



Hort V3.0 Technical Requirements

Final Version Release

Agenda

- **Introduction**
- **Webinar Logistics**
- **V3 Overview and Timeline**
- **V3 Baseline Requirements**
- **V3 Topic Review**
 - **Application Information**
 - **Controllability**
 - **LM-79 & TM-33 Reporting**
 - **Surveillance Testing**
- **Q&A**

Introductions

Presenters



**Kasey
Holland**
*Technical
Manager*



**Adrian
Martin**
*Technical
Analyst*



Andrew Tiebout
*Project Manager
of Technical
Development*

Q&A Support



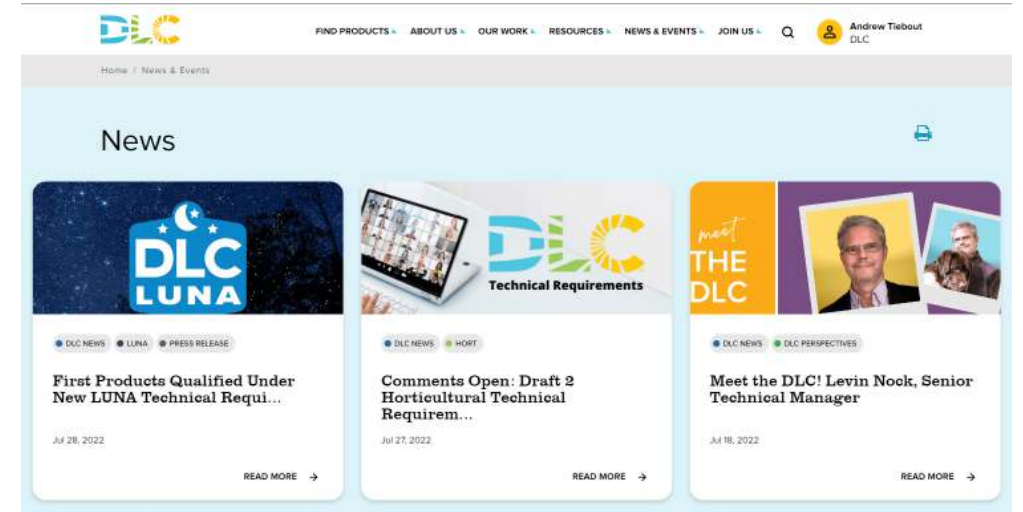
**Leora
Radetsky**
*Senior Research
Scientist*



**Aaron
Feldman**
*Senior Technical
Operations Analyst*

Webinar Logistics

- **Slides and recorded webinar will be posted** on the *DLC News & Events* page at www.designlights.org shortly after today's presentation
- All attendees are automatically muted
 - If you experience technical issues, please use the Chat feature to let us know



Questions and Answers

- We will leave **15 minutes** after the presentation to answer questions. Please enter your questions into the “Questions” pane in GoToWebinar.
 - DLC technical support team will answer questions as they come in via the Questions pane
 - Some questions will be answered aloud (anonymously) at the end during the Q&A session



The screenshot displays the GoToWebinar interface. At the top, there is a menu bar with 'File', 'Options', 'View', and 'Help'. Below this is a 'Sound Check' section with a volume indicator and a 'Sound Check' button. Underneath, there are three radio button options: 'Computer audio' (selected), 'Phone call', and 'No audio'. Below these are two volume sliders: one for the microphone (Realtek High Definition...) and one for the speaker/HP (Realtek High Definition...). A 'Talking:' indicator is present. The 'Questions' pane is open, showing a 'Show Answered Questions' checkbox and a table with columns for 'X', 'Question', and 'Asker'. At the bottom of the pane, there are buttons for 'Send Privately' and 'Send to All'. The footer of the pane displays 'Test Webinar' and 'Webinar ID: 739-969-195', along with the GoToWebinar logo.



