



# **Luminaires V2.0 Draft 1 Webinar**

**January 21, 2015  
2:00pm-5:00pm EST**

**Taylor Jantz-Sell LC, U.S. Environmental Protection Agency  
Austin A. Gelder LC, ICF International**



# Today's Agenda

- Introductions
- Specification Process
- Goals

## **Draft 1 Changes**

- Scope
- Definitions
- Allowable Variations
- Certification Path: ENERGY STAR Lamps

## **Break**

- Photometric Performance
  - Efficacy
  - Color

## **Draft 1 Changes Cont'd**

- Lumen Maintenance / Life
- Electrical
- Serviceability
- Thermal
- Safety
- Controls
- Packaging
- Toxics

## **Wrap up**

- Timeline
- Questions/Discussion



# Welcome!

- Introductions
  - In Person
  - Remote / Call-In
- Questions / Comments are Welcome
  - For benefit of everyone, please state name prior to a comment
  - Can ask questions via the webinar at any time



## Goals of the Specification Revision

- Goals
  - Streamline & Simplify
  - Increase Efficacy Levels
  - Adjust Scope and Increase Flexibility



# Specification Development Process Overview

- Timeline
  - Draft 1:
    - Published December 18, 2014
    - Stakeholder Meeting January 21, 2015
    - Comment Period Closes January 30, 2015
  - Draft 2:
    - Estimated release March 2015
    - Webinar & 4 week comment period
  - Final Draft:
    - Estimated release April 2015
    - April 21<sup>st</sup> stakeholder meeting & 2 week comment period
  - Final Specification
    - Estimated release May 2015
  - Effective 9 months later (February 2016)

## Document – Major Changes to Format for Ease of Use:

- Table of Contents
- Reorganized and numbered sections and tables
- Clarified Allowable Variations with new table
  - Explicitly describe required testing for variations

Table 1: Allowable Variations Within Product Families <sup>1</sup>		
Luminaire Attribute	Allowable Variation	Additional Test Data Required for Each Variant
Housing / Chassis	Allowed so long as the light source or lampholder, ballast or driver, and heat sink (as applicable) are integrated into housing / chassis variations in such a way that the thermal performance of the luminaire is not degraded by changes to the housing / chassis.	Thermal measurements of each variation may be required (e.g. ballast case temperature, TMP <sub>LED</sub> , or TMP <sub>C</sub> ).



## Section 1: Scope

- Clarifications made to scope
  - New format for table but same scope
  - Removed references to commercial only products
  - Improved readability
  - Separated out Inseparable
  - Excluded Products listed out to add clarity (though not exhaustive, just examples)

## Section 1: Scope: Additional Retrofits

- Why Add Retrofits?
  - Energy saving solution for existing decorative installations in residential multifamily & hospitality
  - Reduced chance of reversing retrofit
- What Categories/Examples: Non-Directional
  - Wall Sconces
  - Ceiling Mount





## Section 1: Scope: Outdoor Lighting to Directional

- Why change?
  - Confusion caused by outdoor products appearing in both directional and non-directional
  - Limiting uplight from outdoor lighting
  - Security lighting is typically directional
  - Only non-directional are those mounted under ceilings



## Section 1: Scope: Product Types Removed in Draft 1 Luminaires Shipping without Lamps

- Performance of end product is unknown
- Performance figures on QPL and packaging are not necessarily applicable and can be misleading
- Consumers will choose what is available, not necessarily what is recommended
- Halogen:
  - Short lives, inefficient light source
  - Technology has advanced in LED to meet application requirements



## Section 1: Scope: Product Types Removed in Draft 1 – Linear fluorescent

- Shipment Issues – Linear Fluorescent do not survive shipping with fixtures well
- Majority of Luminaires shipped without Lamps were Linear Fluorescent
  - Linear Fluorescent and their Ballasts are already efficient and regulated by the DOE
    - DOE Linear requirements are from 77-97 Lumens / Watt
  - Limited benefit of ENERGY STAR above baseline for linear



## Section 1: Scope: Product Types Removed in Draft 1–HID

- High Intensity Discharge:
  - No products certified to date
  - No knowledge of interest in certifying
  - Technological challenges for color maintenance, start time, etc.





