

LED LIGHT INFORMATION
Town of Highlands – Town Board
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Pages

Overview.....	1-4
Snapshot specs comparison.....	1
Color Temperature graphic.....	2
Different qualities in light options ¶2.....	2
Local Testimonials.....	3, 22
Quotes from American Medical Association (AMA) report.....	3
Suggested Demonstration project and conclusions.....	4
Breakage of LED Diodes, U.S. Agency for Toxic Substances and Disease Registry (ATSDR) reports	5
French Agency for Food, Environmental and Occupational Health and Safety (ANSES) Regulatory Reports.....	5-6
High Frequency Transients Created by LEDs.....	6-8
Negative Effects of Blue Light on Human Health.....	8-11
Graph showing melatonin levels by lighting environment.....	8
Discussion of scientific studies showing effects of reduced melatonin, retinal toxicity etc.....	9-10
Graphs showing components of lights by wavelength and sensitivity by wavelength with a superimposed graph of the components of an LED light.....	11
Photo of LED light on Eagle Valley Road.....	12
Photo of LED light versus Amber Lighting at Yosemite National Park.....	13
American Medical Association (AMA) and International Agency for Research on Cancer (IARC) quotes.....	14
Joshua Rosenthal, MD (NY Otolaryngologist) letter.....	15-18
Joel Kestenbaum, OD (NY Optometrist) letter.....	19-21

Sodium vapor lights do NOT emit any blue light, which is implicated with disturbed circadian rhythms, breast cancer and retinal toxicity. **ALL LED lights, even so-called amber (orange) LEDs, also emit this blue light that is of concern.** This is true even if the amber bulb theoretically has a lower color temperature than a sodium vapor bulb.

Amber lights are comparable in efficiency to sodium vapor; both are less efficient than LED white/blue lights. Sodium vapor produce a pure yellow light, more akin to candlelight. They also distribute the light more evenly and are the best option in mist and fog.

No LED light by definition can be as safe as what it is replacing and safe for all residents. On information and belief, nobody in town has expressed that they suffer an irritation from existing Sodium Vapor and/or Mercury Vapor Lights which emit a light in the yellow-orange range only.

Typical high pressure sodium bulb¹, yellow color, best to cut through mist and fog
50 watts, 4,000 lumen, color-temperature- **1900-2200 Kelvin** yellow light only
80 lumens/watt efficiency (higher wattage can go up to 106 lumens/watt efficiency)

Some LED blue lights used in Eastern MA¹

13-15 Watts, 1,600 lumen **3000 Kelvin**, contains blue light (2,700 is lowest blue light)
110 lumens/watt energy efficiency

These blue lights may look brighter for many than the sodium bulb, even w/ lower lumen.

Other LED blue lights²

25-40 Watts, 2770-3650 lumen (color temperature can vary 2,700-5,000 and above).

90-110 lumens/watt efficiency- up to and past 120

(they can get past **120 lumens/watt** efficiency and are several-fold brighter due to blue)

Lowest color-temperature LED light

20 Watts, 2,800 lumen- **2200 Kelvin**, Lumican-small chassis³

140 lumen/watts (dimmable- not a desirable feature)

Amber/orange LED lights

16-42 Watts, 1150-3300 lumen², **2200 Kelvin**, still contain blue light

40-80 lumens/watt efficiency (on par with sodium vapor lights in terms of efficiency)

Even if lower lumens, still may appear brighter because of residual blue light.

30-228 Watts, 2500-10,000 lumens- 1750 Kelvin Osram⁴

43-77 lumens/watt 1750K

Incandescent bulb (not an option for streetlights)

7.25-14 lumens/watt efficiency 2700 Kelvin

Candlelight (not an option for streetlights), yellow light-ideal for humans

1800Kelvin

¹ Data from J. Kelly Beatty, Sky and Telescope Magazine

² This Data from National Optical Astronomy Observatory (Kitt Peak National Observatory):

https://www.noao.edu/education/QLTkit/ACTIVITY_Documents/Energy/TypesofLights.pdf

³ <http://lumican.com/wp-content/uploads/2018/10/Lumicana-Cobrahead-Small-Chassis-V14.pdf>

⁴ <https://www.osram.com/ls/news/amber/index.jsp>

Correlated Color Temperature: indicates a light's overall color or hue:



Effects on brightness include (1) existence of any blue light, (2) relative color temperature (3) lumens. (Lower color-temperature will not appear less bright if there is any blue in it and possibly, but not definitely if it emits more lumens). Humans have used orange lights at night with no blue for years- candlelight and fire. They also used incandescents indoors- which are more white.

All bulbs have a wattage (power) and intensity measured in lumens (these numbers are related to each other and together (lumens/watt) represent energy efficiency); color-temperature in Kelvin as well as a glare rating- lower glare makes a smaller puddle of light. Yellow is the best color for mist and fog because white and blue light reflect off of water molecules more and visibility is lessened. LED also has residual flicker while sodium vapor does not and also creates high frequency transients. High pressure Sodium vapor is effectively as efficient as an LED bulb of the same color-temperature (amber). (Some amber lights may be more efficient, but this needs to be investigated further.) LED's can create too bright pools of light with more blackness in between the areas as opposed to a more distributed, natural yellow light that is less of an irritant.

Individuals have different reactions to such light and no LED lights can be guaranteed not to irritate peoples' eyes and cause the other aforementioned reactions with cumulative exposure.

To date, at least three people have communicated that they are irritated by LED's- including LED lights on a computer. Dr. Janet Wilkie wrote letter to the News of the Highlands printed on June 7th, I have expressed same, and Merv Livsey has provided a picture of an irritating LED light on Eagle Valley Road. A fourth resident, Jason Taylor has expressed that there are too many streetlights in existence now that create too much light pollution. (These are the only people I surveyed; a demonstration would give a fuller picture).

The American Medical Association ("AMA") states,

It is estimated that a "white" LED lamp is at least 5 times more powerful in influencing circadian physiology than a high pressure sodium light based on melatonin suppression"⁵.

They go on to state the following:

Many early designs of white LED lighting generated a color spectrum with excessive blue wavelength. This feature further contributes to disability glare, i.e., visual impairment due to stray light, as blue wavelengths are associated with more scattering in the human eye, and sufficiently intense blue spectrum damages retinas⁶⁷. The excessive blue spectrum also is environmentally disruptive for many nocturnal species. Accordingly, significant human and environmental concerns are associated with short wavelength (blue) LED emission.

