



## A New Day for Outdoor Lighting

The Model Lighting Ordinance, Outdoor Energy Codes, Fixture Labeling, and How It Will Change the Lighting Industry

**James R. Benya**  
PE, FIESNA, FIALD, LC



BENYA LIGHTING DESIGN

**Cheryl R. English**  
FIESNA, LC



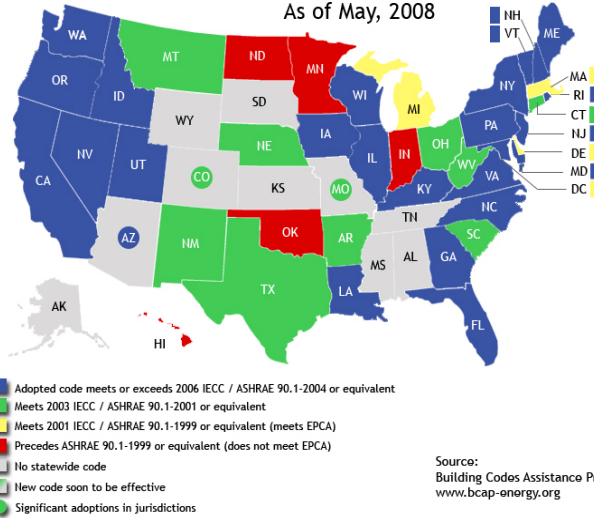
## What We Will Cover Today

- Opportunity & reality for outdoor lighting
  - Outdoor Energy Codes
  - Ordinances
  - Q&A
- 
- *Outline handouts saved over 5,000 pages of paper*
  - *Copies of slides are available for download at:*  
[www.benyalighting.com](http://www.benyalighting.com)



# Energy Codes

## Commercial State Energy Code Status As of May, 2008



## Outdoor Energy Codes ASHRAE IESNA 90.1 - 2007



- Lamp efficacy of at least 60 lumens per watt or controlled by a motion sensor
- Exterior lighting power allowance is the sum of the sum of the individual LPDs
  - Allows an additional unrestricted 5% of that total
  - Tradable and non-tradable surfaces are defined
- Controls
  - Automatic shutoff required
  - Photosensor or astronomical time switch for dusk to dawn installations
- Various exemptions
  - Signage, athletic playing areas, temporary lighting, industrial production, transportation sites, theme & amusement parks, public monuments, registered historic structures or buildings and others



## Power Allowance Tradable Surfaces



- Unused watts from one area may be used in another area
- Allowed LPDs:
  - Uncovered parking areas and drives 0.15 w/sq.ft
  - Walkways less than 10' wide 1.0 w/linear foot
  - Walkways 10' wide or greater 0.2 w/sq.ft
  - Plaza areas 0.2 w/sq.ft
  - Special feature areas 0.2 w/sq.ft
  - Stairways 1.0 w/sq.ft
  - Main entrances 30 w/linear foot
  - Other doors 20 w/linear foot
  - Canopies and overhangs 1.25 w/sq.ft
  - Outdoor sales areas 0.5 w/sq/ft
  - Street frontage for vehicular sales 20 w/linear foot



## Power Allowance Non-tradable Surfaces



- Use-it-or-lose-it
  - Building Facades
  - ATMs
  - Entrances and gatehouse inspection stations at guarded facilities
  - Loading areas for emergency services
  - Drive thru windows at fast food restaurants
  - Parking near 24-hour retail entrances



## Changes Expected in ASHRAE 90.1-2010



- Introducing a four lighting zone system
  - LZ1 – Developed areas of national parks, state parks, 'forest land' and rural areas
  - LZ2 – Areas predominantly consisting of residential zoning, neighborhood business districts, light industrial with limited nighttime use and residential mixed use areas
  - LZ3 - All other areas
  - LZ4 – High activity commercial districts in major metropolitan areas as designated by the local jurisdiction
- Allows for a base site allowance of:
  - LZ1 – 500W / LZ2 – 600W / LZ3 – 750W / LZ4 – 1300W
- An example, for 'Parking areas and drives':
  - LZ1 – 0.04 w/sq.ft
  - LZ2 – 0.06 w/sq.ft
  - LZ3 – 0.10 w/sq.ft
  - LZ4 – 0.13 w/sq.ft



## IECC 2009 – Code Proposals



- EC 147 - Power Density by Lighting Zone
  - Four zone definition – same as ASRHAE 90.1-2007
  - Power density limits - aligned with ASRHAE 90.1-2007
  - 5% additional power allowance





