

Persons with Light Sensitivity Disabilities and the ADA

By Soft Lights

The Americans with Disabilities Act protects those with light sensitivity disabilities. This includes, but is not limited to, the following conditions:

- Migraines
- Autism
- Post-Traumatic Stress Disorder
- Epilepsy
- Bipolar Disorder
- Thyroid Cancer
- Breast Cancer
- Prostate Cancer
- Lupus
- Detectors of subsensory flicker.

Any project that has government involvement is required by federal ADA law to ensure that those with light sensitivity disabilities are not harmed by any artificial lighting used for the project.

Light Emitting Diodes are a recent technological innovation that has rapidly become the standard for illumination. However, this change came about so rapidly that government regulations have not yet been reworked to accommodate this new technology. While light sources such as the sun, a candle or an incandescent bulb emit radiation spherically in 4π steradians, a light emitting diode is a flat-source emitter with very different mathematical characteristics. This means, for example, that if a previous regulation specified a maximum luminous intensity in candela, this measurement is no longer useful for LED lighting because of the non-uniform peak luminance of LED. The proper measurement for LED would be luminance, measured in candela per square meter.

In addition to luminance, the Spectral Power Distribution has typically not been previously regulated. Blue wavelength light controls biological circadian rhythms and tells biological systems when to sleep, when to wake, when to eat, when to be energetic and when to relax. The blue light suppresses the hormone melatonin and with low melatonin levels, humans become energetic. Thus, with natural sunlight, the blue wavelength light makes us alert at noon. However, as the sun sets, the amount of blue wavelength is reduced, the melatonin levels increase, and we begin to feel sleepy. Note that sunlight has approximately even power distribution across all visible wavelengths as shown in Figure 1.

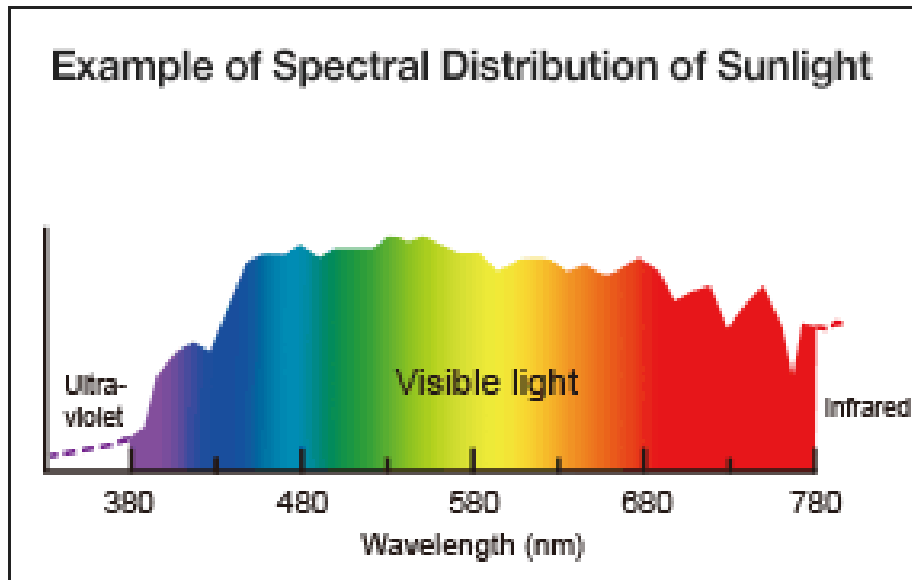


Figure 1 - Sunlight Spectral Power Distribution

During sleep, our hormonal system works to clear away waste products that were generated during the day and our cells are repaired. The natural night resource with the stars and the phases of the moon is of fundamental importance to the proper functioning of our biological system. Figure 2 shows the natural night resource on a moonless night.



Figure 2 - Stars at Night

Figure 3 shows the Spectral Power Distribution of a 2700 Kelvin color temperature incandescent light. Notice the small amount of blue wavelength light and the large amount of red wavelength light.

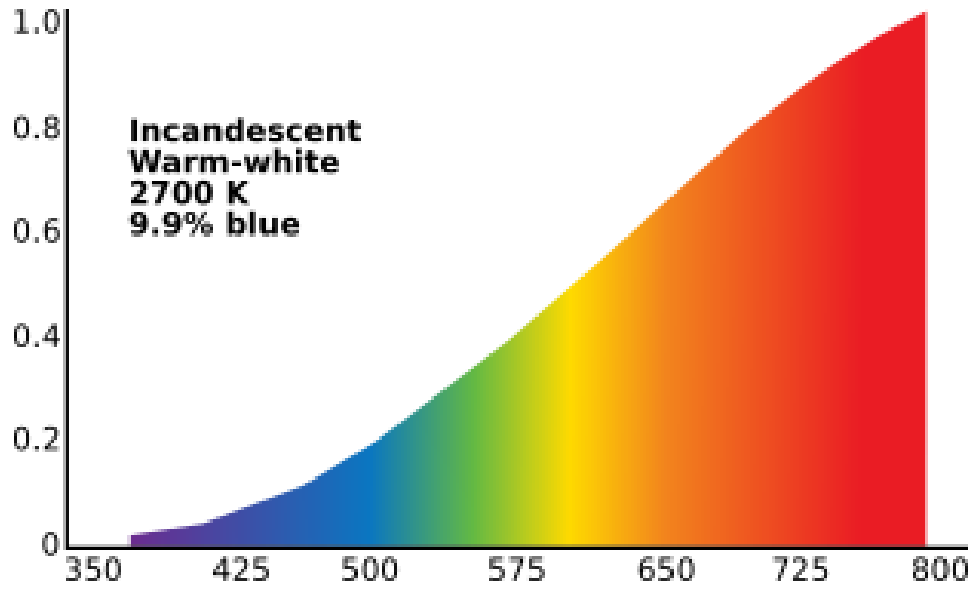


Figure 3 - Incandescent Spectral Power Distribution

Figure 4 shows the Spectral Power Distribution of a 4000 Kelvin color temperature LED light. Notice the large spike of blue wavelength light at 450 nanometers and the small amount of red wavelength light.