Backlit LED technologies, room lights affect sleep. The AMA reports:

A number of controlled laboratory studies have shown delays in the normal transition to nighttime physiology from evening exposure to tablet computer screens, backlit e-readers, and room light typical of residential settings.⁸⁹¹⁰ These effects are wavelength and intensity dependent, implicating bright, short wavelength (blue) electric light sources as disrupting transition. These effects are not seen with dimmer, longer wavelength light (as from wood fires or low wattage incandescent bulbs). In human studies, a short-term

⁵ Falchi F, Cinzano P, Elvidge CD, Keith DM, Haim A. Limiting the impact of light pollution on human health, environment and stellar visibility. *J Environ Manage*. 2011;92:2714-22., also reported in the Report of the Council on Science and Public Health, "Human and Environmental Effects of Light Emitting Diode (LED) Community Lighting" http://darksky.org/wp-content/uploads/bsk-pdf-manager/AMA_Report_2016_60.pdf (Report to the American Medical Association ("AMA"))

⁶ Shang YM, Wang GS, Sliney D, Yang CH, Lee LL. White light-emitting diodes (LEDs) at domestic lighting levels and retinal injury in a rat model. *Environ Health Perspect*. 2014;122(3):269-76.

⁷ Lougheed T. Hidden blue hazard? LED lighting and retinal damage in rats, *Environ Health Perspect*. 2014;122(3):A81.

⁸ Cajochen C, Frey S, Anders D, et al. Evening exposure to a light-emitting diodes (LED)- backlit computer screen affects circadian physiology and cognitive performance. *J Appl Physiol*. 2011;110:1432-8.

⁹ Chang AM, Aeschbach D, Duffy JF, Czeisler CA. Evening use of light-emitting eReaders negatively affects sleep, circadian timing, and next-morning alertness. *Proc Natl Acad Sci USA*. 2015;112:1232-7.

¹⁰ Gooley JJ, Chamberlain K, Smith KA, et al. Exposure to room light before bedtime suppresses melatonin onset and shortens melatonin duration in humans. *J Clin Endocrinol Metab*. 2011;96:E463-72.

detriment in sleep quality has been observed after exposure to short wavelength light before bedtime. Although data are still emerging, some evidence supports a long-term increase in the risk for cancer, diabetes, cardiovascular disease and obesity from chronic sleep disruption or shiftwork and associated with exposure to brighter light sources in the evening or night.¹¹¹²

No change in technology should be considered at all in the absence of putting up a few next to each other in one location in a demonstration project (not a permanent fixed pilot project) so that people can look at them and report their experiences and compare and contrast. Again, the irritation of the light is one issue- the long term ramifications of blue-light exposure are another. Companies hawking these lights are not able to and not interested in proving safety (this is not the only industry that rolls out things ubiquitously that are unsafe or not yet proven safe (violation of the precautionary principle)- this includes drugs, an assortment of chemicals, products emitting wireless radiation, nanotechnology, synthetic biology, artificial intelligence.

It is up to elected officials to make conservative decisions that do not roll things out ubiquitously that can have adverse effects and to way the potential costs versus the so-called benefits. A solution for a Long Island town may not be appropriate for the Hudson Valley, especially for a town nestled in a state park. The cost savings on a yearly basis are not that great and this should not be entertained lightly given the possibility for the need to remove them. As Merv Livsey mentioned to me, many of us choose to live here and not New York City for a reason, and New York City is increasingly being lit up like a runway. There are other ways to save more meaningful amounts of money and/or reduce global warming if that is a goal (for example, offices could be made to comply with recycling rules that residents must comply with).

Ultimately, anyone who does not want such a light should have the option of opting out within view of their home if new lights were installed (and having O&R re-install a sodium-vapor light or at least some narrow band amber light selected by the Town). Sodium vapor emit no blue, are best for mist and fog, which are conditions we have; we are not a city and don't need blue to illuminate colors of car you are seeing, and anything with any blue will affect humans and animals to varying degrees. Amber LED lights have the least amount of blue light and are at least comparable in energy efficiency to sodium vapor lights.

¹¹ . Council on Science and Public Health Report 4. Light pollution. Adverse effects of nighttime lighting. American Medical Association, Annual Meeting, Chicago, IL. 2012.

¹² Koo YS, Song JY, Joo EY, et al. Outdoor artificial light at night, obesity, and sleep health: Cross-sectional analysis in the KoGES study. Chronobiol Int. 2016;33(3):301-14.

Breakage of LED diodes

A 2012 Scientific American article, “The Dark Side of LED lightbulbs¹³ refers to release of copper and nickel due to LED bulbs breaking on the concrete, absorbed through air, water and soil In the Common House, the bulbs would fall on a concrete floor where children and adults congregate. This article and another article on metal toxicity health dangers follow:

The U.S. CDC Agency for Toxic Substances and Disease Registry defines nickel and copper as toxic substances and the potential for adverse health effects is dose dependent. Twenty percent of the population is allergic to nickel and would have a stronger reaction to a nickel spill from a broken LED bulb.

Nickel: <http://www.atsdr.cdc.gov/toxfaqs/tf.asp?id=244&tid=44>

Copper: <http://www.atsdr.cdc.gov/toxfaqs/tf.asp?id=205&tid=37>

The French Agency for Food, Environmental and Occupational Health and Safety (“ANSES”) Reports

On April 5, 2019, the French Agency for Food, Environmental, and Occupational Health and Safety, ANSES, put out its latest “Opinion on the effects of human health and the environment (fauna and flora) of systems using light-emitting diodes”: The report cites the scientific evidence on the "phototoxic effects" of short-term exposures to high-intensity blue light, as well as an increased risk of age-related macular degeneration after chronic exposure. Age related macular degeneration causes vision loss in those over 50 by damaging a spot in the center of the retina. The press release¹⁴ for the report¹⁵ states:

.....the expert appraisal showed that even very low levels of exposure to blue light in the evening or at night disrupt biological rhythms and therefore sleep. ANSES stresses that the screens of computers, smartphones and tablets are major sources of blue-rich light, and children and adolescents, whose eyes do not fully filter blue light, are a particularly susceptible population.

¹³ The Dark Side of LED Lightbulbs, *Scientific American*, 2012: <https://webcache.googleusercontent.com/search?q=cache:59DGs7rBqVoJ:https://www.scientificamerican.com/article/led-lightbulb-concerns/+&cd=1&hl=en&ct=clnk&gl=us>

<http://www.globalhealingcenter.com/natural-health/metal-toxicity-health-dangersnickel/>

¹⁴ French Agency for Food, Environmental, and Occupational Health and Safety . *Recommendations for limiting exposure to blue light*. <https://www.anses.fr/en/content/leds-anses%20%99s-recommendations-limiting-exposure-blue-light>

¹⁵ French Agency for Food, Environmental, and Occupational Health and Safety. *Opinion on the effects of human health and the environment (fauna and flora) of systems using light-emitting diodes*. April 5, 2019 <https://www.anses.fr/en/system/files/AP2014SA0253EN.pdf>

The Agency confirms the toxicity of blue light on the retina and highlights the biological rhythm and sleep disruption associated with exposure to blue light in the evening or at night, particularly via screens and especially for children. The Agency therefore recommends limiting the use of LED devices with the highest blue-light content, especially for children, and reducing light pollution as much as possible to preserve the environment.