## Section 4: Definitions

- Removed definitions that were not referenced in the specification
- Removed references to HID and Halogen.
- Additions of note:
- Color Tunable Luminaire
- SSL Surface Mount Retrofit Kits
  - A type of solid state lighting product intended to replace existing light sources and systems including incandescent and fluorescent light sources in previously installed luminaires that already comply with safety standards. These kits replace the existing light source and related electrical components. This may employ an ANSI standard lamp base, either integral or connected to the retrofit by wire leads. This category does not include self-ballasted lamps, which are covered by the ENERGY STAR Lamps Specification, or products that utilize the existing ballast or transformer

## Section 4: Definitions: Modified Definition of Light Engine

- Added “*For purposes of this specification, light engines that rely on the luminaire for optical control and/or thermal management...*”
- What Changes Mean:
  - Widens the interpretation of a light engine
  - Allows greater luminaire manufacturer flexibility
  - Allows reduced components and reduced cost



## Section 5.1: NEW Testing Color Tunable

- Definition of Color Tunable:
  - For the purpose of this specification, a color tunable luminaire has functionality that allows the end user to alter the color appearance of the light generated by the luminaire. This tuning must include white light that is capable of meeting the specification's CCT requirements, and can alter the color appearance along the black body curve, or may also extend to colors beyond the ANSI defined correlated color temperature ranges.
- Testing:
  - Default Setting – Photometric Testing
  - Least Efficient White Light – Photometric Testing
  - Highest Consumption – Power Only



## Section 6.1: Product Families

- Modified table similar to that in Lamps
  - Lays out the allowable variations
  - Clarifies required testing for variant models
  - Addresses stakeholder desire for clarity and consistency
- Added a new variation for sharing test data: wattage

Product Wattage <sup>2</sup> (directional luminaires)	<p>For SSL products:</p> <ul style="list-style-type: none"> <li>• The LED package, array, or module model must not change, although CCT remains an allowable variation.</li> <li>• The only performance change to the luminaire is to a driver that provides a different drive current to the LED package, array or module.</li> <li>• The model tested should be the highest wattage, highest CRI , and lowest CCT variant.</li> </ul>	<ul style="list-style-type: none"> <li>• LED current measurement</li> <li>• Integrating sphere scan to represent performance of variants</li> </ul>
	<p>For Fluorescent products:</p> <ul style="list-style-type: none"> <li>• The lamp wattage may change, but not the general type or configuration.</li> </ul> <p>Example: A 32W triple tube pin based fluorescent representing a 26W triple tube pin based fluorescent would be acceptable, but not representing a 26W twin tube fluorescent.</p> <ul style="list-style-type: none"> <li>• The only performance change to the luminaire is to the lamp (or lamp and ballast) with a lower wattage.</li> <li>• The model tested should be the highest wattage, highest CRI, and highest CCT variant .</li> </ul>	<ul style="list-style-type: none"> <li>• Certified lamp data for variants</li> <li>• Integrating sphere scan to represent performance of variants</li> </ul>





## Section 6.1 Product Families: Power (Scaling)

- Intended to increase flexibility for directional luminaires
- Similar in principle to relative photometry: if the power / output of the source changes, but the source light distribution does not change, the overall distribution should not change significantly
- What to test on goniophotometer:
  - LED: Test the highest wattage, highest CRI, lowest CCT (worst case)
  - CFL: Test the highest wattage, highest CRI, highest CCT (worst case)
- Uses integrating sphere scan for performance confirmation
  - Reduces goniophotometer scans for distribution and color angular uniformity

## Section 6.2 Significant Digits and Rounding

- Minor Updates to match the Lamps specification for consistency
- No material changes
- Better defines rounding



## Section 7: Methods of Measurement & Reference Documents

- EPA has removed methods of measurement that are no longer relevant based on the proposals mentioned above,
  - e.g. HID method of measurements
- The following new methods which are proposed in the draft have been added e.g. IE LM-84, TM-28.
- EPA requests feedback on additional reference documents that may be appropriate, or if additional updates are necessary.



