

New Mexico Night Sky Protection Act

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Lighting Ordinances in New Mexico

Galen Gisler

for the New Mexico DarkSky State Council

2023 December 1

(Some) New Mexico Lighting Ordinances

Alamogordo	1999	shielding, curfews, NSPA, watts, lps, amortization
Albuquerque *	2022	shielding, cutoffs, watts, footlamberts, footcandles, lumens
Angel Fire	2005	shielding, curfews, lumens
Belen	2016	shielding, NSPA
Bernalillo County	1997	watts, lps, shielding, cutoffs, curfews, amortization
Capitan	2022	shielding, glare, trespass
Carlsbad	2016	shielding, glare, curfews, NSPA
Cloudcroft	2005	shielding, glare, trespass, curfews, watts, lps, hps,
Clovis	2019	shielding, cutoffs, trespass, footlamberts, lumens ,
Corrales	2022	shielding, glare, trespass, lumens
Doña Ana County	2020	shielding, NSPA
Elephant Butte	2004	shielding, watts, curfews, trespass,
Española	2020	shielding, curfews, <4000K CCT
Farmington	2021	shielding, cutoffs, trespass, lumens
Hatch	1993	shielding
Jemez Springs	2020	shielding, trespass, curfews, footcandles, lumens, lux, <3500 K CCT
Las Cruces	2016	shielding, cutoffs, trespass, curfews, BUG, lumens
Las Vegas	2022	shielding, glare, trespass, curfews, NSPA, footcandles
Los Alamos County	2023	principles, lighting zones, trespass, curfews, amortization, BUG, lumens, lux, <2700 K CCT
Los Lunas	2002	shielding, footcandles
Los Ranchos	2003	shielding, trespass, curfews
Magdalena (proposed)	2022	NSPA, shielding, watts, curfews
Mesilla	2006	shielding, glare, trespass, curfews, amortization, NSPA, lumens
Rio Rancho	2020	shielding, glare, trespass, NSPA, footcandles, lumens
Roswell	2020	shielding, NSPA, <4000K CCT
Ruidoso	2022	NSPA
Santa Fe *	2011	shielding, glare, trespass, lps, watts, footcandles
Santa Fe County	2016	shielding, trespass, NSPA, footcandles, lumens
Socorro	1991	shielding, lps, watts, warm white preferred
Silver City	2015	shielding, cutoffs, glare, trespass, lps, hps, led, curfews, watts, footcandles, lumens
Taos	2007	shielding, cutoffs, glare, trespass, watts, lumens
Tijeras	2020	shielding, curfews, lumens
Valencia County	2005	shielding, NSPA

Steps toward the new Los Alamos Lighting Ordinance

January 2020	In-person meeting of representatives from Valles Caldera, Bandelier, Jemez Springs, and PEEC (the Los Alamos Nature Center) to preserve night skies
March 2020	Pandemic: formation of virtual “Jemez Mountains Night Sky Coalition” via monthly Zoom meetings.
Summer 2020	Jemez Springs adopts modern new lighting ordinance. Thanks, Amalio Madueno and Mayor Roger Sweet. Valles Caldera and Bandelier both seek IDSP certification.
Autumn 2020	First attempts at drafting a modern lighting ordinance for Los Alamos. Used models from Jemez Springs, Flagstaff, Tucson, Moab UT, Springdale UT, and the IDA/IES Model Lighting Ordinance
Winter 2020-21	We learned that Los Alamos County was undertaking a re-drafting of its Development Code, which included the old (1998) lighting ordinance. I signed up to sit on the Citizens’ Advisory Panel.
Winter 2021	Valles Caldera achieves IDSP status; Bandelier’s application pending lighting retrofits. We submit our draft Los Alamos ordinance to the Development Code team.
All 2021 & 2022	Bi-weekly lunchtime meetings of the Citizens’ Advisory Panel and the Development Code Team. I learn about parking, building & fence heights, zoning, before getting to lighting.
Summer 2022	The Development Code Team finally gets to lighting. Our most recent draft accepted almost verbatim, except for unacceptable changes. Arguments ensued.
Autumn 2022	The Development Code Team calls in Clanton & Associates as independent experts. Most of what we wanted was put back in the draft.
Winter 2022-23	The Los Alamos County Council approves the new Development Code, including the new Lighting Ordinance in a succession of public hearings with no further changes.