V3.0 Overview and Timeline

Cultivating Sustainable Growth

\$6 billion annually in 2021

\$8 billion annually by 2026

38.8 kWh per 1 kg of harvested crop

18.43 kg CO₂

29.5 kWh daily home consumption

14.02 kg CO₂

Hort V3.0 Goals

**Accelerate energy efficiency of lighting in
Controlled Environment Agriculture**

**Support Energy Efficiency programs development
& aid end users of the QPL to identify and select
products that are eligible for rebates**

**Protect the integrity and value of the QPL for all
stakeholders**

Hort V3.0 Strategies

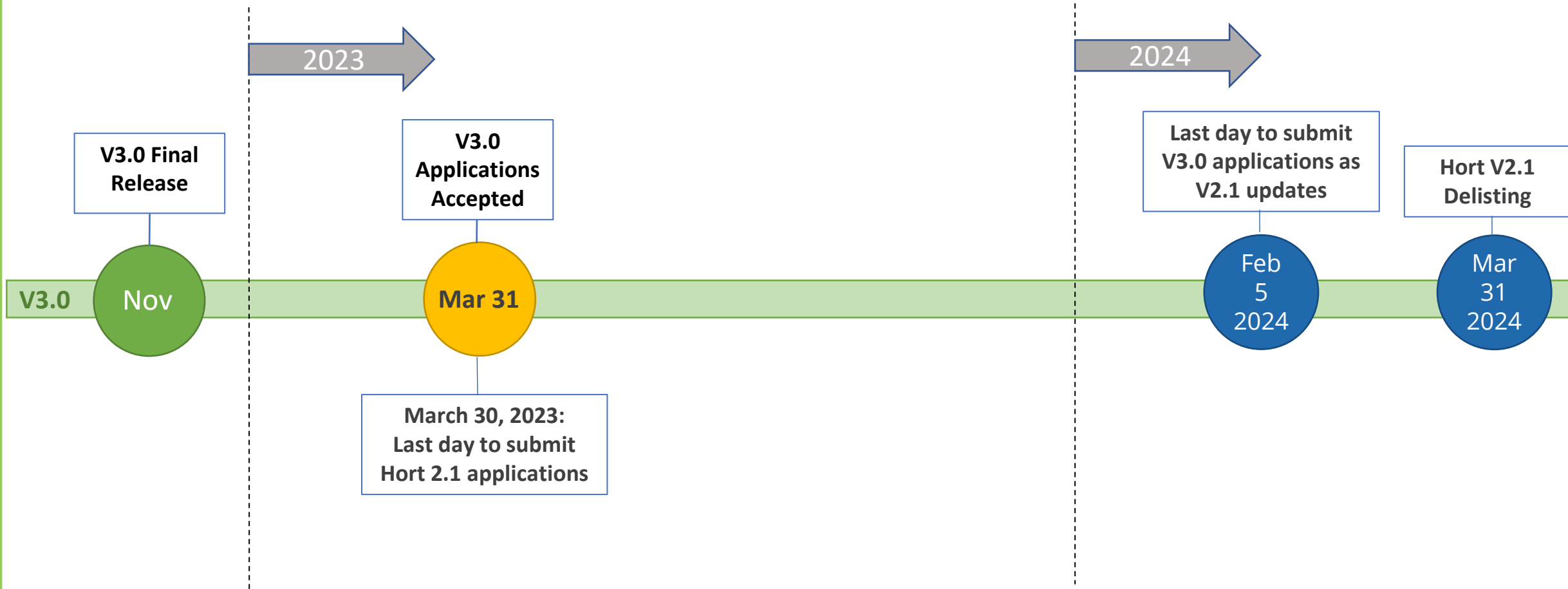
Increase the efficacy threshold

Require reporting for intended use of products, dimensions, and images

Introduce product-level controllability requirements

Build a surveillance testing program

Hort Version 3 Timeline



The slide features a white background with a large green arrow shape pointing to the right. The arrow's outline is a vibrant green, and its interior is white. In the corners, there are blurred images of food: a green vegetable in the top-left, a white dish in the top-right, and green leafy vegetables in the bottom-right.