## Section 8. Certification by Shipping Fixtures with ENERGY STAR Certified Lamps

- New streamlined method for certification
- Primarily useful for Non-Directional Luminaires
- Majority of performance based on existing lamp certification
  - Excellent variety of high performing ENERGY STAR lamps
  - Wider choice of form factors and sizes compared to GU-24 and other dedicated sockets
  - Improved consumer choice



## Section 8. ENERGY STAR Lamps and Certification

Source Type	ENERGY STAR Requirements
<b>Source Efficacy</b>	<p><math>\geq 65</math> lm/W per lamp</p> <p>All lamp permutations (makes and models) employed in a given luminaire model shall meet this requirement.</p>
<b>Source Minimum Light Output (initial)</b>	<p>Lamp-ballast platform shall provide a minimum of 800 lumens.</p> <p><u>Exception:</u> Outdoor porch, bath vanity luminaires and ceiling fan light kits featuring <math>\geq 3</math> heads shall provide a minimum of 450 lumens per head.</p> <p>Chandeliers, decorative pendants, wall sconces, and other multi-head indoor luminaires shall provide a minimum of 250 lumens per head.</p>
<b>Safety Rating</b>	Lamp must be safety rated for the luminaire type it will be shipped with, e.g. a lamp shipped with an enclosed fixture must be rated for use in an enclosed fixture. Luminaire must meet applicable safety rating in <a href="#">section 14</a> .
<b>Product Packaging &amp; Labeling</b>	Luminaire must comply with <a href="#">section 16</a> . Unless shipped with lamps directly installed, ENERGY STAR certified lamps shipped with luminaires must comply with lamps packaging requirements.
<b>Warranty</b>	Luminaire must comply with <a href="#">section 17</a>
<b>Toxics</b>	Luminaire must comply with <a href="#">section 18</a>

## Section 8. Shipping with ENERGY STAR Lamps: Luminaire Specific

- Leveraging certified lamps only requires a few luminaire specific requirements:
  - Safety
  - Packaging
  - Warranty
  - Toxics





## Questions??

- Questions about previous section?
- Break

## Section 9.1 Luminous Efficacy

- Significant gains in efficacy since Luminaires V1.0
  - Largely in directional luminaires
- Anticipated Levels for Effective Date in 2016
- Efficacy levels proposed are achievable **today, even with 90+ CRI.**





## Section 9.1 Efficacy: Non-Directional: Light Engines

- With Optics 65 lm/W
  - No change
- Without Optic 90 lm/W
  - Set higher to account for less optic losses from diffuser
    - Approximately 20% optic loss estimate
    - Allows more luminaires incorporating optical control to be more efficient



## Section 9.1 Efficacy: Non-Directional: Retrofits

- What are these?
  - Essentially Light Engines Designed for Specific Retrofit Applications
  - Two surface mount retrofits for non-directional luminaires are included:
    - Ceiling Lights
    - Wall Sconces
- Distribution Requirements
- Efficacy:
  - With Optics 80 lm/W
  - Without Optic 100 lm/W



## Section 9.2 Efficacy: Directional

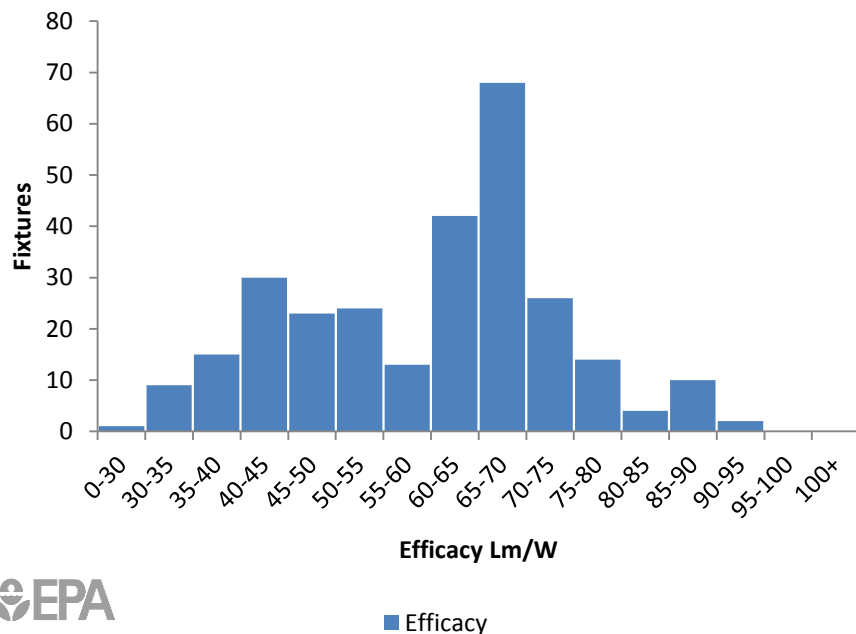
- Directional efficacies have soared in recent years
- Based on analysis of currently Certified ENERGY STAR products
  - Impact on products CRI 90 or above
- Current ENERGY STAR Requirements for product families reports the least efficient models



