and balances. However, the introduction and growth of electrical outdoor lighting in the last 100 years has apparently had a substantial effect on insect populations (IDA ISI09 1996). Moth numbers in particular appear to have declined greatly by attraction to artificial lights and consequent death by impact, heating, exhaustion and predation. [ASV-BC]



The Mountain Pygmy-Possum. A native of south eastern Australia.

Because Bogong Moths are a major component of their diet in summer, any factors which severely reduce Bogong Moth populations are likely to impact on Mountain Pygmy-possums. Light can upset the moth's navigation system and large numbers of moths may be diverted from their migration routes by city lights.[NPW]

Picture Linda Broome, NSW National Parks and Wildlife Service.

Experiments and anecdotal evidence demonstrate that both temporary and permanent changes to the illumination of an area may affect frog reproduction, foraging, predator avoidance, and social interactions. [UWG-Conf-BB]

Higher plants rely heavily on environmental signals to guide their development. Among the more important environmental signals are those that come from their light environment. Among the many processes affected by light are seed germination, stem elongation, leaf expansion, conversion from a vegetative state to a flowering state, flower development, fruit development, and senescence. [UWG-Conf-WB]

Energy waste & Economic consequences

A totally unshaded outdoor light shines about 50% of its light up into the sky where it serves no useful purpose. This wasted light represents also wasted energy. Replacement of such lights with a better designed fitting would allow the use of lower power lamps to give the same degree of illumination thus halving their running costs. This benefits the owner of the light while at the same time reducing the light polluting effect. This is a win-win situation for all concerned.

" . . . substantial amounts of electricity are consumed through unnecessary outdoor lighting by retail establishments after business hours, including but not limited to, shopping centres, auto malls and dealerships . . . " [IDA-Quotes]

The following Satellite image (23 October 2000), documents the billions of dollars worth of wasted light energy poring up into the night sky each year around the world.



Image by Craig Mayhew and Robert Simmon, NASA GSFC. This image of Earth's city lights was created with data from the Defense Meteorological Satellite Program (DMSP) Operational Linescan System (OLS). Originally designed to view clouds by moonlight, the OLS is also used to map the locations of permanent lights on the Earth's surface.

What can council do?

Formulate rules which control glare, trespass and unnecessary light spill from outdoor night time lighting.

Glare can have a significant nuisance and safety consequences where lighting has been established without any thought to the effects on adjoining properties or road users. Council policies should aim to control the effects of exterior lighting on neighbouring properties and to minimise the effect on road safety.

Australian Standard AS 4282 - 1997 'Control of the obtrusive effects of Outdoor Lighting' could be used as a basis for determining intrusive nuisance resulting from the glare effects of outdoor lighting. The standard takes account of several aspects of potential obtrusiveness, the light falling on surrounding properties, the brightness of the luminaries in the field of view of nearby residents, and glare to users of adjacent transport systems and the effects of astronomical observations.

Rules stating standards for glare that recognise the different amenity values for:

- Residential zones (most glare sensitive zone)
- Town centre zones (moderately glare sensitive zone)
- Industrial zones (least glare sensitive zone)

Setting a maximum lux level would assist in safeguarding amenity values and provides for public scrutiny of development applications where a standard is not complied with.

All lighting fixtures should be designed and installed so that lighting outside the area to be lighted and spill into the night sky is minimized.

Advertising lighting should have maximum lighting levels established, with downward directed lighting, and drivers and pedestrians should not be blinded by glare.

Wherever possible, all outdoor lighting should be dimmed or turned off after close of business and at times of lower traffic levels.

Monument and façade lighting should be tightly controlled to reduce glare, light intrusion and sky glow, and it should be switched off after midnight, except in tourist centres. Lighting levels should be established so that energy is not wasted.

The supposition that more lighting will defeat crime may not be true. Persons or organisations pushing for increased lighting on security or safety grounds should be expected to justify their assertions with reference to available scientific studies. When security lighting is installed it should be controlled by motion detection sensors so that the lights are only turned on when there is an actual threat.

Intrusive lighting can be just as much a problem as noise and should be placed on equal footing with this and any other environmental nuisance. At present, the problem of obtrusive lighting is not mentioned at all on the council website, while noise is. The quality of the night time visual environment should be included in Councils regular State of the Environment Reports.

Until more adequate measures are instituted, the existing, weak planning rules should be enforced in the interests of safety and preservation of amenity. The existence of these rules should be made known more widely so that residents are aware of their rights when subject to obtrusive lighting.

Bibliography

ASV:

Astronomical society of Victoria

http://www.asv.org.au/index.php?option=com_content&task=view&id=33&Itemid=76

ASV-BC:

Dr. Barry Clark,

OUTDOOR LIGHTING PRINCIPLES FOR AUSTRALIA IN THE 21ST CENTURY

Astronomical Society of Victoria

<http://www.asv.org.au/lpoll/olp.rtf>

SOLIS:

Sydney Outdoor Lighting Improvement Society

<http://www.solis.org.au/>

SP:

Stephen M. Pauley MD FACS

2004 Medical Hypotheses (2004) 63, 588–596

<http://www.darksky.org/links/pauleylhh.pdf>

RR:

Professor Russel Reiter

Mechanistic insights into possible links between electric power, melatonin, biological rhythms and leukaemia, International Scientific Conference on Childhood Leukaemia

<http://www.leukaemiaconference.org/>

PM:

Dr Paul Marchant

What works? A critical note on the evaluation of crime reduction initiatives

Crime Prevention and Community Safety: An International Journal, 7(2), 7-13, 2005

BC:

Dr Barry Clark

Lighting and Crime

<http://www.asv.org.au/lpoll/lppage.htm>

IDA-is054:

Dark Campus Programs Reduce Vandalism and Save Money,

<http://www.darksky.org/infoshts/is054.html>

IDA-Quotes:

International Dark-Sky Association

<http://www.darksky.org/resources/quotable.html>

MCCN:

The Marine and Coastal Community Network

<http://www.mccn.org.au/article.php/id/372/>

NPW:
NSW National Park and Wildlife Service
Recovery Plan for the Mountain Pygmy-possum(*Burramys parvus*)

UWG-Conf-BB:
Bryant W. Buchanan
Observed and potential effects of artificial light on the behavior, ecology, and evolution of nocturnal frogs
<http://www.urbanwildlands.org/abstracts.html>

UWG-Conf-WB:
Winslow R. Briggs
Plant photoreceptors: proteins that perceive information vital for plant development from the light environment
The Urban Wildlands Group
<http://www.urbanwildlands.org/abstracts.html>

Quality nighttime lighting is available now. Everyone benefits from better quality lighting. Everyone should use the correct amount of light when and where it's needed. People would then see better, save energy and protect the nighttime environment.

Now I think we are small enough. Let's call it a night."

-- Theodore Roosevelt, a comment after marvelling at the enormity of the number of visible stars [IDA-Quotes]

STOP PRESS

Light pollution control is now official Victorian State ALP Policy! State Conference on 21 May 2005 passed a resolution to:

1. Investigate the introduction of Australian Lighting Standards
2. Improve efficiency of lighting by the introduction of full cut off lighting in all residential, commercial and industrial developments.
3. Set a time line for the replacement of current outdoor lighting with full cut off lighting.
4. Ensure the E.P.A. has powers over light pollution
5. Undertake research into the effects of urban lighting on social issues such as :
 - crime.
 - sleep loss
 - stress
 - work
 - health
6. Undertake research into the effects of light pollution on environmental issues such as :
 - aquatic creatures
 - blue green algae
 - migratory birds
 - nocturnal wildlife