Version 3.0 Baseline Requirements

Version 3.0 – Technical Requirements

Overview

Introduces additional reporting requirements for all products that build upon V2.1 while only making minimal and necessary changes to already existing requirements

Version 3.0 Technical Requirements

Table 1. DLC Horticultural Lighting Technical Requirements

Parameter, Attribute, or Metric	Requirement	Requirement Type	Method of Measurement and Evaluation
Photosynthetic Photon Flux (Φ_p or PPF) ($\mu\text{mol} \times \text{s}^{-1}$)	n/a	Reported	(ANSI/IES LM-79) 400-700 nm range, with 400-500 nm, 500-600 nm, and 600-700 nm bins reported alongside the total
Far-Red Photon Flux ($\Phi_{p,fr}$ or PFR) ($\mu\text{mol} \times \text{s}^{-1}$)	n/a	Reported	(ANSI/IES LM-79) 700-800 nm range
Photon Flux (P_{FBAR}) ($\mu\text{mol} \times \text{s}^{-1}$)	n/a	Reported (Optional)	(ANSI/IES LM-79) 280-800 nm range
Spectral Quantum Distribution (SQD) ($\mu\text{mol} \times \text{s}^{-1} \times \text{nm}^{-1}$)	n/a	Reported	(ANSI/IES LM-79) (ANSI/IES TM-33-18) 400-800 nm range
Photosynthetic Photon Intensity Distribution (I_p or PPID) ($\mu\text{mol} \times \text{s}^{-1} \times \text{sr}^{-1}$)	n/a	Reported	(ANSI/IES LM-79) (ANSI/IES TM-33-18) 400-700 nm range
Photosynthetic Photon Efficacy ^{1,2} (K_p or PPE) ($\mu\text{mol} \times \text{J}^{-1}$)	$\geq 22.30 \mu\text{mol} \times \text{J}^{-1}$	Required/Threshold	(ANSI/IES LM-79) 400-700 nm range
Photon Efficacy ($P_{E_{FBAR}}$) ($\mu\text{mol} \times \text{J}^{-1}$)	n/a	Reported (Optional)	(ANSI/IES LM-79) 280-800 nm range

NEW Efficacy Threshold ←

Version 3.0 Technical Requirements

Table 1. DLC Horticultural Lighting Technical Requirements

Parameter, Attribute, or Metric	Requirement	Requirement Type	Method of Measurement and Evaluation
Photon Flux Maintenance, Photosynthetic (PFM _p)	Q ₉₀ ≥ 36,000 hours	Required/ Threshold	(ANSI/IES LM-80 and ANSI/IES TM-21, or ANSI/IES LM-84 and ANSI/IES TM-28) 400-700 nm range, fixture specification sheet, and in-situ temperature measurement test (ISTMT) results
Photon Flux Maintenance, Far-Red (PFM _{FR})	Report time to Q ₉₀	Reported	(ANSI/IES LM-80 and ANSI/IES TM-21, or ANSI/IES LM-84 and ANSI/IES TM-28) 700-800 nm range
Driver Lifetime	≥50,000 hours	Required/ Threshold	Driver specification sheet, fixture specification sheet, and in-situ temperature measurement test (ISTMT) results
Fan Lifetime	≥50,000 hours	Required/ Threshold	Fan specification sheet, fixture specification sheet
Warranty	Fixtures: ≥5 years Lamps: ≥3 years	Required/ Threshold	Legal warranty terms and conditions
Power Factor (PF)	≥0.9	Required/ Threshold	Benchtop electrical testing or ANSI/IES LM-79
Total Harmonic Distortion, Current (THDi)	≤20%	Required/ Threshold	Benchtop electrical testing or ANSI/IES LM-79
Safety Certification	Horticultural lighting designation by OSHA NRTL or SCC-recognized body	Required	ANSI/UL 8800 (ANSI/CAN/UL 8800)

No Changes from V2.1

Version 3.0 Technical Requirements

NEW
Product Application
Information
(Intended Product Use)