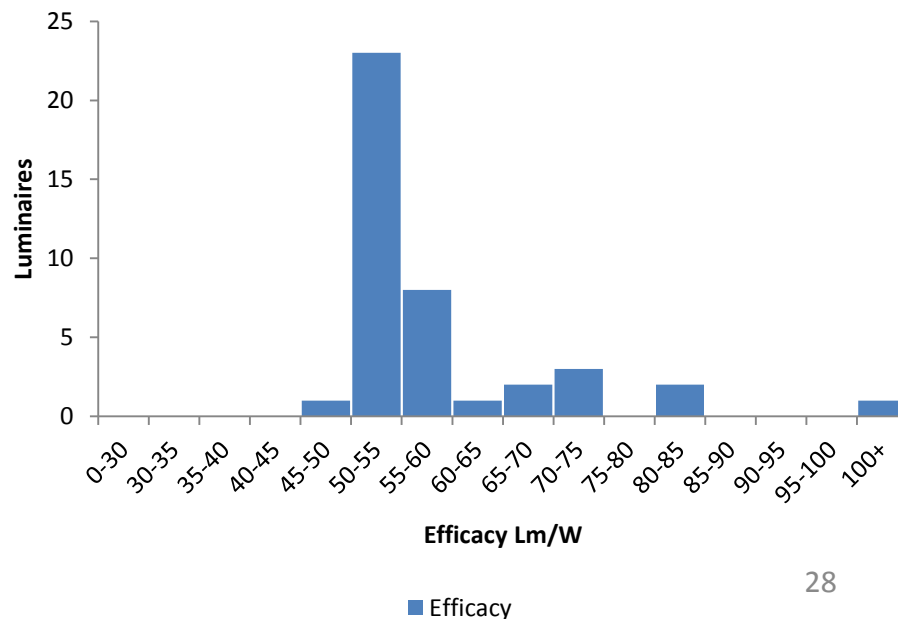
## Section 9.2 Efficacy: Directional Cove & Undercabinet

- Cove 45 → 55 lm/W
- Undercabinet 29 → 60 lm/W
- EPA will consider proposals for additional beam distribution but none have been received to date (e.g. symmetrical beam)