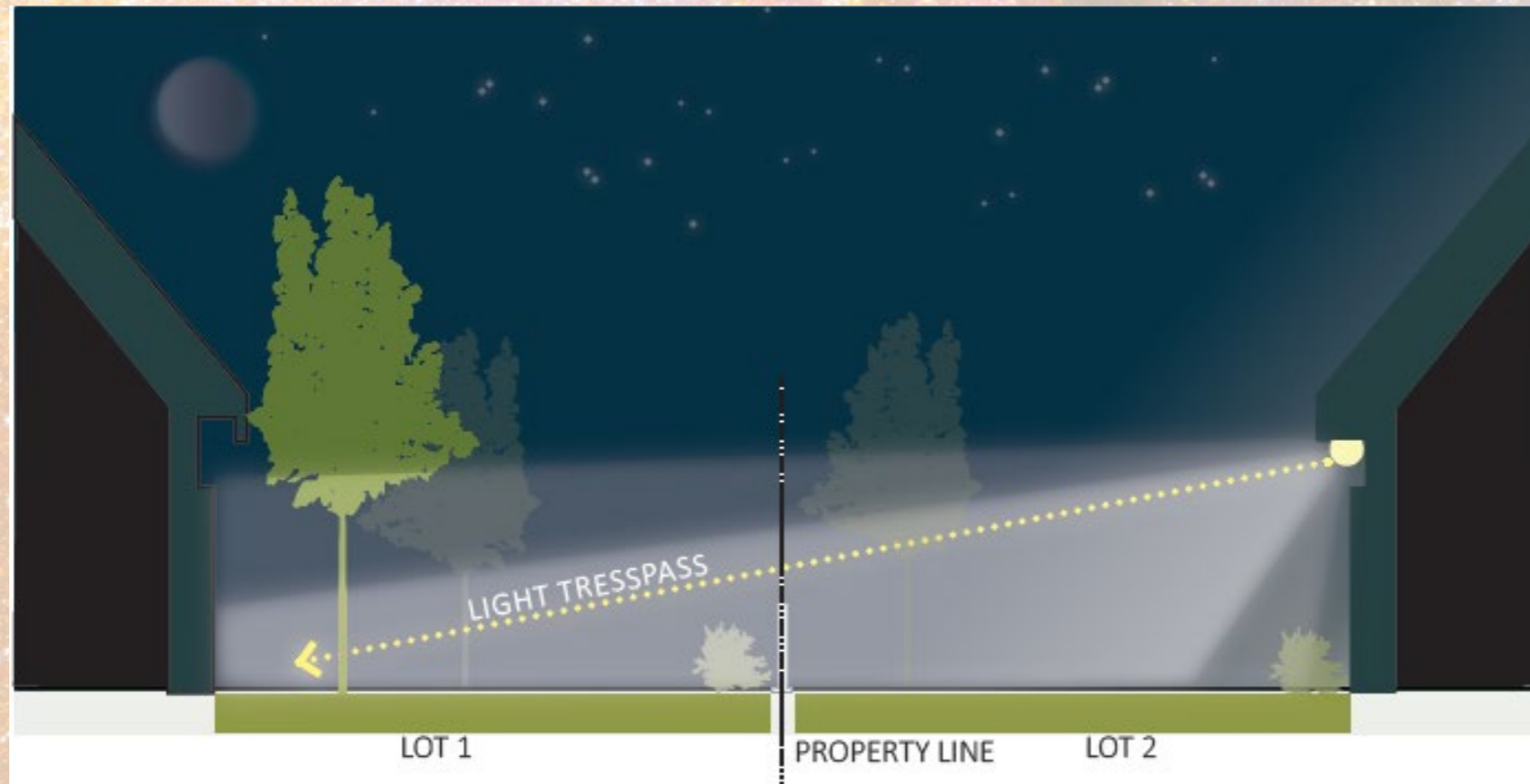
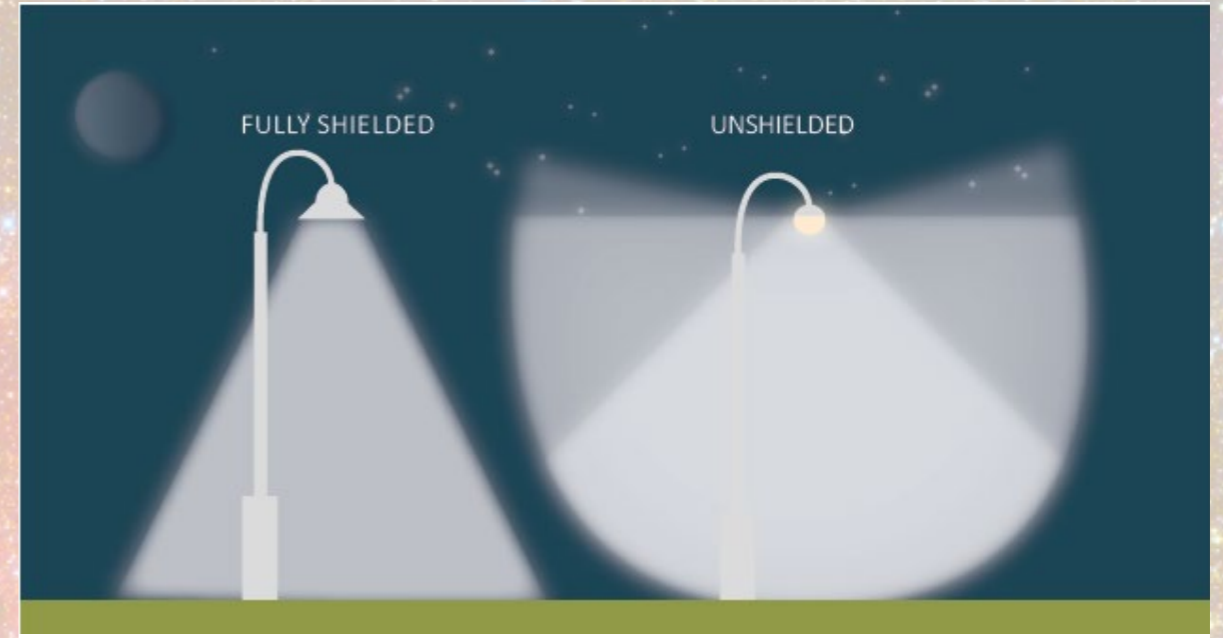