## IECC 2009 – Code Proposals

- EC 150 – Shielded Lighting
  - A fixture that emits no more than 2.5% of its direct light above 90 degrees from horizontal and no more than 10% of its direct light between 80 and 90 degrees from horizontal.
  - Only fully shielded or shielded fixtures shall be permitted unless a lighting plan is submitted showing that the use of alternative fixtures would provide greater energy efficiency than any comparable lighting plan using fully shielded fixtures.
  - Various exemptions including:
    - Luminaires with an output of 150 Watts incandescent or less light output.
    - Facades, flagpoles, landscape, works of art
    - Historic lighting or decorative luminaires to support the architectural theme.
    - Outdoor sports area lighting
    - Signs and temporary lighting
    - Installations where the safety will be compromised
    - Installations where there is an increased energy use or cost



## Title 24 2008



- Officially adopted July 1 2009
- Very similar to ASHRAE/IESNA 90.1-2010
- Revised to a new “layered” method
  - General lighting power allowance for hardscape
  - Allowance includes base watts + perimeter watts + area watts
  - Layers of use it or lose it allowances added for special areas and uses



## Product Regulations Mercury Vapor Ballasts



- EPL 2005 Federal legislation
- Ban on sale or import of MV ballasts manufactured after 1/1/08
- Conversion to MH systems need to address lamp containment considerations



## Product Regulations Metal Halide Luminaires



- EISA 2007 Federal Energy Regulation
- Becomes effective 1/1/09

Ballast Type	Wattage	Ballast Efficiency
Magnetic Probe-Start	150-500 watts	94%
Pulse-Start	150-500 watts	88%
Non-Pulse Start Electronic	150-250 watts	90%
Non-Pulse Start Electronic	251-500 watts	92%

- Federal law preempts all states except CA

*Also covers indoor MH luminaires*



## Lighting Ordinances

- Local law (e.g. city or county)
- Within jurisdiction of adopting agency
- Can't conflict or supersede state or federal law
- Generally deals with community specific issues that are often described as nuisances



## About Lighting Ordinances

### Ordinances DO

- Serve as local "code"
- Regulate all lighting on private property
- Address when the code is enforced
- Spell out penalties

### Ordinances DON'T

- Regulate highways, roadways or street lighting systems
- Regulate signs



## Historically

- Estimated 10,000 or more lighting ordinances in USA
- Worldwide, countless local regulations
- Principal concerns of most ordinances: obtrusive light



## Typical Ordinances

### Nuisance Motivated

- Pole height limits
- Setback requirements

### Safety/security motivated

- Footcandle requirements

### Astronomer Motivated

- Cut off requirements
- LPS required

### Latter Day Dark Sky Motivated

- Lumen-based cutoff requirements

### Latter Day Astronomer Motivated

- Lumens per acre limits



## Problems with Historic Ordinances

- No national standard
  - Every one written locally
  - Mostly based on a few “popular” ordinances
- One size does not fit all
  - Most ordinances only work for small towns and suburbs



## Problems with Historic Ordinances

- Many use a source lumen maximum for non-full cutoff lighting
  - Anybody see the problem here?
- Most require footcandle calculations and measurements under all circumstances
  - This is not even remotely practical



## Problems with Historic Ordinances

- Many have footcandle requirements
  - Most require more light than IESNA recommends
- Many fail to differentiate between commercial and residential uses
  - Fail to address the practical differences



## Problems with Historic Ordinances

- Many have pole height limits
  - Another “brilliant” idea
- Many fail to differentiate between streetlights, commercial and residential uses
  - Fail to address the practical differences
  - Fail to address that the largest polluter is usually the city itself



## Problems with Historic Ordinances

- Most have technical errors
  - Candle-feet per square foot and other doozies
- Most fail to address a whole community
  - Flag lighting
  - Building floodlighting
  - Landscape lighting
  - Sports lighting
  - Outdoor sales



## The Model Lighting Ordinance



## The MLO

- Joint effort of the International Dark Sky association and the Illuminating Engineering Society of North America
- Under development for ~~two three~~ four years
- Getting ready for public review (and this time we really, truly, absolutely mean it)



## Preamble

Curtail and reverse the degradation of the night visual environment and night sky by minimizing artificial sky glow, glare, and obtrusive light

Conserve energy and resources to the greatest extent possible

Permit reasonable uses of lighting for night-time safety, utility, security, productivity, enjoyment and commerce including temporary lighting and seasonal lighting.