Their previous report on the topic was issued in 2010 and called “Lighting systems using light emitting diodes (LEDs): health issues to be considered”¹⁶ It stated:

The issues of most concern identified by the Agency concern the eye due to the toxic effect of blue light and the risk of glare... Blue light is...recognized as being harmful and dangerous for the retina, as a result of cellular oxidative stress

adding that the blue light necessary to obtain white LEDs causes "toxic stress" to the retina. Blue light causes a photochemical risk to the eye, says the report, the level of which depends on the accumulated dose of blue light to which the person has been exposed, which is generally the result of low-intensity exposure repeated over long periods. In other words, cumulative effect as well as intensity matter.

The report also indicated that three groups are particularly at risk; children, populations which are already light sensitive and workers likely to be exposed to high-intensity lighting. The report cited glare and pointed out that because the emission surfaces of LEDs are highly concentrated point sources, the luminance of each individual source can be 1000 times higher than the discomfort level. In particular, the report refers to the glare risk and says that previous lighting standards should not be adapted to systems using LEDs. Any systems should have optics and diffusers to avoid glare and are more appropriate for industrial settings, not residential ones.

Dirty Electricity Involves High frequency voltage transients

LED diodes jack up sine wave- create high frequency transients (also known as “dirty electricity” on the wiring, which are understood to be electrical pollutants. These should not be added into the grid and most sodium vapor lamps do not create them. The nation’s expert on this topic is David Stetzer and Stetzer Electric in Wisconsin. His 2013 study, “Dirty Electricity, chronic stress, neurotransmitters and disease”¹⁷ states the following:

Dirty electricity, also called electrical pollution, is high-frequency voltage transients riding along the 50 or 60 Hz electricity provided by the electric utilities. It is generated by arcing, by sparking and by any device that interrupts current flow, especially switching

¹⁶ French Agency for Food, Environmental, and Occupational Health and Safety. *Lighting systems using light emitting diodes (LEDs): health issues to be considered*, October 19, 2010.

<https://www.anses.fr/fr/system/files/AP2008sa0408EN.pdf>

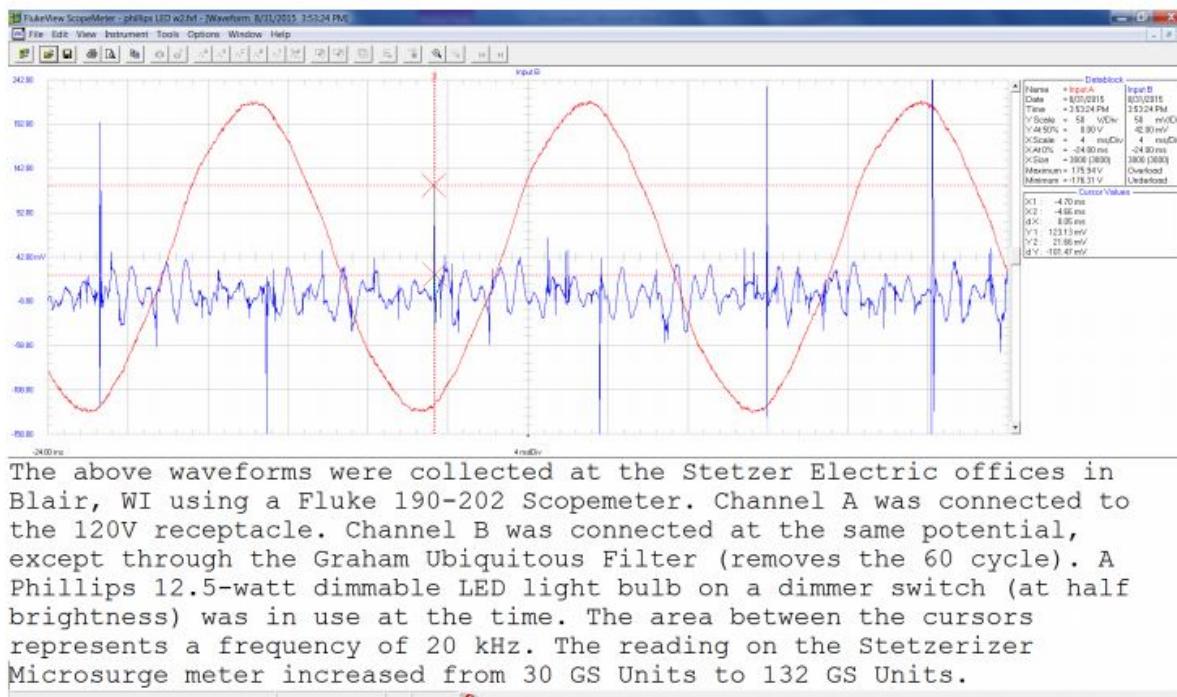
¹⁷ Stetzer D, Milham S. Dirty Electricity, chronic stress, neurotransmitters and disease. *Electromagn Biol Med.* 2013 Dec; 32(4):500-7.

power supplies. It has been associated with cancer, diabetes and attention deficit hyperactivity disorder in humans.

Stetzer also presented a paper with toxicologist Magda Havas in 2004 at a World Health Organization workshop in which they stated:

Deteriorating power quality is becoming increasingly common in developed countries. Poor power quality, also known as dirty electricity, refers primarily to a combination of harmonics and transients generated primarily by electronic devices and by non-linear loads. We have assumed, until recently, that this form of energy is not biologically active..... These results are dramatic and warrant further investigation. If they are representative of what is happening worldwide, then dirty electricity is adversely affecting the lives of millions of people.¹⁸

Dimmable LED lights create even greater line pollution and are to be avoided. The below graphical depiction shows the irregular wave forms created upon dimming:



Stetzer and Havas' report ends by stating the following:

....the body recognizes EMF as a foreign invader and mounts an acute stress response to it. With chronic exposure and stress, neuroendocrine and immune system dysregulation results in a wide spectrum of human morbidity and mortality. Our work shows that lowering of dirty