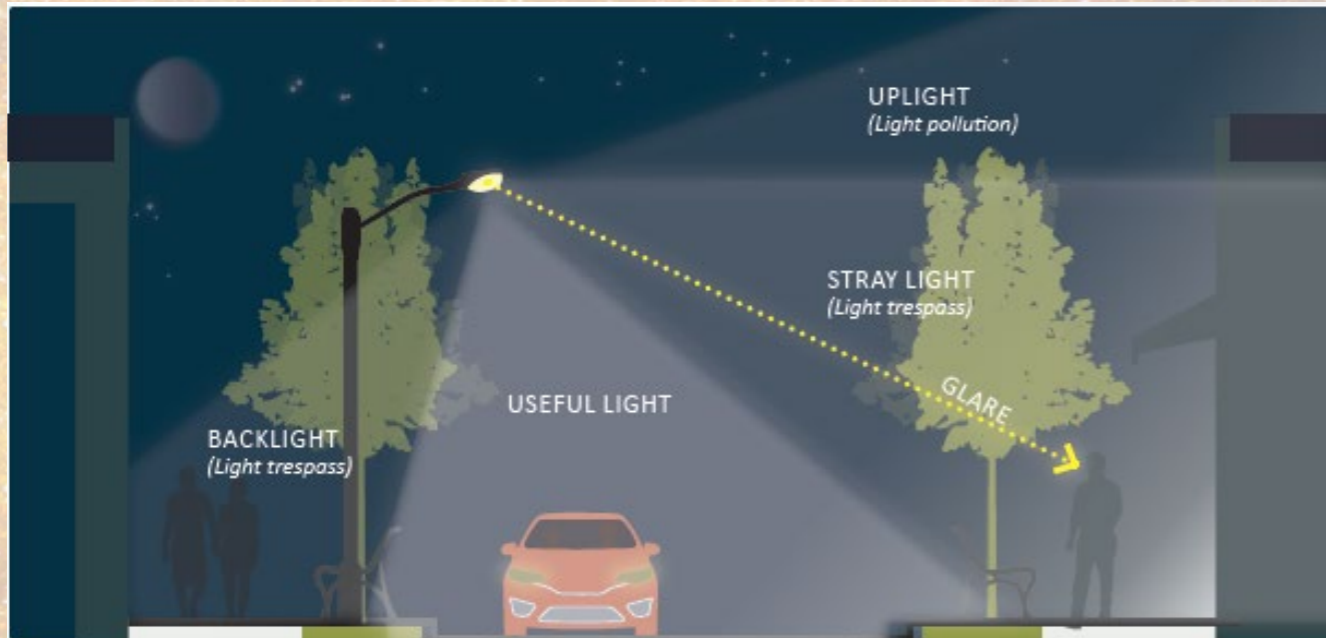
Lighting is Technical and Quantitative!