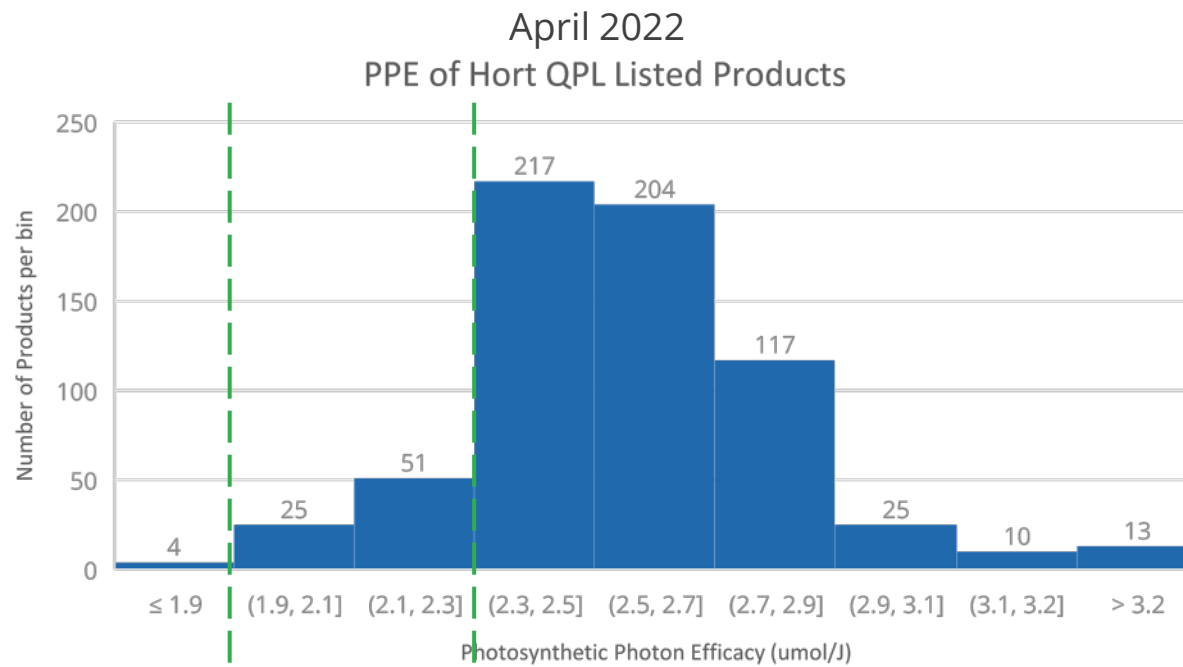
NEW
Controllability
requirements
(at the product-
level)

Table 1. DLC Horticultural Lighting Technical Requirements

Parameter, Attribute, or Metric	Requirement	Requirement Type	Method of Measurement and Evaluation
Application Information	Intended controlled environment(s) and lighting scheme(s)	Reported	Product specification sheet
Controllability	Dimming capability	Required or reported, depending on product attributes	Product specification sheet
	Dimming range	Reported	Manufacturer reported
	Dimming and control methods	Reported	Product specification sheet or supplemental material
	Integral control capabilities	Reported	Product specification sheet or supplemental material