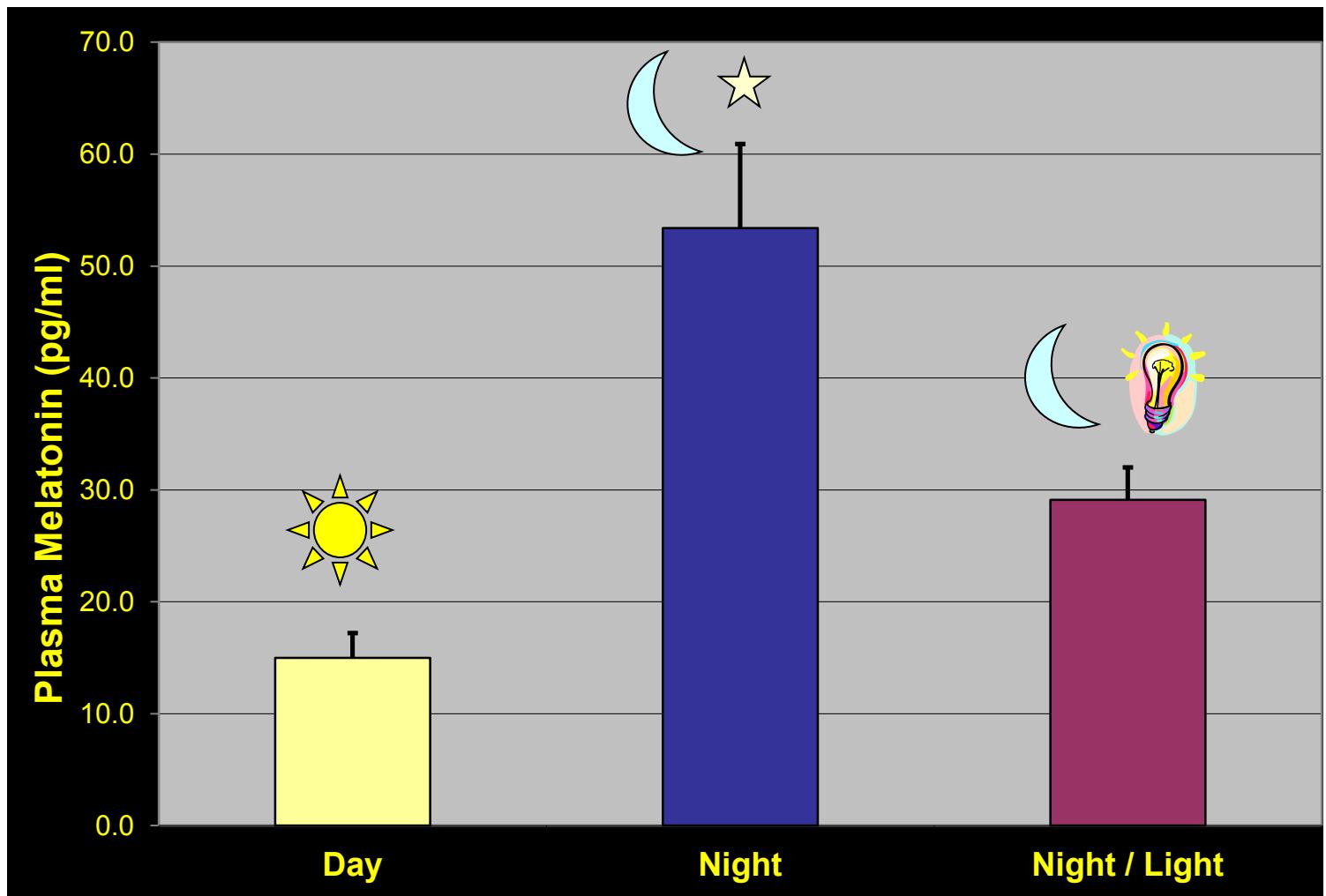
¹⁸ Stetzer D, Havas M. World Health Organization Workshop on Electrical Hypersensitivity, 25-26 October, 2004, Prague, Czech Republic. 1 Dirty Electricity and Electrical Hypersensitivity: Five Case Studies

electricity in an office environment results in increased urinary levels of dopamine and PEA in exposed persons. This is evidence that dirty electricity and probably other types of EMF exposure act as chronic stressors, causing neurotransmitter changes and disease. Neurotransmitters may be biomarkers of dirty electricity and EMF exposures.

Negative Effects of Blue Light

Getting back to the issue of hormone suppression, the artificial blue light from LEDs creates these effects as well as the high frequency transients:

Human Blood Plasma Melatonin Levels (courtesy of the International Dark Sky Association):



Blue light suppresses the production of melatonin, which is the hormone that the sleep-wake cycle. Melatonin has also been shown to be closely related to the development and promotion of breast and prostate cancer. Breast cancer is well known to be caused by high estrogen levels, and melatonin happens to be an aromatase inhibitor, which means it lowers estrogen.

Chronic exposure to blue light, which reaches deep into the eye, is also associated with retinal cell damage and age-related macular degeneration (AMD). According to a 2015 Harvard Medical School (“HMS”) advisory¹⁹, night shift work and exposure to light at night are related to several types of cancer, diabetes, heart disease and obesity. The updated advisory it was based upon²⁰ goes on to state the following:

...while any kind of light can suppress the secretion of melatonin, blue light does so more powerfully

Even dim light can interfere with a person's circadian rhythm and melatonin secretion. A mere eight lux—a level of brightness exceeded by most table lamps and about twice that of a night light—has an effect, notes Stephen Lockley, a Harvard sleep researcher.

While light of any kind can suppress the secretion of melatonin, blue light at night does so more powerfully. Harvard researchers and their colleagues conducted an experiment comparing the effects of 6.5 hours of exposure to blue light to exposure to green light of comparable brightness. The blue light suppressed melatonin for about twice as long as the green light and shifted circadian rhythms by twice as much (3 hours vs. 1.5 hours).

A 2017 study, “Outdoor Light at Night and Breast Cancer Incidence in the Nurses’ Health Study II” conducted by researchers at the Harvard School of Public Health²¹ found that

exposure to residential outdoor light at night may contribute to invasive breast cancer risk.

The Harvard nurses study came to the same type of conclusion as a 2009 study done in Israel²² which stated:

...the analysis yielded an estimated 73% higher breast cancer incidence in the highest LAN [light at night] exposed communities compared to the lowest LAN exposed communities.

Another study, “Melatonin, environmental light and breast cancer” dating to that time from an international team of researchers including a doctor at Columbia University in New York, NY

¹⁹ “Using these lights at night may harm your health”. Harvard Medical School Advisory 2015.

<https://www.health.harvard.edu/healthbeat/using-these-lights-at-night-may-harm-your-health>

²⁰ “Blue light has a dark side”. Harvard Medical School Advisory May 2012, updated, August 13, 2018

<https://www.health.harvard.edu/staying-healthy/blue-light-has-a-dark-side>

²¹ Bertrand K, James P, et al. *Environmental Health Perspectives* Outdoor Light at Night and Breast Cancer Incidence in the Nurses’ Health Study II. 2017; 0817

²² Kloog I, Haim A, Stevens RG, Barchana M, Portnov BA. Light at Night Co-Distributes with Incident Breast but not Lung Cancer in the Female Population in Israel. *The Journal of Biological and Medical Rhythm Research*. 2008; Vol 25: Issue 1.

came to the same conclusion in regard to female shift workers who were exposed to light at night²³.

In addition to cancer risk, there is the risk of retinal toxicity. One recent study published in Spain in 2012²⁴ found that blue LED light can irreparably damage the cells in the eye's retina—specifically the retinal pigment epithelial cells. The study comes to the disturbing conclusion that once damaged, the retina cannot be regenerated and thus LED light exposure can cause blindness.

In 2018, a group from the University of Toledo, Ohio found, as ANSES reported, that LED light exposure can lead to macular degeneration²⁵. The authors recommend not using cell phones in the dark because LED blue light dilates pupils and causes the harmful blue light to enter the eyes, triggering the production of a toxic chemical that interacts with oxygen to kill photoreceptor cells.

LED lights are also inadvertently having a bleaching effect on the works of Van Gogh and Cezanne in art galleries according to Professor Koen Janssens at the University of Antwerp²⁶.