luminous flux	lumen (lm)	cd sr	total visible light emitted by a source
luminous intensity	candela (cd)	lm/sr	total visible light per unit solid angle
illuminance	lux footcandle	lm/m ² lm/ft ²	total visible light incident on a surface per unit area
luminance	cd/m ² footlambert	lm/sr/m ² lm/sr/ft ²	visible light incident on a surface per unit area from a given direction
correlated color temperature	degrees Kelvin (K)		temperature of a black-body radiator whose color best matches that of the source
color rendering index	nondimensional		ability to distinguish test color samples under illumination by a source; controversial, perhaps obsolescent in favor of TM-30?
BUG rating	nondimensional		scale to restrict relative amount of backlight (B), uplight (U), and glare (G) from a luminaire

A lighting ordinance should include (my opinion):

principles of good lighting	include these as a preface
applicability	all outdoor lighting, with limited and well-justified exceptions and exemptions
lighting zones	residences should be darker than commercial areas; preserves and protected areas unlit
$B < 2$, $U = 0$, $G < 2$	limit glare and trespass; careful with varied topography
trespass illuminance limits in lux	vary by lighting zone
brightness limits in lumens	per site, or per acre, vary by lighting zone
individual luminaire limits in lumens	vary by lighting zone
average roadway illuminance in lux	use ANSI/IES RP-8-21, vary by roadway type; for a municipality, specify street names
curfews and dimming	business lights should be off after business hours; roadway lighting can be dimmed late at night; motion sensors should be used for security lighting
maximum CCT, minimum CRI	< 2200 K with CRI > 65 is achievable; even better would be elimination of all wavelengths less than 500 nm; with exceptions for sport lighting
sport and recreation lighting	conform to ANSI/IES RP-6 and strictly limit trespass
require lighting plan submittal	to municipal authorities for approval before every building or remodeling project
amortization & education	nonconforming installations must be made conforming after a certain period (5-10 yrs)
education rather than enforcement	publicize importance of darkness for health, wildlife, and culture; peer pressure preferred to penalties

Illustrations are essential!



But they often suffer in reproduction, especially in code archives.

Five Principles of Responsible Outdoor Lighting

Purpose of the Five Principles

When designing lighting for nighttime applications, there's more to think about than lighting for the task...

Be conscious about how light affects people, flora and fauna, and the view of the night sky.

Be responsible

Only light *what* is needed, *when* it is needed, *in the amount* needed.

The effects of light pollution

People

Plants

Pollinators

Wildlife habitat & migration

View of the night sky

Culture and heritage

Energy use & climate change

Five Lighting Principles for Responsible Outdoor Lighting



Responsible outdoor lighting is

1 Useful

Use light only if it is needed

All light should have a clear purpose. Consider how the use of light will impact the area, including wildlife and their habitats.



2 Targeted

Direct light so it falls only where it is needed

Use shielding and careful aiming to target the direction of the light beam so that it points downward and does not spill beyond where it is needed.



3 Low Level

Light should be no brighter than necessary

Use the lowest light level required. Be mindful of surface conditions, as some surfaces may reflect more light into the night sky than intended.



4 Controlled

Use light only when it is needed

Use controls such as timers or motion detectors to ensure that light is available when it is needed, dimmed when possible, and turned off when not needed.



5 Warm-colored

Use warmer color lights where possible

Limit the amount of shorter wavelength (blue-violet) light to the least amount needed.