New Efficacy
Threshold

Version 3.0 PPE Increase




V2.1 PPE → V3.0 PPE

V3 PPE
2.3 $\mu\text{mol}/\text{J}$

**21% more efficacious
than today**

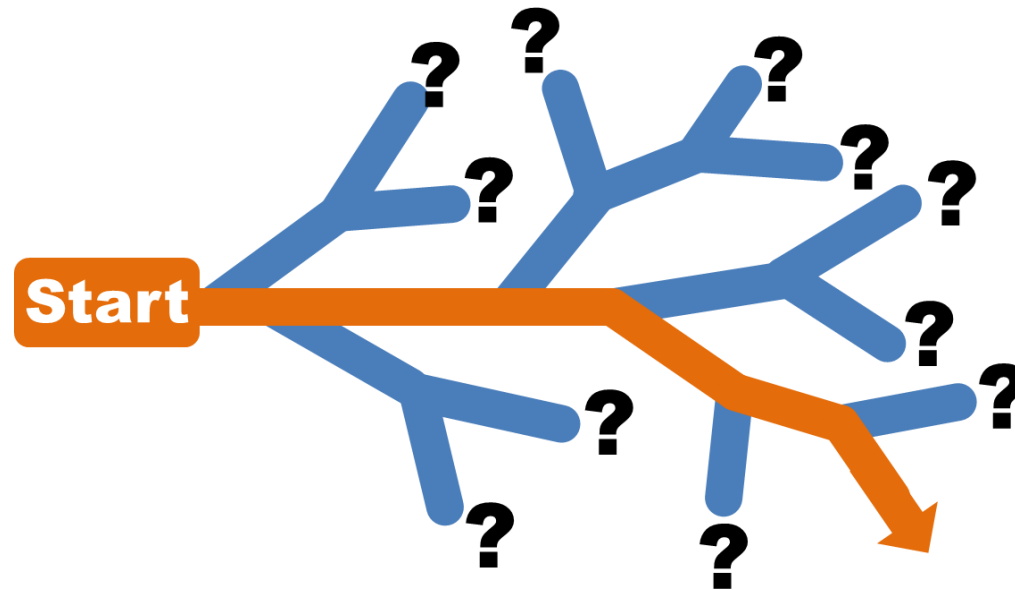
**>35% better than
1000 DE HPS**

*The DLC has a 2-year major revision cycle to drive energy efficient lighting in CEA
by increasing PPE to **delist the bottom 15% of listed products***



Application (Intended Product Use) Information

Version 3.0 – Application (Intended Product Use) Information



Version 3.0 requires the reporting of the intended **controlled environment and lighting strategy** for all listed products

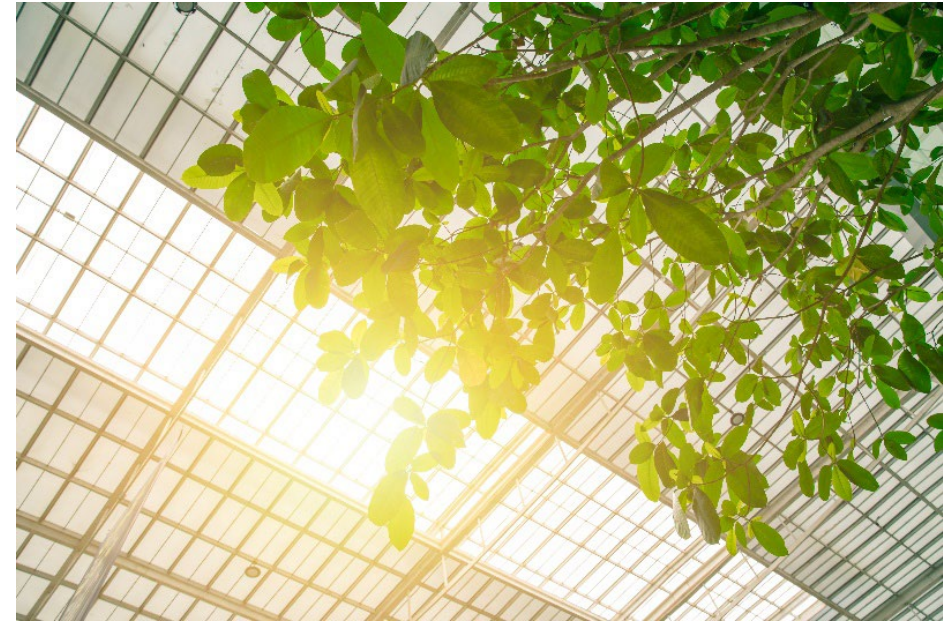
Version 3.0 – Application Information

Controlled Environment Reporting Options



Indoor (Stacked or Non-Stacked)

Fully enclosed controlled environments with single or multiple layers.



Greenhouse

Rely on sunlight as a primary light source, but often require supplemental electric lighting

Version 3.0 – Application Information

Lighting Scheme (Use Case):

Sole-Source and/or Supplemental

Products reporting to be **sole-source** shall be intended for applications where the **lighting fixture is the primary source of optical radiation**.

Products reporting to be **supplemental** shall be intended for applications where the **lighting fixture is not the primary source of optical radiation**.

Lighting Scheme (Position):

Top light, Intra-canopy, or Other

Products reporting to be a **Top light** shall be intended to be mounted with the emission area **facing down, toward the canopy**.

Products reporting to be an **Intra-canopy light** shall be intended to be mounted **within the canopy**.