### Undercabinet Fixture Efficacy



### Cove Mount Fixture Efficacy

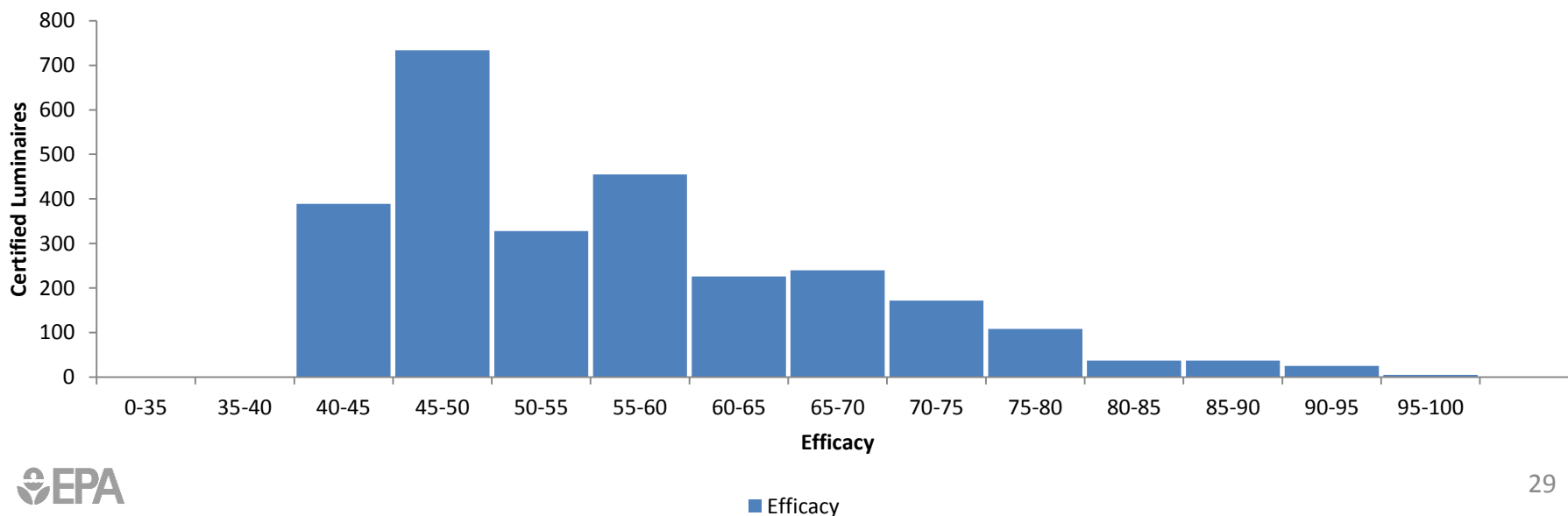


## Section 9.2 Efficacy: Downlights

- Largest category of certified products
- 42 → 60 lm/W
- Many currently certified products meet or exceed this already:
  - 58% of downlights found on LED Lighting Facts
  - 32% of downlights found on Certified Products Lists



**Downlight Efficacy**

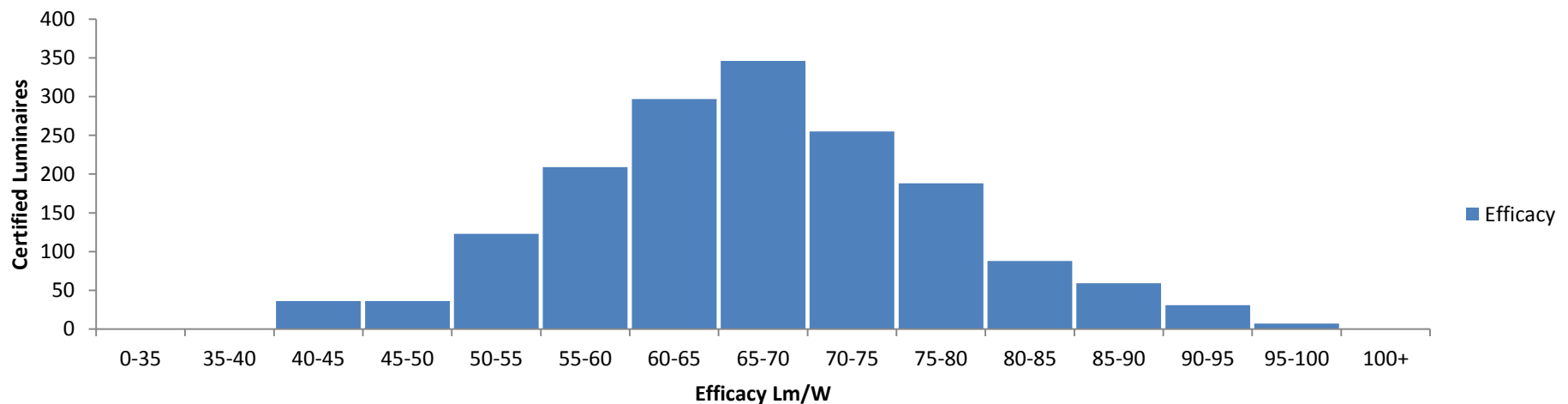


## Section 9.2 Efficacy: Downlight Retrofits

- 42 → 70 lm/W
- Data suggests retrofits performing better than Downlights
  - Feedback suggests this is related to product design
- Must meet performance installed in appropriate situation
  - In the worse case can that it's rated for
    - E.g. if it is rated for ICAT cans down to 4", that is what it should be tested in