Finally, a 2016 article, “Effects of blue light on the circadian system and eye physiology”²⁷ speaks to the disruption to sleep and blue-light induced damage to the retina. The graph in this paper makes the point that lights can appear similar intensity to a person, but the LED will have much more of the dangerous blue-spectrum light in it:

²³ Srinivasan V, Spence DW, Pandi-Perumal et al. Melatonin, environmental light and breast cancer. *Breast Cancer Res. Treat* 2008; 108: 339-350

²⁴ Tejedor JV, Marchena M, Ramirez L, Garica-Ayuso D, Gomez-Vicente V, Sanchez-Ramos C, dela Villa P, Germain F. Removal of the blue component of light significantly decreases retinal damage after high-intensity exposure. *PLOS One*, 2018:0315.

²⁵ Ratnayake, K. Payton JL, Lakmal OH, Karunaratne A. Blue light excited retinal intercepts cellular signaling. *Scientific reports*. 2019: July 5.

²⁶ Smith L. Will we have to look at Sunflowers in the dark? Scientists discover museum lights are damaging valuable masterpieces by Van Gogh and Cezanne. *Daily Mail* January 7, 2013

<https://www.dailymail.co.uk/sciencetech/article-2258344/Scientists-discover-LED-lights-damaging-valuable-masterpieces-artists-including-Van-Gogh-C-zanne.html>

²⁷ Tosini G, Ferguson I, Tsubota K. Effects of blue light on the circadian system and eye physiology. *Molecular Vision Biology and Genetics in Vision Research*. *Mol Vis*. 2016; 22: 61–72.

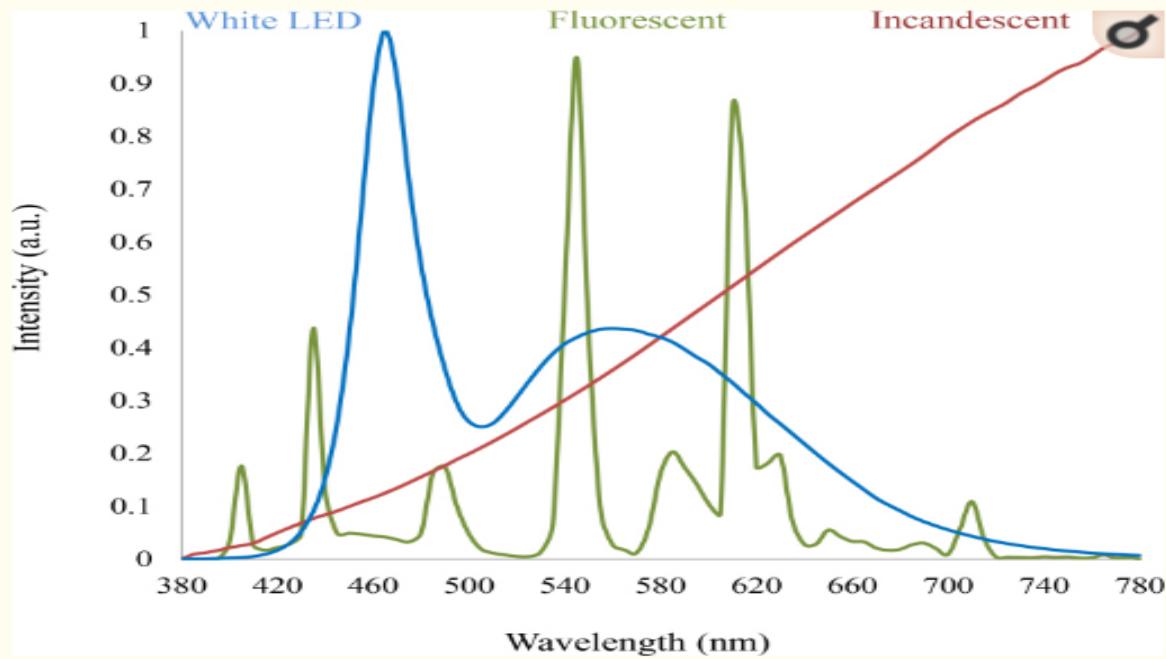
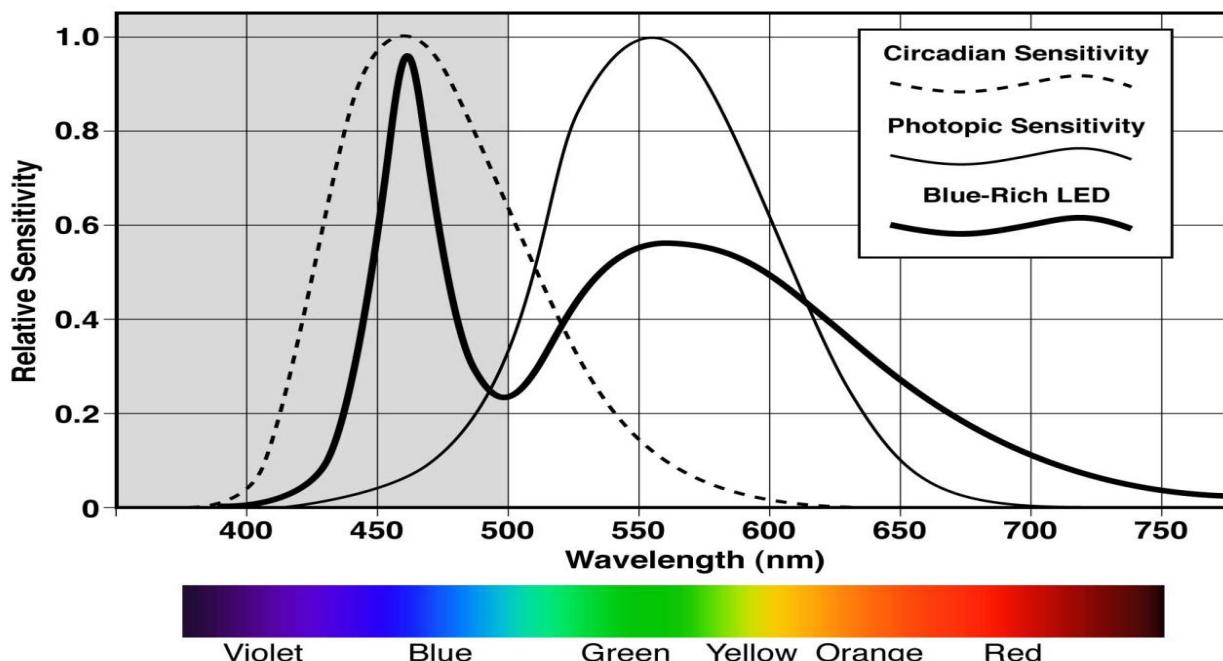


Figure 1

A comparison of the power spectrum of a standard white-light LED, a tricolor fluorescent lamp, and an incandescent source. The radically different power spectra can look similar when viewed directly by the eye, irrespective of how much blue emission is present.