To account for innovative technologies in this developing field, the DLC proposes an **“Other (text)”** option to support **products that do not fit within the top lighting or intra-canopy lighting categories**.

For instance, “Other (Bottom lighting)”.

Version 3.0 – Application Information

Table 2. Application Information Reporting Requirements

Controlled Environment ¹		Lighting Scheme ¹		Product Image and Dimensions ²	Requirement Type	Method of Measurement and Evaluation
		Position	Use Case			
Indoor	(Stacked)	Top light, intra-canopy, other (text)	Sole-source or Supplemental	All product submittals are required to include: <ul style="list-style-type: none"> • A representative image of the qualifying product or family • Product physical dimensions (in inches) 	Reported	Product specification sheet or supplemental materials
	(Non-stacked)					
Greenhouse		Top light, intra-canopy, other (text)	Supplemental			

A single listed product may report that they are intended for multiple controlled environments and/or lighting schemes.

Version 3.0 – Application Information

Table 2. Application Information Reporting Requirements

Product Image and Dimensions ²	Requirement Type	Method of Measurement and Evaluation
All product submittals are required to include: <ul style="list-style-type: none">• A representative image of the qualifying product or family• Product physical dimensions (in inches)	Reported	Product specification sheet or supplemental materials

A **representative image of the qualifying product or family** along with **product physical dimensions** shall be reported for all products (new V3 qualifications and updated V2.1 listings) **for display on the Hort QPL**

Additional Style Guidance for required product images will be provided prior to application acceptance date

Controllability



Version 3.0 – Controllability

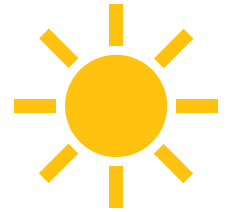
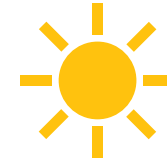


Version 3.0 – Controllability

Parameter, Attribute, Metric		Requirement	Requirement Type	Method of Measurement, Evaluation
Dimming Capability	All replacement lamps	Products must be dimmable	Required	Product specification sheet ¹
	All DC products			
	AC luminaires with PPF $\geq 350 \mu\text{mol} \times \text{s}^{-1}$			
	AC luminaires with PPF $< 350 \mu\text{mol} \times \text{s}^{-1}$	Report whether the product is dimmable or non-dimmable	Reported	
Dimming Range ²		Report: minimum input wattage, minimum PPF, default input wattage, default PPF	Reported	Manufacturer reported
Dimming and Control Methods ²		Report: dimming or control method designation to the product, connector, or transmission hardware ³	Reported	Product spec sheet or supplemental documentation ¹
Integral Control Capabilities		N/A	Reported	Product spec sheet or supplemental documentation ¹

Version 3.0 – Controllability

Dimming Capability



DC powered products

Replacement lamps

Luminaires with PPF $\geq 350 \mu\text{mol} \times \text{s}^{-1}$

- Products must be capable of dimming through line voltage, low voltage or wireless signal
- Product spec sheets must state that the product is dimmable

Luminaires with PPF $< 350 \mu\text{mol} \times \text{s}^{-1}$

- Dimming capability is a reported metric and is not required
- Product spec sheets must state whether the product is dimmable or not

Version 3.0 – Controllability

Dimming Range

- Manufacturer reported values:
 - Minimum Input Wattage (in Watts)
 - Minimum PPF (in $\mu\text{mol} \times \text{s}^{-1}$)
 - Default Wattage (in Watts)
 - Default PPF (in $\mu\text{mol} \times \text{s}^{-1}$)



Version 3.0 – Controllability

<i>Dimming and Control Methods</i>	
Dimming and Control Method Designations to the Product	Connector or Transmission Hardware
Protocols or methods of communication between the product and other devices or controllers	Hardware integrated into the product that enables it to physically connect with and receive signals from a controller or other device.
<ul style="list-style-type: none">• All applicable options from the following tables must be reported• Must be stated on the product spec sheet or supplemental material	