### Downlight Retrofit Efficacy

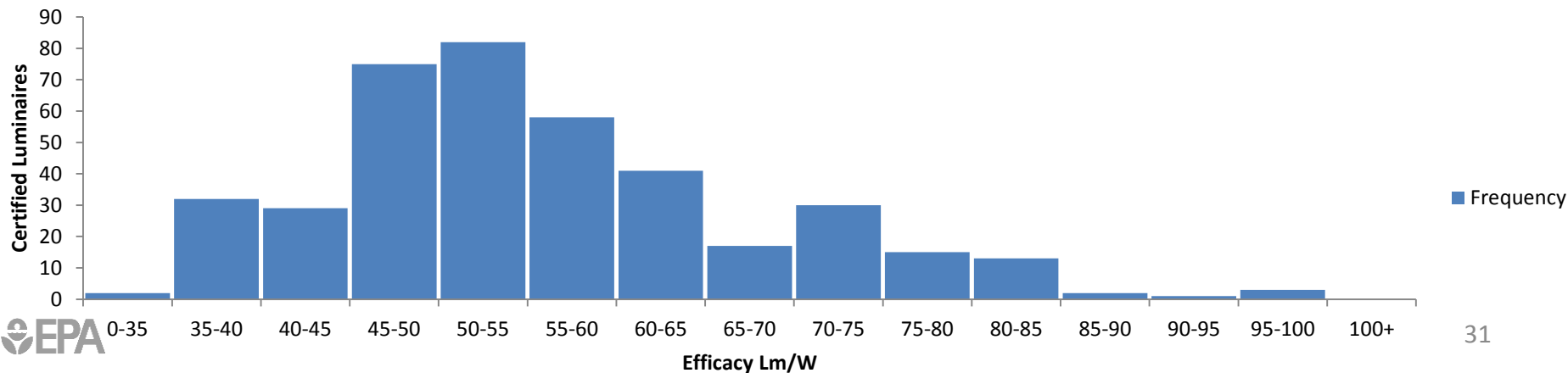


## Section 9.2 Efficacy: Accent Lights

- 35 lm/W → 60 lm/W
- Clarified Types
  - Line Voltage Track Luminaires
  - Line Voltage Track Head
  - Line Voltage Monopoint
  - Still includes Directional Ceiling Fans
- Send proposals for alternate beam patterns for Draft 2



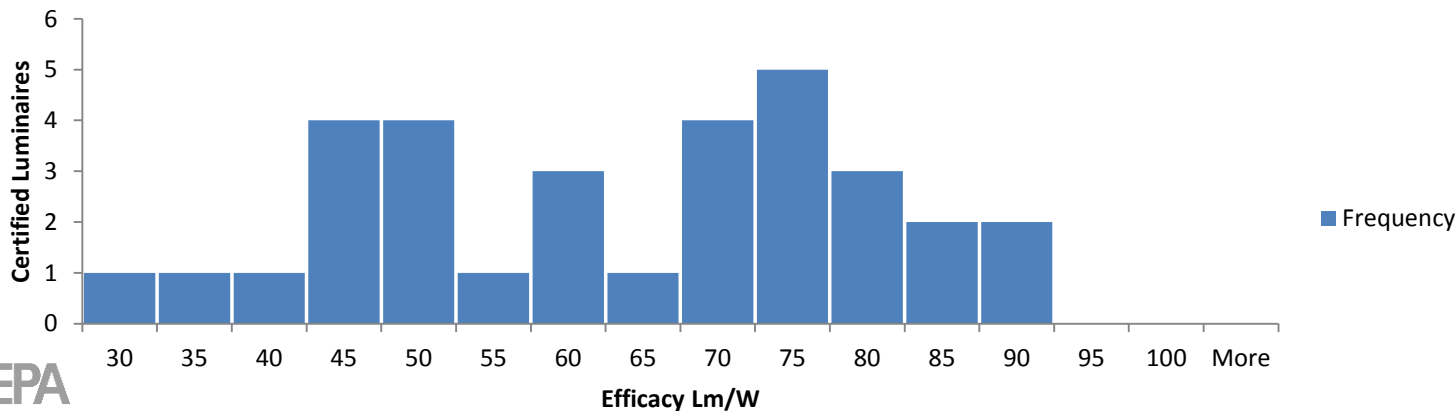
### Accent Light Efficacy



## Section 9.2 Efficacy: Directional Outdoor

- 35 lm/W → 60lm/W
- Most outdoor types
  - Wall
  - Porch
  - Pendant
  - Security (change from previous)
- Tiny fraction of upright allowed to account for material reflection during measurement