Practical use

- **DarkSky Policies & Programs:**

- DarkSky Approved applications follow the Principles (Sports Lighting & Lodging)
- DarkSky Responsible Outdoor Light at Night (ROLAN) education program
- DarkSky Policies for legislation and ordinances use the Principles as main guidance

- **IES Standards:**

- Utilize Five Principles as guidance for outdoor lighting standards
- Set maximum light levels, for instance

DarkSky Policy Templates

State legislation and municipal ordinances:

- **Policies follow Five Principles**
 - Simple measures, not overly complex
- **Mutli-tiered approach**
 - Recognizing that there is no “one size fits all”
- **Policies will:**
 - Be free and accessible
 - Contain understandable and accurate definitions, concise language
 - Be practical, to achieve meaningful outcomes
 - Provide guidance on how to work with states and municipalities for adoption



DarkSky
INTERNATIONAL

Contact

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DarkSky.org



Who is the IES?

IMPROVING LIFE THROUGH QUALITY OF LIGHT™

Mission Statement

The Illuminating Engineering Society seeks to improve the lighted environment by bringing together those with lighting knowledge and by translating that knowledge into actions that benefit the public.

The IES was established in 1906; over 119 years of history. Over 7,500 members. Membership from over 65 countries. 96 active local Sections. Accredited Standards Development Organization (SDO) under American National Standards Institute (ANSI).

In addition to other valuable member services, the Society publishes nearly 100 varied publications including recommended practices (RPs) on a variety of applications, design guides (DGs), technical memoranda (TMs), and publications on energy management (EMs) and lighting measurement (LMs).



IES Belief Statements

- Light is vital to life; it is as important as air, food, water and shelter
- Light **and the absence of light** affect human vision, health, and behavior
- Lighting should enhance comfort and aesthetics, important components of the built environment
- Lighting designs should respond to human needs, while **minimizing negative environmental impacts**
- Lighting quality should be a priority at the onset of any design and be maintained throughout the construction process
- Sustained research is necessary to quantify lighting benefits that improve the quality of life
- Lighting Standards and policies should be based on the consensus of topic experts informed by scientifically validated data
- As the lighting authority, the IES believes that **collaboration with other non-lighting organizations on lighting policies and regulations is essential for the benefit of the public interest**
- Global collaboration and member participation are vital to the long-term viability of the lighting community
- Education is critical** to maintaining a robust, dynamic lighting community and for continued professional growth



2023



IES Post Covid Priorities

- **Expand and update Education offerings and Standards development**
- **Standards will now be updated every 2 years**
- **Expand membership locally, regionally and globally**
- **Partner with other organizations and industry pillars**



Submission Breakdown:			
Code	Type	No.	Percent
IS	Inc Sources	1	0.5%
FS	Fluorescent Sources	2	0.9%
MS	Metal Halide Sources	3	1.4%
SS	HPS Sources	1	0.5%
LS	LED Sources	29	13.5%
HB	HID Ballasts	1	0.5%
FB	Fluorescent Ballasts	6	2.8%
LD	LED Drivers	16	7.4%
EM	Emergency	0	0.0%
EL	Emergency LED	1	0.5%
CO	Controls	16	7.4%
AC	Accessory	8	3.7%
FL	Fluorescent Fixtures	2	0.9%
ML	Metal Halide Fixtures	1	0.5%
LL	LED Fixtures	121	56.3%
RE	Research	2	0.9%
PU	Publications	2	0.9%
MA	Materials	1	0.5%
DT	Design Tools	2	0.9%
		215	100.0%



2012

Convergence of technologies is accelerating
i.e. controls and sensors

LED's are better for Dark Skys
LED's are more controllable than
traditional outdoor light sources

Standards are progressing with
Dark Skies in mind

2023

Where are the IES and DarkSky headed...

April 16, 2020

Darksky International and the Illuminating Engineering Society (IES) announce a strategic collaboration to address the global issue of light pollution that negatively affects our environment and the human condition.

The Boards of Directors of DarkSky and IES have unanimously adopted Five Principles for Responsible Outdoor Lighting. By joining forces, DarkSky and IES seek to guide the outdoor lighting industry in the U.S. and beyond to be more socially and environmentally responsible.

The Five Principles for Responsible Outdoor Lighting that unite our organizations are based on simple ideas; limit light at night to where and when it is needed, don't overlight, and be sensitive to environmental concerns.

In recent years, light pollution has increased globally by two percent per year. The indiscriminate use of electric lighting at night leads to at least \$3BN in wasted energy in the U.S. alone. This wasted light can harm wildlife, imperil important astronomical research, and can obscure our view of the star-filled sky.