Help protect the natural environment from the damaging effects of night lighting from man-made sources.



## Basis

- IESNA Lighting Handbook Ninth Edition
- IESNA RP-33 (Outdoor Environmental Lighting)
- IESNA RP-20 (Parking)
- IESNA RP-2 (Retail)
- CIE TC 5.12 (Lighting Zones)
- California Title 24 and ASHRAE/IESNA 90.1 (Energy Code)



## Concept: A National Model

Too many local codes with widely differing requirements

- Limits education
- Prevents standardization
- Encourages do-it-yourself codes with unintended results
- Done in US
  - NEC, IBC, etc.
- Done in other Countries
  - Czech Republic, Australia



## Benefits of a Standard Code

- Better Name Recognition
- Common language
- National education
- Ease of adoption by communities and other bodies
  - Saves money
  - Saves time
- National committee to provide 3 year revision cycle
- Similar to National Electrical Code (US and Canada)



## Absolute Requirements

- Must address broad national interests
  - Astronomers and other dark sky lovers
  - Outdoor sales
  - Safety and security interests
- Must be as scientifically based as possible
- Must be technically correct



## Philosophy

- Readable and enforceable by electricians and electrical inspectors
- Easily checked by planning and building officials
- Repeatable results



## IDA / IESNA Model Lighting Ordinance



- The materials presented in this program relative to the IDA / IESNA MLO represents to work of the task group.
- Nothing in this program has been endorsed by IDA or IESNA at this point in time.



## MLO Applicability

- Exemptions (not regulated by the ordinance)
  - Street & roadway lighting
  - Public monuments and statuary
  - Signs
  - Temporary lighting
  - Others
- Exceptions
  - Special use permits
  - Lighting required by federal, state or provincial laws or regulations



## Lighting Zones

- Corresponds with new IESNA RP-33 definitions
  - **LZ0**: No ambient lighting
  - **LZ1**: Low ambient lighting
  - **LZ2**: Moderate ambient lighting
  - **LZ3**: Moderately high ambient lighting
  - **LZ4**: High ambient lighting
- Definitions include use of curfews



## Lighting that Responds to Nighttime Activity

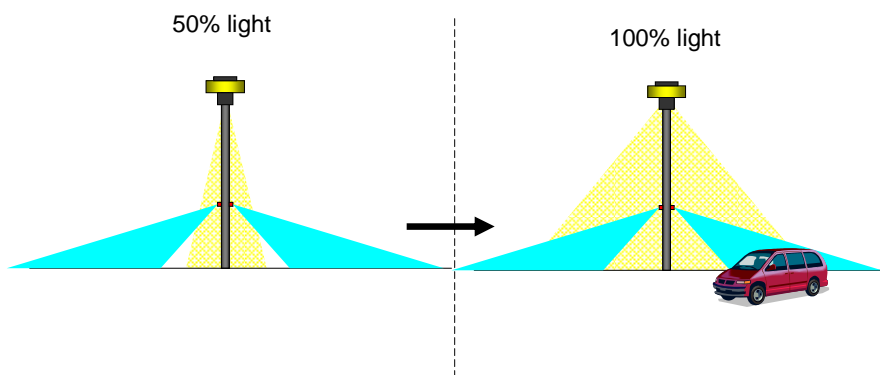


Motion sensor



## Motion Activated Lighting

Wide pattern occupancy sensor system



## Allowed Lumens per Site



**DRAFT**

- Per Parking Space Method (small sites only)
  - Lumen allowance per parking space
- Simple Hardscape Method
  - Lumen per square foot allowance
- Complete Site Method
  - Lumen allowance per site
  - Lumen per lineal foot of perimeter
  - Lumen per square foot allowance
  - Specific use allowance
- Allowance for all methods vary by Lighting Zone



## Two Compliance Methods

**DRAFT**

-  Prescriptive method
  - Simple for inspectors and municipalities
  - Lumen density limit to prevent over lighting
  - Requirements for fixture performance to control:
    - Backlight / Uplight / “Glare”
-  Performance method
  - Lumen density limit to prevent over lighting
  - Detailed analysis allowing flexibility in design where design professionals are involved
  - Requirements for application performance:
    - Skyglow / Light Trespass / Glare