Outdoor Luminaire Efficacy





## Section 9.2 Efficacy: Directional: Desk Lamps

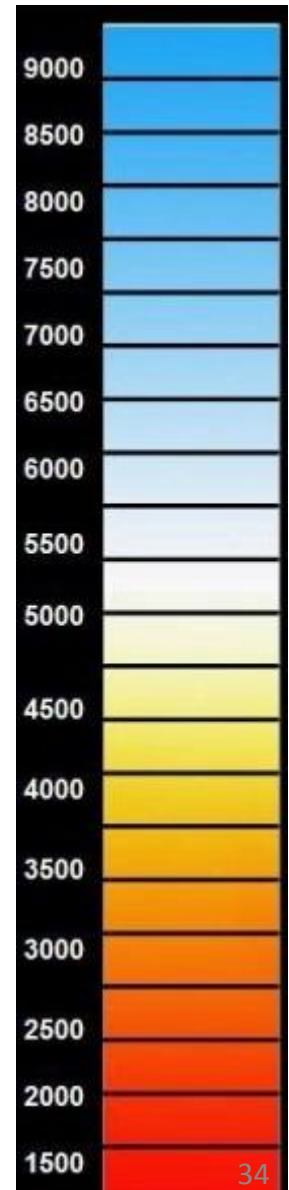
- 29 lm/W → 50 lm/W
  - Lowest Efficacy 43 lm/W
  - Average Efficacy ~50 lm/W
- Wider beam proposed from stakeholders
  - Better area due to general proximity to work surface
- Additional feedback?





## Section 9.3: Correlated Color Temperature

- 5000K no longer commercial only
- Reduced testing sample size for fluorescent sources from 10 to 3
- Included language to accommodate color tunable fixtures



## Sections 9.4 Color Rendering & 9.5 Color Angular Uniformity

- Introduced  $R9 \geq 0$ 
  - Consistency with ENERGY STAR Lamps, to support more precise specifier requirements, and state programs
- Reduced testing sample size for fluorescent sources from 10 to 3
- Aligned color angular uniformity requirements with ENERGY STAR Lamps





## Section 10: Lumen Maintenance and Lifetime

- Inseparable SSL minimum raised to 50,000 hours
- Reduced testing sample size for fluorescent sources from 10 to 3
- Added LM-84 / TM-28 to replace Option 2 for products that do not have LM-80 data to support faster lumen maintenance projections
- Added test guidance for tunable luminaires to be tested at least efficacious setting per section 5.1



## Section 11.1: Electrical: Start Time

- Introduced test method from ENERGY STAR Lamps
- Reduced sample size to 1
- Reduced requirement to  $\frac{1}{2}$  second
  - “While the bulbs look great they are not “instant on” as the package says. They have an annoying lag between when you flip the switch and when they turn on...”



## Section 11.2: Run Up Time

- Reduced Run-Up time for fluorescent to be consistent with ENERGY STAR Lamps
  - 60 seconds bare
  - 120 seconds covered



## Section 11.5: Electrical: Standby Power

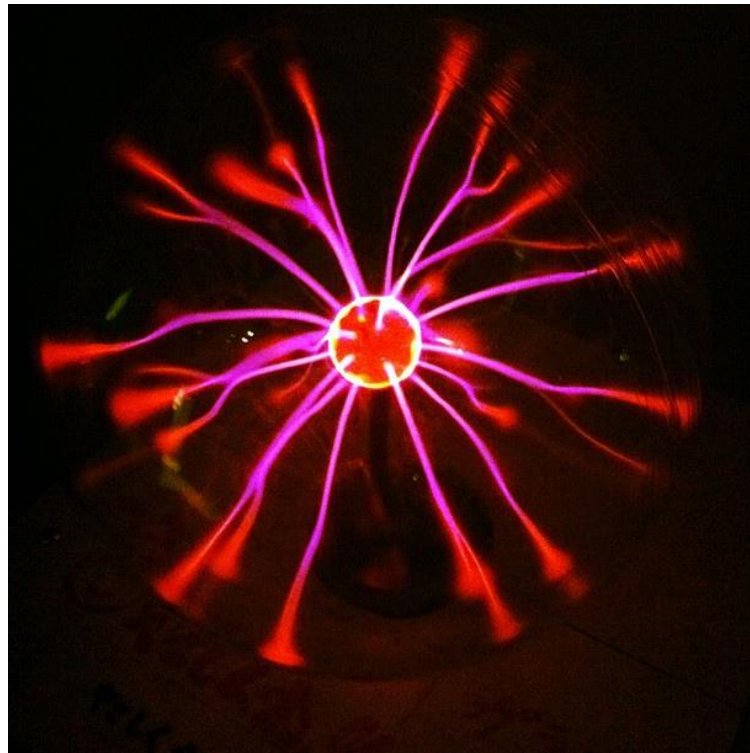
- Allowance reduced from 1 watt to ½ watt
- Referencing DOE Test Method for measuring standby power
- Updated to Allow Higher Efficiency Power Supplies
- Updated Marketing Protocol