A graph from the International Dark Sky Association shows how the excess blue light emitted by LED's corresponds with peak sensitivity of sleep (circadian) rhythms:



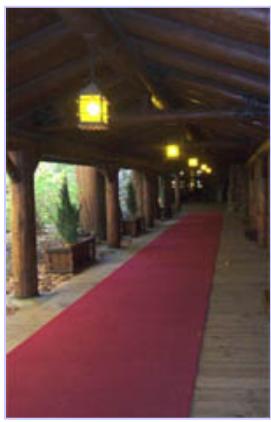
An LED light on Eagle Valley Road, Highland Falls, NY



An LED light courtesy of the International Dark Sky Association:



Yosemite National Park:





American Medical Association (June 2012):
“Pervasive use of nighttime lighting
disrupts various biological processes,
creating potentially harmful health effects

related to disability glare and sleep **disturbance.”**



International Agency for Research on Cancer (May 2007):
“Shiftwork that involves circadian disruption is
probably carcinogenic to humans.”



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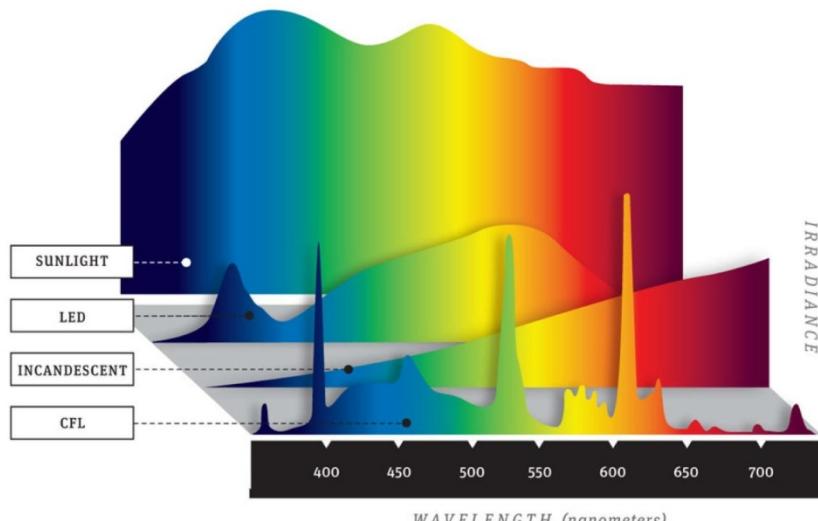
To Whom It May Concern:

This letter is in support of preventing conversion to LED street lamps. As a physician board certified in sleep medicine, I am very able to state that blue light is one of the biggest threats to the human circadian rhythm and health. For patients with sleep issues (and quite frankly nearly everyone), proper avoidance of blue light is necessary to maintain physiologic melatonin production and appropriate circadian rhythms. Circadian biologic disruption has been linked to disease across the board including but not limited to diabetes and metabolic disorders , neurodegenerative disorders, mental illness, and likely many forms of cancer. Unfortunately, the emitted spectrum of LED lighting is high in the most disruptive frequency for melatonin secretion.

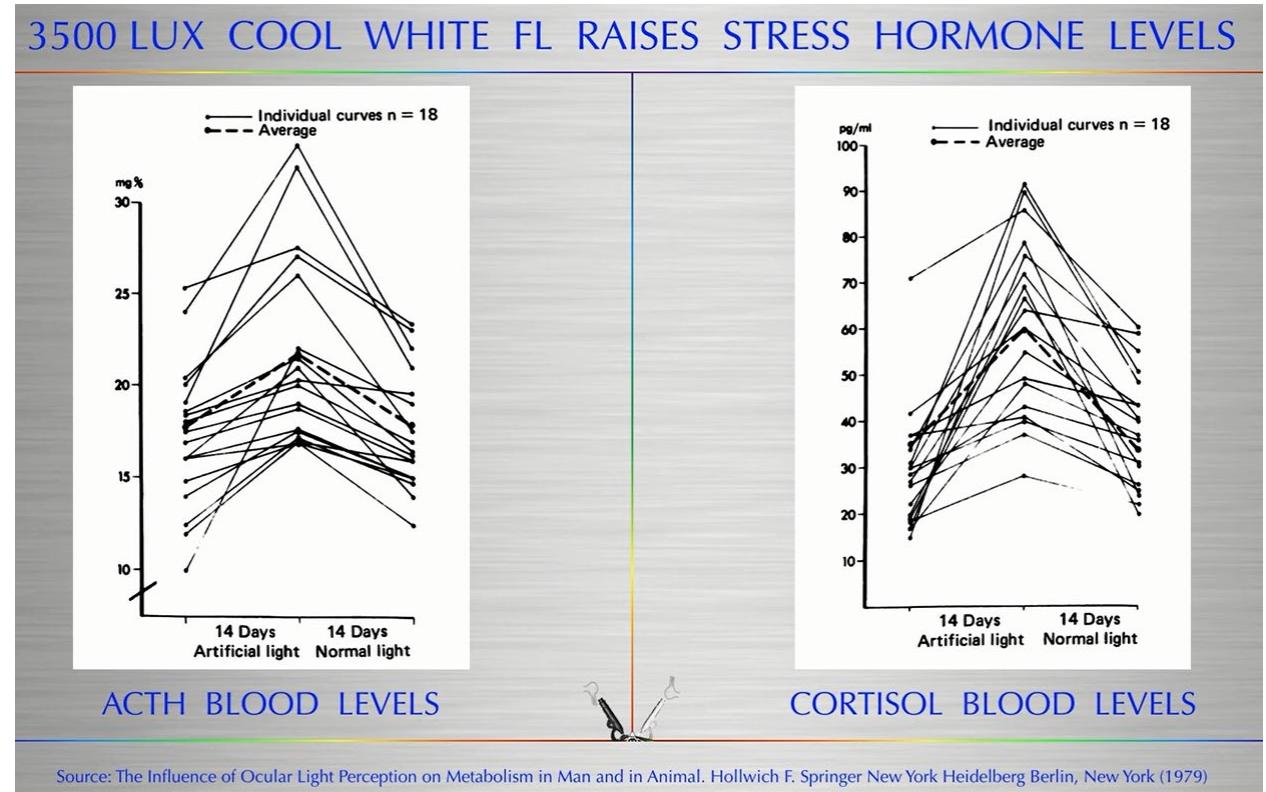
The blue light hazard is not complex and is well studied with scientific rigor, despite arguments to the contrary. In fact, I would say the scientific literature is packed with such support; however, the general medical community and public awareness of this fact is poor, likely due to the inconvenient truth. Whilst most artificial lighting is damaging in such regard, homeowners have a personal choice for the lighting

environment they allow in their home, and take ownership of the health consequences. However, street lighting is especially important, since it is on all night and is unchangeable. Such a choice will not only open up liability for the town, but also limit revenues as the community and public at large come to realize the impact of such lighting on human physiology and thus will stay home at night.