*All criteria based on performance attributes – not product construction*



## The “B U G” System



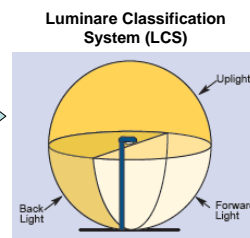
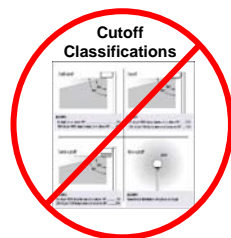
- A prescriptive method to categorize lighting equipment based on product optical control
- 3 digit identification system for lighting products
  - **“B rating”** Backlight or “light trespass” component
  - **“U rating”** Upward light or “skyglow” component
  - **“G rating”** High angle zone or “glare” component
- BUG angles relate directly to the LCS solid angles defined in TM-15

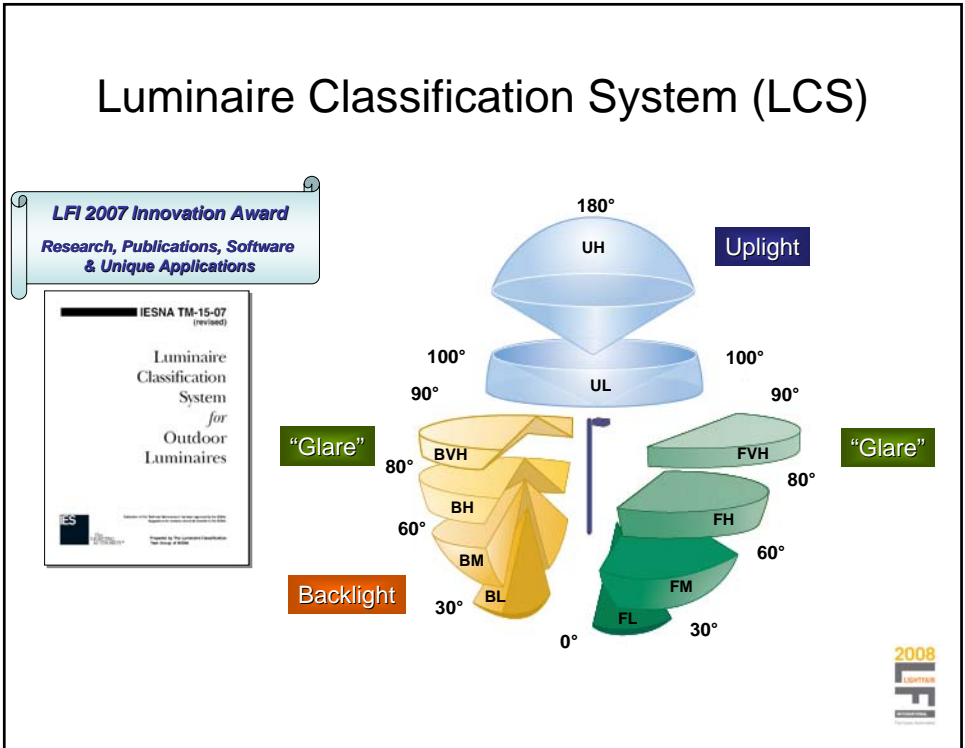


## Luminaire Classification System

IESNA TM-15-07

- New techniques to describe the performance of outdoor lighting.
  - Cutoff Classifications are no longer valid
  - The LCS system addresses more than just high angle brightness





## Defining Product Limits

**Prescriptive Method Maximum Allowable Backlight, Uplight and Glare (BUG) Ratings**


A luminaire may be used if it is rated as follows according to the Lighting Zone of the Site.