## Section 11: Electrical: Other

- Transient Protection: Reduced sample size from 3 to 1
- Removed Lamp Current Crest Factor
- Operating Frequency: Reduced sample size from 3 to 1





## Section 12: Luminaire Serviceability

- New Section, combined existing requirements
- Intent: for Luminaire to be serviceable by a consumer
- Clarified that wire nuts are not acceptable



## Section 13: Thermal Performance: Case Temperature & Downlights

- New Luminaire retrofits section
- Testing should be under worst case thermal situation product is rated for
- Clarifies airtight and insulation contact cans (additional marketing guidance now appears in packaging requirements)



## Section 14: Product Safety

- Luminaire specific
- Condensed into one table for ease of reference
- Added references for SSL Retrofits
  - UL1598 C



## Section 15: NEW Section for Luminaires with Controls

- Minimum required light output for dimming luminaires for luminaires from 35% to 20% consistent the ENERGY STAR Lamps specification.
- Noise requirement for dimming products removed for non-dimmable
  - test methodology TBD
- Step dimming guidelines removed
- Optional criteria for luminaires with connected functionality
  - Required to be listed as “connected”
  - Consistent with other ENERGY STAR specifications
  - Encourages use of open standards



## Section 16: Labeling and Packaging

- Proposed nomenclature for communicating color temperature
  - 2700 - Warm White
  - 3000 - Soft White
  - 3500 - Neutral White
  - 4000/4100K - Cool White
  - 5000K - Daylight
- Dimming Labeling Updated
  - Can include compatibility via a hyperlink



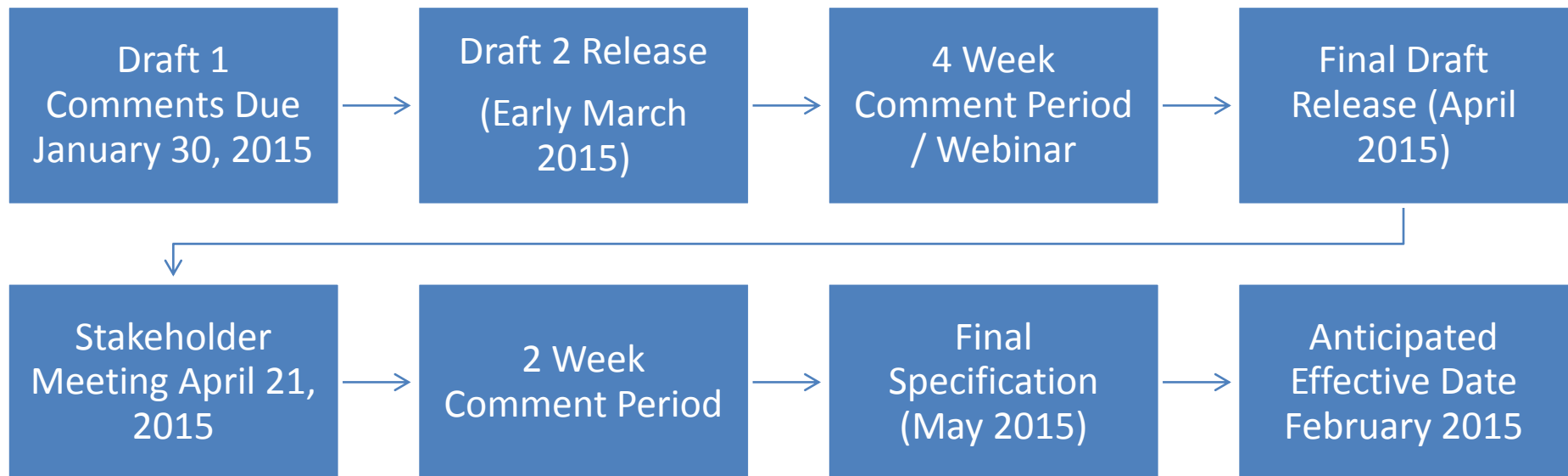
## Section 17 Toxics

- Updated Mercury requirements to be consistent with the Lamps





## Planned Timeline





## Discussion time

- Questions?
- Send comments and questions after the meeting to:

**lighting@energystar.gov**