Color temperature is not enough of a measure to determine the safety of artificial lighting, although it would suggest that lower color temperature is less damaging than higher color



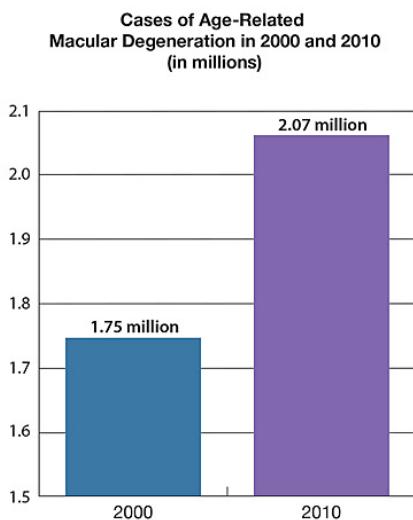
temperature. With that being said, it has been shown that at 3500 Kelvin cool white artificial light increased stress hormone release during illumination. During the day the sun's color temperature changes from 1,800 Kelvin at sunrise to 16,000 Kelvin at sun down. It does so with a relatively flat frequency response and much closer ratios of red and blue in the spectrum. The main problem with LED lighting is the paucity of purple and red visible spectrum as well as the heavy blue spike as compared to the spectrum of the very natural sun we evolved under.



Stating that the research on melatonin suppression by blue light is not sufficient is not accurate. Very clear suppression of melatonin has been found, and this finding has been upheld by research studies. What has been controversial is the physiologic mechanism in the eye responsible for it. The lighting industry's response of lack of research on the "temporal-spatial-spectral distribution of optical radiation" seems like a semantic diversion to me as I've seen no clinical data on such measures. In fact, searching for these terms on pubmed did not reveal any medical/clinical research, instead revealing articles on "benchtop" optical and biochemical research. Melanopsin is the photopigment responsible for the circadian rhythm in the intrinsically photosensitive retinal ganglion cells (ipRGC) and responds to blue light from ~430-465nm in wavelength. This is the retinal controller of our circadian rhythm. It is well known that when melanopsin is excited by such blue light, it suppresses melatonin secretion. There should be no doubt in anyone's mind that light stimulating the eye with this frequency at night is deleterious to the circadian rhythm and melatonin expression.

To say the causal relationship between melatonin suppression and circadian disruption is not proven is inaccurate. Melatonin is the gatekeeper hormonal conductor of sleep. Without it your sleep quality suffers. It is also an anticancer hormone. Studies have already demonstrated melatonin to suppress tumor growth, and the lack of melatonin's estrogen suppression may be one of the possible causes to its link to breast cancer. Regardless of the actual pathophysiology, the link is clear and reproducible. Further research is needed on the pathophysiology to reveal possible new treatments, not to further the already clear relationship in the literature. This situation is not "stimulation" of the circadian system. Creating a hormonal imbalance changes the functioning of the whole human adversely. Ask any woman who has low thyroid levels before discovered upon laboratory testing how her body felt and you will understand more clearly how this works. Based on the current state of research, it is clear that the stimulus (artificial light of which LED is included) creates a clear response (melatonin suppression) which is responsible for downstream effects (many already described but likely many more to be elucidated) which create disease.

Additionally, the heavy amounts of blue light in LED fixtures have been shown to cause photochemical damage to the retina. Research has shown photochemical, photomechanical and photothermal damage of retinal cells caused by light. In rod dominant mammals, blue light has been shown to cause apoptosis and necrosis of photoreceptors and retinal pigment epithelium. While human studies are lacking, one thing is clear: the incidence of retinal diseases is rising. While a clear answer has not been identified, our increased usage of blue heavy lighting is likely to blame.



I acquiesce that unfortunately the subclass of "street lamp LED" has not been studied. While unfortunate, this should not preclude our common sense judgment that there is an effect. Also, the study of such effect would be difficult based on the possibility of so many different exposures based on location of the lamps. It should be noted that residents may all have different lifestyles that would create differing exposures to such lamp light. It is obvious that

this would make such research difficult, and further study is going on in clinical areas that may create more therapeutic options. I can't currently see much need for any such study with the current evidence in the literature.

The AMA's warning on these lights should be heard. I can see the difficulty for the AMA to advise completely against this money-saving change to LED lights, when there doesn't appear to be a clear option to recommend in its stead. A lack of a better option should not influence a decision for planning which will adversely affect the public's health. Even GE has acknowledged these issues in their own position paper on light and sleep from 2014. The industry's lack of immediate response should not encourage our use of already made products that have ill effects on the human condition.

I strongly urge public health be considered in this decision making. The cost savings of LED lamps may be surpassed by health costs and legal bills in the near future.

Sincerely,

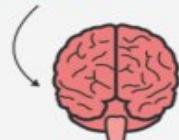


Joshua Rosenthal, MD

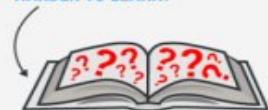
How exposure to blue light affects your brain and body

BY DISRUPTING MELATONIN, SMARTPHONE LIGHT RUINS SLEEP SCHEDULES. THIS LEADS TO ALL KINDS OF HEALTH PROBLEMS:

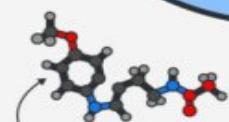
The disruption to your sleep schedule might leave you distracted and impair your **MEMORY** the next day.



A poor night's sleep caused by smartphone light can make it **HARDER TO LEARN**.



Over the long term, not getting enough sleep can lead to **NEUROTOXIN** buildup that makes it even harder for you to get good sleep.

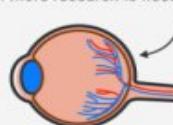


People whose melatonin levels are suppressed and whose body clocks are thrown off by light exposure are more prone to **DEPRESSION**.



By disrupting melatonin and sleep, smartphone light can also mess with the hormones that control hunger, potentially increasing **OBESITY RISK**.

There's some evidence that blue light could damage our vision by harming the **RETINA** over time – though more research is needed.



Researchers are investigating whether or not blue light could lead to **CATARACTS**.



There's a connection between light exposure at night and the disturbed sleep that come with it and an increased risk of breast and prostate **CANCERS**.





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Your Vision, Your Look, Our Focus

October 17, 2016

Dear Nassau County Government Leaders,

I am writing to inform you of the hazards imposed by the installation of LED (light emitting diode) street lamps in our towns. The potential devastating effect on public health should be further explored before moving forward and finalizing these plans. Most people do not realize how LED lights affect health, both short and long term. This letter should provide a good basic understanding of this very important issue. Along with many of my colleagues, the American Medical Association, and researchers and health scientists, it is my opinion that installing LED lighting in street lamps represents a threat to public health.

The typical visible spectrum encompasses wavelengths between 390 to 700nm. Blue light, including violet, encompasses light wavelengths between 390 and 500nm. Scientific studies worldwide are pointing to the fact that the shorter wavelengths or high energy visible (HEV) “blue light” are harmful to human health. These shorter wavelengths are between 390 and 450nm. Another short wavelength and higher energy emitter than blue is UV (ultraviolet light). UV is invisible to the human eye. We all know that UV light is harmful to our skin and our eyes. We have developed ways to protect ourselves, reducing damaging effects from UV wavelengths, with sunscreen and sunglasses. Do we need to wait for 100 percent public awareness to protect ourselves from HEV?