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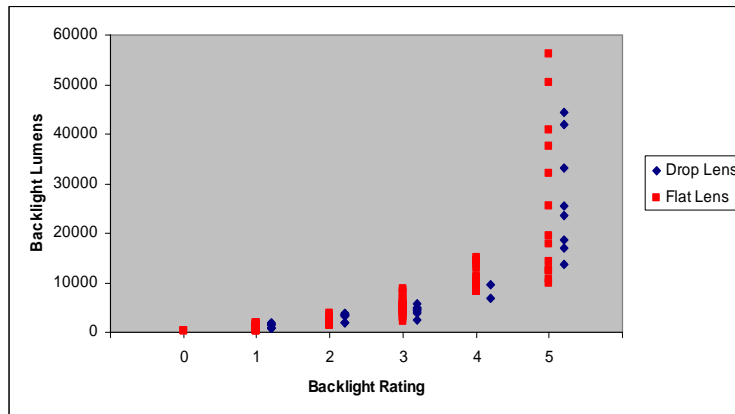
Lighting Zone	Backlight Rating					Uplight Rating	Glare Rating
	>2 mounting heights from property line	1 to 2 mounting heights from property line and properly oriented*	0.5 to 1 mounting height to property line and properly oriented*	<0.5 mounting height to property line, adjacent to a street and properly oriented*	<0.5 mounting height to property line and properly oriented*		
LZ0	B0	B0	B0	B0	B0	U0	G0
LZ1	B0-B1	B0-B1	B0	B0	B0	U0-U1	G0-G1
LZ2	B0-B2	B0-B2	B0-B1	B0-B1	B0	U0-U2	G0-G2
LZ3	B0-B3	B0-B3	B0-B2	B0-B2	B0-B1	U0-U3	G0-G3
LZ4	B0-B4	B0-B3	B0-B2	B0-B2	B0-B2	U0-U4	G0-G4

*Ratings are currently be evaluated based on designer evaluation of solid angle analysis of luminaire optical performance*

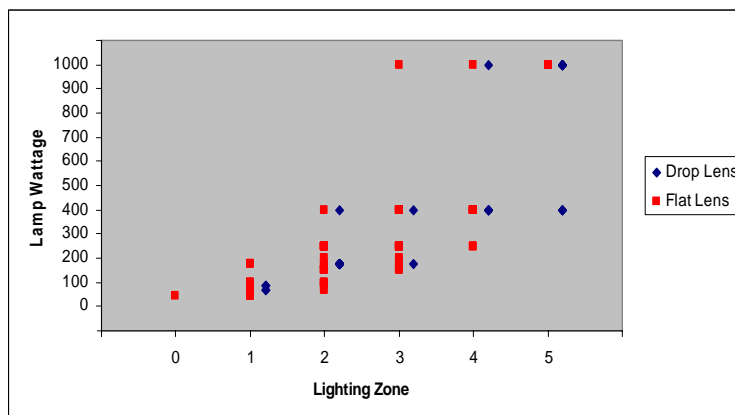
- Based on commercial products – not theoretical photometry
- Includes a broad spectrum of manufacturer's lighting products



## Area Luminaire Backlight Ratings



## Lighting Zone vs. Lamp Wattage

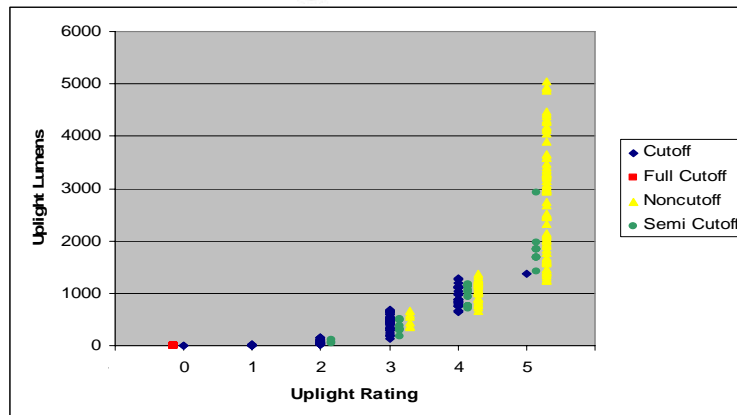


## Findings for Area Luminaires

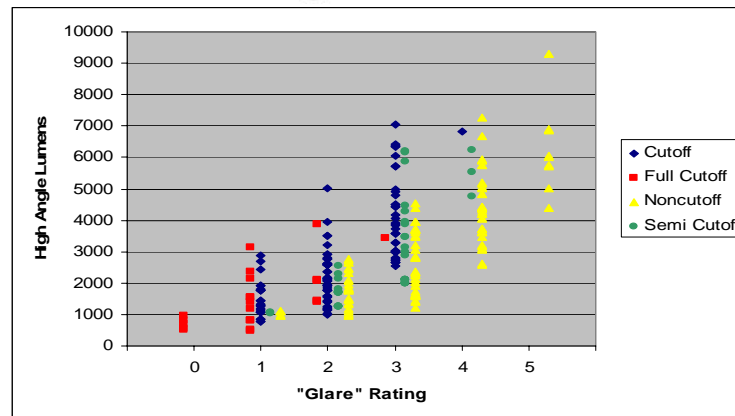
- The “glare” rating almost always is the determining factor for the Lighting Zone
- House side shield often increase the “glare” rating
- Zone 0 and 1 will require low wattage sources
- Zones 2, 3 and 4 can vary widely in terms of source wattage
- Type IV sharp cutoff optics or high quality house side shielding is required when poles are located near the property line