Future avenues for engagement between the two organizations include convening experts to advance a new metric to characterize the color quality of outdoor electrical lighting, assessing and updating the Model Lighting Ordinance adopted by IDA and IES in 2011, and working to educate and inform municipalities and individuals about how these principles can be applied to save money and advance quality lighting that protects the night.



LIGHT TO PROTECT THE NIGHT

Five Principles for Responsible Outdoor Lighting



Illuminating
ENGINEERING SOCIETY



USEFUL



ALL LIGHT SHOULD HAVE A CLEAR PURPOSE

Before installing or replacing a light, determine if light is needed. Consider how the use of light will impact the area, including wildlife and the environment. Consider using reflective paints or self-luminous markers for signs, curbs, and steps to reduce the need for permanently installed outdoor lighting.

TARGETED



LIGHT SHOULD BE DIRECTED ONLY TO WHERE NEEDED

Use shielding and careful aiming to target the direction of the light beam so that it points downward and does not spill beyond where it is needed.

LOW LIGHT LEVELS



LIGHT SHOULD BE NO BRIGHTER THAN NECESSARY

Use the lowest light level required. Be mindful of surface conditions as some surfaces may reflect more light into the night sky than intended.

CONTROLLED



LIGHT SHOULD BE USED ONLY WHEN IT IS USEFUL

Use controls such as timers or motion detectors to ensure that light is available when it is needed, dimmed when possible, and turned off when not needed.

COLOR



USE WARMER COLOR LIGHTS WHERE POSSIBLE

Limit the amount of shorter wavelength (blue-violet) light to the least amount needed.



Relevant IES Standards

ANSI/IES LP-11-20

Lighting Practice: Environmental Considerations for Outdoor Lighting

The introduction of exterior lighting will often have a profound effect on the natural world. It may change complex ecosystems in ways that are not immediately obvious or easily discernable. For this reason, **the first question should always be, is lighting necessary?** This should be followed by, **what is the specific task to be lighted, how much luminance is required, and for what duration? When designing exterior lighting the environmental effects should always be considered.** Lighting is also a sustainability issue, since the energy consumed often comes from power generation that produces its own environmental impacts. While exterior lighting may be necessary for mobility, the feeling of safety, and commerce, used indiscriminately, the light pollution produced by it reduces the enjoyment of the natural nighttime sky, and may create biodiversity issues (see ANSI/IES LP-10-20, Lighting Practice: Sustainable Lighting – An Introduction to the Environmental Impacts of Lighting).



Relevant IES Standards

ANSI/IES RP-43-22

Recommended Practice: Lighting Exterior Applications

Lighting for the outdoor environment is different from lighting for an interior space. The natural cycle for light is to arrive from the sun and sky during the day and from the stars and moon at night, with gradual changes between dark and light. However, electric lighting is different from the natural cycle in numerous ways.



Relevant IES Standards

ANSI/IES LP-2-20

Lighting Practice: Designing Quality Lighting for People in Outdoor Environment

The charter of this Lighting Practice (LP) is to provide pedestrian-oriented lighting recommendations for the reassurance, safety, comfort, amenity, and enjoyment of pedestrians in outdoor environments. These recommendations provide a basis for lighting and space design, including the flexibility for application of multiple methods.

This LP makes **recommendations beyond illuminance** - which, considered alone, is inadequate as a means of accomplishing the complete visual experience necessary for pedestrian based tasks. Rather, it takes **a comprehensive approach and makes recommendations based on zonal light level allowances, glare, adaptation, spectrum, and contrast while addressing safety, timing, and the need for reassurance. Application of these recommendations will ultimately enhance the pedestrian's visual experience while also respecting the environment.**

A number of IES Recommended Practice (RP) documents provide recommendations and design guidelines for specific outdoor lighting applications. This document is not intended to supersede those publications. Instead, it supplements the various RPs, augmenting them in subject areas not otherwise addressed.



Relevant IES Technical Memorandums

ANSI/IES TM-37-22

Technical Memorandum: Description, Measurement, and Estimation of Sky Glow

Numerous human benefits derive from the use of light at night. Unfortunately, increased brightness of the night sky, or sky glow, also directly accompanies the alteration of natural lighting levels by human-based light sources. The first, most easily observed effect of sky glow is decreased visibility of the night sky. Associated expressions of concern began almost simultaneously with the widespread deployment of electric lighting, and are now common around the globe.