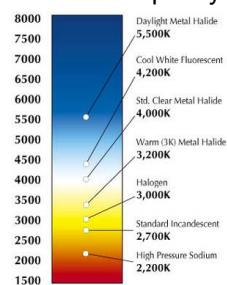
To put it simply, overexposure to blue light presents a major health issue to which the public is unaware. Years ago, the only exposure we had to HEV light was the sun. I would consider this short-term exposure. Outdoors we were exposed, indoors we were not. Today we are also exposed to HEV via LED bulbs, smart phones, tablets, television screens, computer screens and CFL (compact fluorescent) bulbs. This creates issues for long term exposure. Studies have shown that it is the cumulative or total exposure to HEV light over time that causes both short and long term medical problems. The high cost of medical care is also highly associated with our exposure to blue light as will be explained below.

The public should know that HEV light is not all bad and a certain amount of HEV light exposure is needed to enhance vitamin D production in our body. Vitamin D is responsible for strong bones and protects in a host of other health problems. Photo-therapeutic benefits of blue light have also been demonstrated to help with jaundice and SAD (seasonal affective disorder). That being said, anyone who reads the newspapers or watches the news has read or heard about increases in obesity, cardiovascular disease, cancer, and ADHD (attention deficit hyperactivity disorder), just to name a few medical issues affecting this country and others. Many of these issues are directly linked to sleep disruption; one of the major causative factors being overexposure to HEV light. In order for our bodies to get ready for sleep, our brain secretes the hormone melatonin. Melatonin production is suppressed when we are exposed to HEV light (smart phone/tablets/computer screens/TV/LED and CFL bulbs in our home). If we cannot

sleep, we tend to eat, increasing our risk for diabetes, and heart disease. Our children cannot concentrate in school and sometimes are falsely labeled with ADHD. And to top it off, schools are installing LED lights in the classroom, further exposing our children to HEV light. Everyone should also know that certain cancers have been directly linked to HEV exposure.

Short term and long term effects on vision and eye health have also been well documented by optometrists, ophthalmologists and researchers. In my vision care practice, my associates and I have seen the short term effects include glare, eye strain, headaches, red eyes, dry and burning eyes, irritability, and reduced workplace productivity. The long term effects of HEV exposure that we see are more devastating. People are getting cataracts at an earlier age. Adult onset macular degeneration (AMD) has historically been considered to be a disease of people over age sixty-five. Based on today's overexposure to HEV, scientists are concluding that AMD will soon be a disease of people in their forties. AMD, for those who are not familiar, causes a loss of central vision, severely diminishing a person's ability to read, perceive colors, and walk without bumping into objects or tripping off a curb. Reduced mobility is one of the major causes of falls and injury in the elderly. We are very fortunate that eyeglass lens companies have developed and are constantly improving lens products that block much of the HEV wavelengths to which we are exposed. Some of these lenses have a champagne color, softening the visible "blue" in HEV blue lights. Your eye doctor must be consulted before wearing these lenses or any other tinted lens at night.

Let me recap why we are overexposed? LED or CFL lights in our home and workplace, flat screen computer monitors used by 90% of the public, smart phones and tablets used at least 4-5 hours per day or more, and then another 3 to 4 hours or more of watching our flat screen TVs. There is no getting away from HEV exposure.



Choosing to save money on energy, businesses and government offices like those in Nassau County are installing LED lighting in many of their offices and parking lots, exposing their employees to HEV light. Locally, public works projects in Great Neck and other municipalities are proposing to install LED street lamps adding to our exposure. Indeed, LED lights are less expensive to maintain, but are they worth negatively affecting public health? It is very important to note that although a lower color temperature (3000K and below) (see figure below) is better for glare, all LED street lamps emit a certain amount of HEV light. Most municipalities who have already installed LED street lamps have installed the higher color temperature lighting, a cheaper alternative but more glare producing and higher HEV exposing blue-white light. Residents in these areas are up in arms. After public outcry, the city of Davis, CA spent hundreds of thousands of dollars installing warmer LED fixtures just a month after installing white LED lamps. Phoenix residents are also complaining and they are also considering retrofitting to a lower color temperature light. Locally, LED street lamp installations in NYC and Brooklyn are being seen as a disaster by residents. They feel as if there is a film crew outside their windows and the light is spilling into their homes, disrupting their lives. Most don't even realize that they are being exposed to additional HEV light that has potential to lead to health issues.

In June, 2016, the American Medical Association declared that LED lights are a public health risk. The AMA states, "*As a result of a potential risk to public health from excess blue light exposure, the AMA report encourages attention to optimal design and engineering features when converting from existing lighting technologies to LED. These include requiring properly shielded outdoor lighting, considering adaptive controls that can dim or extinguish light at night, and limiting the correlated color temperature (CCT) of outdoor lighting to 3000 Kelvin (K) or lower. Color temperature is a measure of the spectral content of light, and higher CCT values indicate a greater amount of blue light that a fixture emits.*"

It is my opinion that a municipality should be 100 percent certain that the installation of LED lights is in the best interest of the residents. Based on current research and best practices for reducing light pollution, it is just a matter of time that lawsuits are filed for either installing the wrong LED lamps or improperly shielding them in public areas. Technology is wonderful but can also be dangerous. There needs to be a balance between public benefits, health concerns, and cost savings. With what I have learned in the past few years about health issues and LED exposure and from the complaints that patients reveal in my eye care practice, my vote is for public safety.

Feel free to contact me with any questions.

Sincerely,

Joel N. Kestenbaum, OD
drkestebnbaum@optixeyecare.com

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Dear Mary Jane

Many people have said that LED lights are energy efficient. The problem is, they are not people efficient.

A cheap light that causes eye damage, disrupts people's sleep patterns, contributes to rising rates of breast cancer (because it stimulates too much estrogen production), and is damaging to the health of people in our town who are sensitive to it, is not cheap, and is not efficient.

For myself, even looking at the little LED lights in electronic equipment feels like suddenly being stabbed in the eye with a laser.

I do not understand why, in this time of economic stress for so many people, we need to spend all this money on the latest thing, when the lights we have now work very well, and do not cause people health problems.

Consider that Monsanto was just successfully sued for billions of dollars for their product (Glyphosate) that caused cancer. Do we want lawsuits here from the women who live here who suddenly find that the town has an increased rate of breast cancer?

A lot of new technology ideas are terrific. LED lights are a new technology that looks good up front, and is terribly costly to our eyes, our bodies and our lives. It's a high price to pay for a few kilowatts of electricity. And the resulting medical costs will be brutally expensive.

Furthermore, it is absurd to think that the equivalent intensity/temperature of an LED streetlight is similar to the existing light, some people will still be affected by the LED's unnatural effects on the human eye and body.

Janet Wilkie