## Posttop Luminaire Uplight Ratings



## Posttop Luminaire "Glare" Ratings



## Findings for Posttop Luminaires

- The upright rating almost always is the determining factor for the Lighting Zone
- Luminaires with internal reflectors or optical refractors have a lower "glare" rating
- Zone 0 and 1 will require low wattage sources
- Zones 2, 3 and 4 can vary widely in terms of source wattage



## Performance Method

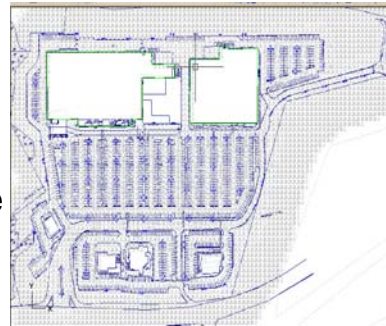
**DRAFT**

- Specific design guidelines addressing overlighting, high angle brightness, light trespass and sky glow
- Requires design modeling and analysis
- Less dependent on equipment performance, more dependent on application design
- Provides more flexibility to meet requirements, but requires a more complex analysis process
- Will be supported by major software systems

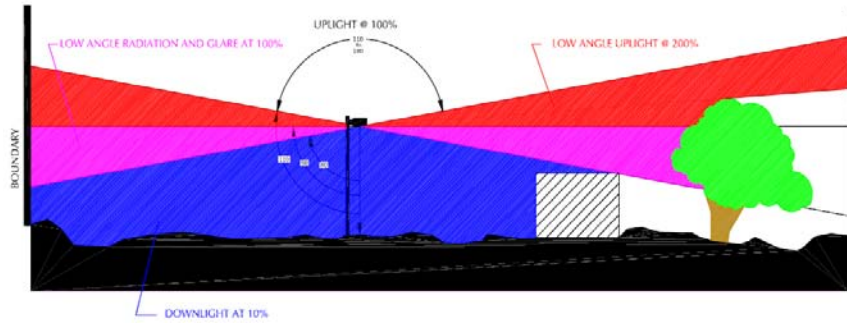


## Performance Method Lumen Allowance

- Hardscape lighting
  - Initial lumen allowance
  - Area lumen allowance
  - Linear lumen allowance
- Specific applications
  - use it or lose it



## Direction of Light Makes a Difference



SECTION THROUGH SITE SHOWING OFF SITE IMPACTS



## Performance Method Skyglow, Light Trespass and Glare Ratings

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### Performance Method Maximum Allowable Skyglow, Light Trespass and Glare (SLG) Ratings

An complete outdoor lighting system analyzed using certified software shall have a numeric rating for Skyglow, light trespass and glare that is equal to or lower than the following

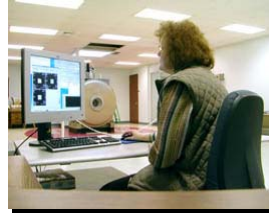
Lighting Zone	Maximum Allowed Skyglow Rating (S)	Maximum Allowed Light Trespass Rating (L)	Maximum Allowed Glare Rating (G)
LZ0	0	0	0
LZ1	1	1	1
LZ2	2	2	2
LZ3	3	3	3
LZ4	4	4	4

***But HOW do I determine the SLG ratings?***



## Performance Method Application Limits

- Limits offensive levels of light exiting the property
  - Determined based on software modeling
  - Based on a standard calculation, the application is assigned a performance rating for:
    - Skyglow
    - Light trespass
    - Glare



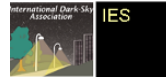
## Special Lighting Applications



- Considerations are included for applications with special requirements
  - Exemptions
  - Exceptions



## IDA / IESNA Model Outdoor Lighting Ordinance



- Work is still in a draft form and has not been approved by IESNA or IDA
- Prevents the installation of offensive lighting
- Provides flexibility with
  - a simple prescriptive selection of luminaires or
  - a comprehensive performance method based on lighting design
- Provides consistency in ordinance development



**Please remember to complete  
the course evaluations.**

**Thank You!**

**We hope you enjoy the  
trade show and conference!**