ANSI/IES TM-15-20

Technical Memorandum: Luminaire Classification System for Outdoor Luminaires

Use of ANSI/IES TM-15-20's "BUG" (Backlight, Uplight, and Glare) classifications for outdoor lighting fixtures to ensure that only well-shielded fixtures are used; no uplight for area and street lighting is allowed in any zone



Other related IES Standards

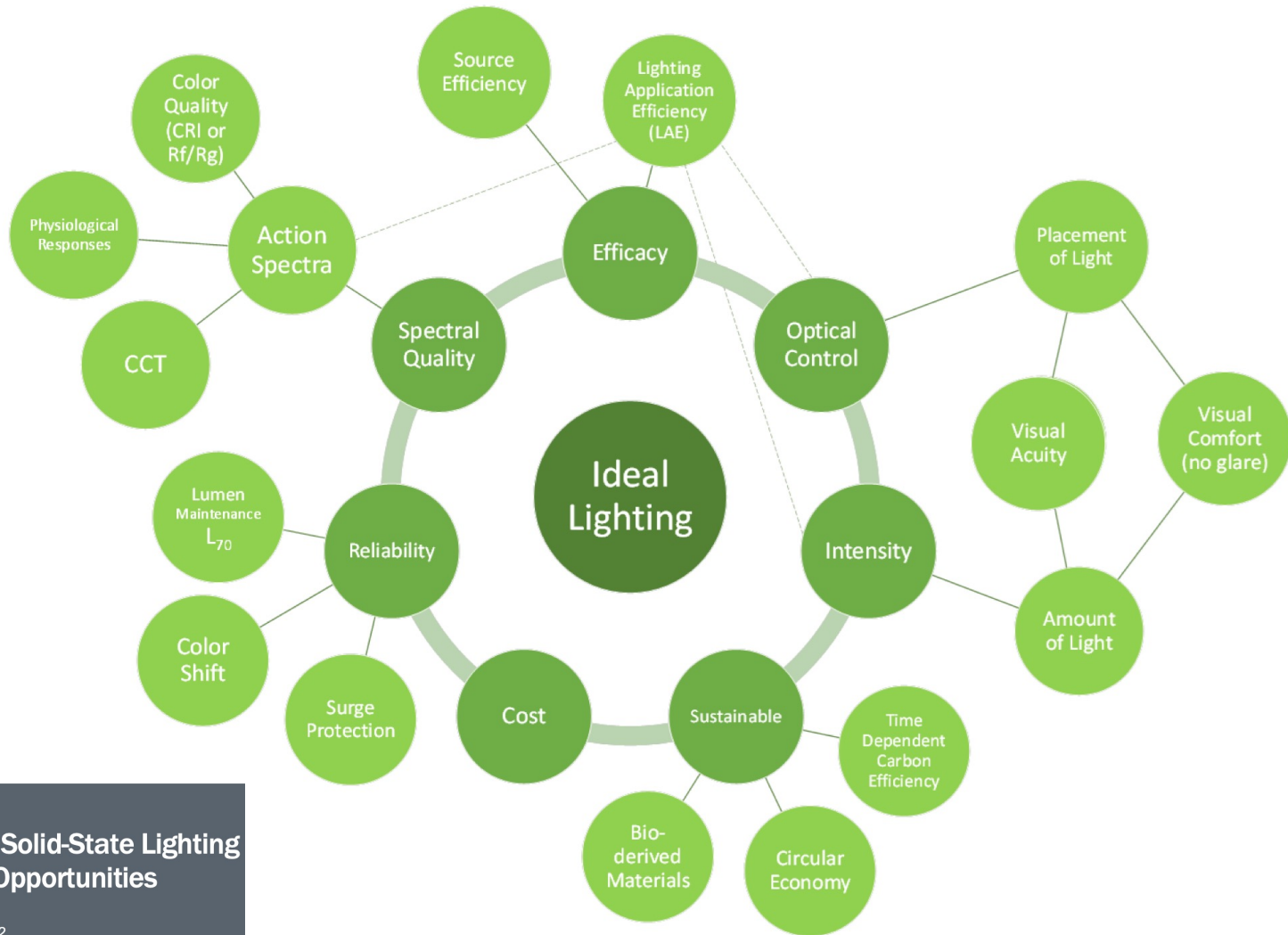
RP-37-22 Lighting Airport Outdoor Environments

RP-8-21 Roadway Lighting

G-1-22 Guide for Security Lighting for People, Property, and Critical Infrastructure

LP-16-22 Control Narratives







Where we could work together...