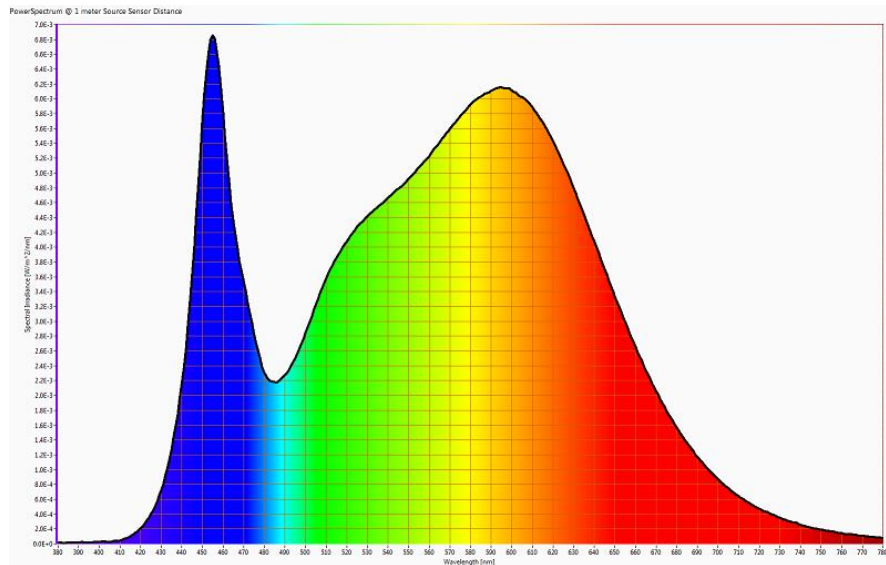


Figure 4 - LED 4000K Spectral Power Distribution

The blue wavelength at around 450nm light is high energy light. This light enters the eye and bounces around and causes glare. Note that even though Figure 4 shows a high color temperature that might be similar to mid-morning sun, the Spectral Power Distribution of LED light is very different than the SPD of natural daylight.

High luminance LED flashing lights can be devastating for people who suffer from migraines, or those with PTSD, epilepsy, or autism. A city that uses high luminance LED flashing lights on their police vehicles, utility trucks or crosswalk signs is most likely discriminating against persons with light sensitivity disabilities. Here is a video of a utility vehicle. <https://youtu.be/ma0hGwHivO4>



People with light sensitivity disabilities may be significantly impacted by LED lights due to the unnatural spectral power distribution and unnatural non-uniform luminance. It is currently debatable as to whether LED lighting should be used at all for the purpose of illumination. Human biology may simply not be able to process this type of unnatural light. While that debate moves forward, what is undebatable is that LED light can have a severe impact on sensitive receptors. Here are some examples:

Migraine Sufferer – LED light can trigger a debilitating migraine

Autism – The unnatural characteristics can trigger severe emotional trauma.

PTSD – A high luminance light may trigger flashbacks.

Epilepsy – A flashing, high luminance light may trigger a seizure.

Cancer – LED light at night can affect the immune system and reduce the body's ability to fight cancerous cells.

Lupus – LED light can trigger inflammation and pain.

Detectors of Subsensory Flicker – LED lights cycle on and off and poorly designed electronics will exhibit a flicker that is noticeable by some sensitive receptors. Flickering lights can be unbearable emotionally.

Under Title II of the Americans with Disabilities Act, government agencies must not discriminate against those with light sensitivity disabilities. The ADA law requires that government agencies consider the needs of sensitive receptors when making policy decisions. For instance, if a policy decision is made

to switch from High Pressure Sodium streetlights to LED, the government must engage in a meaningful way with the disability community to ensure that the policy change will not discriminate.

While there are almost no standards for lighting to ensure protection of those with light sensitivity disabilities, we propose the following guidelines to help government agencies better protect sensitive receptors.

- 1) Protect the natural night resource. Any artificial light reduces the ability to fight cancer and increases risks of psychological disorders and premature births. Therefore, only add artificial light as a last resort.
- 2) If artificial light is added, use a very low color temperature from 1000K (more red) to 2200K maximum (more orange).
- 3) Shield and diffuse the light. A bare-diode LED can easily trigger a migraine.
- 4) Use low luminance and low luminous flux. We suggest a peak luminance maximum of 100 candela per square meter and a maximum luminous flux of 400 lumens.
- 5) Do not use flashing/strobing/blinking lights. A person with autism can be mesmerized by such lights and lose spatial awareness. If the government agency still decides to use such a flashing light, ensure that the peak luminance maximum is 50 candela per square meter and that the light has a ramp-up and decay time so as not to appear as a digital on/off.
- 6) Require that all LED lighting use electronics that do not produce subsensory flicker.

A government agency that applies these recommendations to their lighting policies will be well positioned to meet federal ADA requirements for those with light sensitivity disabilities.

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