- **Increased presence in the consumer market not just commercial lighting**
- **Consumer Education – promote “Good outdoor lighting”**
- **Adoption of improved state and local energy codes**
- **Revision and adoption of the Model Lighting Ordinance**

eLearning portal

eLearning Home

GETTING STARTED

My eLearning Dashboard

FAQs

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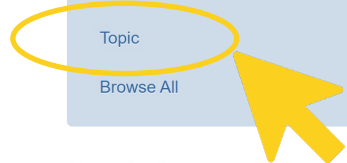
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Intro to Lighting



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THANK YOU!

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Outdoor
Lighting

Roadway

elearning.ies.org/topic

Standards Access

Individual Standards: Buy any Standard, any time, in PDF.

The image shows a screenshot of the IES (Illuminating Engineering Society) website. The top navigation bar is dark blue with the IES logo on the left and links for About, Membership, Advocacy, Donate, MY IES, and Sign In on the right. A search icon is also present. Below the navigation bar, a dropdown menu is open, showing options: Books, Individual Standards (circled in yellow), Lighting Library Subscription, Research, LD+A Magazine, and Educational Courses. A yellow mouse cursor points to the 'Individual Standards' option. Another yellow circle highlights the 'IES Webstore' link in the top navigation bar, with a yellow arrow pointing to it. In the bottom right corner, there is a large magnifying glass graphic containing the text 'Add to cart'. The background of the website features a dark image of a building with the text 'Learn more about our community of lighting professionals' and 'WE BELIEVE'.

Standards Access

Library Subscription: Access all standards, cloud-based, collaborative, always up to date.

The image shows a screenshot of the Illuminating Engineering Society (IES) website. The top navigation bar is dark blue with the IES logo on the left and links for 'About', 'Membership', 'Advocacy', 'Donate', 'MY IES', and 'Sign In' on the right. A search icon is also present. Below the navigation bar, a dropdown menu is open under the 'Resources' link, listing 'Books', 'Individual Standards', 'Lighting Library Subscription', 'Research', 'LD+A Magazine', and 'Educational Courses'. The 'Lighting Library Subscription' option is circled in yellow, and a yellow arrow points to it. Another yellow arrow points to the 'Resources' dropdown menu. In the bottom right corner, a magnifying glass graphic contains the text 'Subscribe Now'. The background of the website features a photograph of a modern building with a glass facade and trees.

Learn more about our community of lighting professionals

Join us on our journey as we share how our beliefs guide us in our mission to improve life through quality of light.

Subscribe Now

Thank You!

Billy Tubb

IES President 2023-2024

Billytubb@msn.com



Afternoon breakout session

Topics

- Economic development / tourism
- Ecological/biological issues/mitigation
- Ordinances, monitoring, enforcement (2)
- Education, public outreach and engagement
- Preservation of dark sky place and establishment of new ones (2)
- NM Night Sky Protection Act (2)
- Upcoming items in Albuquerque and Santa Fe
- Open discussion : whatever you want!

- Possible questions:
 - what are some specific actions in these areas, both short-term and longer-term?
 - How can different organizations contribute?
 - What are 3-5 year outcomes, and the short-intermediate term actions to get them?

Morning presentations : building a broad coalition for dark skies

- Cody Johnson : NM True
- Grady Owens : NM Skies
- McKinney Briske : BLM
- Peter Lipscomb : NM State Parks
- John Winscott / Brian McLoughlin (State lands office)
- Zandra Fleming : NMOGA
- Brian Jensen : Santa Fe Conservation Trust
- Trish Cutler : WSMR/DoD/Audubon
- Anna Walker : NM Biopark
- Catherine DeMaria / Marisela LaGrave : Dark Sky Land
- John Briggs : Astronomical Lyceum
- Antoine Ribaut : Magdalena Astronomical Society
- Eileen Ryan : New Mexico Tech
- Robert Johnson : Starfire Optical Range

Closing

- Meeting summary
- Actions/Feedback/etc: newmexico@darksky.org
- Resources for website :
 - nmdarksky.github.io (address/look may change, but want to accumulate content)
- Future chapter endeavors
- Future meetings

Thank you!