Version 3.0 – Controllability

Wired Dimming and Control Method Designations to the Product

Control Type	Definition	Acceptable Terms
0-10V IEC 60929 Annex E	Wired analog low-voltage control that varies DC voltage between 0 and 10 volts to produce varying light output.	0-10V, 10V, 10V0
0-10V ANSI C137.1-2019 (8-Volt)		
0-10V ANSI C137.1-2019 (9-Volt)		
0-10V Other		
Phase Cut (Forward Phase)	Modification, or cutting, of the leading edge of the AC mains sinusoidal waveform to produce varying light output.	Phase-cut, forward phase, leading edge, TRIAC, magnetic low-voltage (MLV)
Phase Cut (Reverse Phase)	Modification, or cutting, of the trailing edge of the AC mains sinusoidal waveform to produce varying light output.	Phase-cut, reverse phase, trailing edge, electronic low-voltage (ELV)
DALI	Digital Addressable Lighting Interface Protocol, a wired digital communication protocol registered by the DALI Alliance.	DALI
DALI2		DALI2, DALI-2
Power Over Ethernet	Power over Ethernet (PoE) products are a specific subset of DC products that comply with the IEEE 802.3 standards for carrying both power and communication signals on Ethernet cables.	Power Over Ethernet, PoE
Ethernet TCP/IP	Wired networking technology defined by IEEE 802.3 standards.	Ethernet
Ethernet Proprietary		
Other Wired	Other wired communication protocol as specified by the manufacturer.	N/A

Version 3.0 – Controllability

Wireless Dimming and Control Method Designations to the Product

Control Type	Definition	Acceptable Terms
Zigbee 3.0	Wireless digital communication protocol developed by the Connectivity Standards Alliance.	Zigbee 3.0, ZB3
Zigbee - Manufacturer Specific		ZigBee
Bluetooth® Sig MESH and MMDL Layers	Wireless digital mesh communication protocol developed and maintained by the Bluetooth Special Interest Group (SIG). Product utilizing and qualified with the Bluetooth mesh specification in the networking and application layer.	Bluetooth SIG MESH, Bluetooth MESH Technology
Bluetooth® - Manufacturer Specific	Any Bluetooth implementation not described above and not utilizing the Bluetooth specification in both the networking and application layers.	Bluetooth
Wi-Fi	Wireless networking protocol based on IEEE 802.11.	Wi-Fi, WIFI, IEEE 802.11, Wi-Fi Certified
EnOcean	Wireless digital communication protocol developed by EnOcean.	EnOcean
Other Wireless	Other wireless communication protocol as specified by the manufacturer.	N/A

Version 3.0 – Controllability

Connector or Transmission Hardware

Connectors and Transmission Hardware		Acceptable Terms
Wired	RJ-11	RJ-11, RJ11
	RJ-12	RJ-12, RJ12
	RJ-14	RJ-14, RJ14
	RJ-45	RJ-45, RJ45
	USB	USB
	Flying Leads	Flying Leads, Quick Disconnect
	Terminal Block	Terminal Block
	Other Wired	N/A
Wireless	Wireless Radio	Any of the acceptable terms from the Wireless section of the previous table
	Infrared Receiver	
	Other Wireless	N/A


Version 3.0 – Controllability



Integral Control Capabilities

- All capabilities from this table that apply to the product must be reported
- Must be stated on the product spec sheet or supplemental material
- Products are not required to have these capabilities

Integral Control Capabilities	Definition	Acceptable Terms
Dim to Off	The ability for a product to be turned on or off via a dimming control signal.	Dim to off, Dimming: 0%-100%
Energy Monitoring	The capability of a driver to report the energy consumption of a luminaire or lamp.	Energy (or Power) Monitoring, Energy (or Power) Metering, Energy (or Power) Measurement, Energy (or Power) Reading
Manual Dimming	A knob or other control device integrated into the fixture and used for manual dimming.	Manual Dimming, Knob Dimming, Dimming Knob, Fixture Integrated Dimming



Additional Reporting Requirements

Version 3.0 – Additional Reporting Requirements

Only ANSI/IES LM-79-19 version test reports will be accepted for new applications or update applications requiring a new LM-79 test report

All Tests shall be conducted at full output and test reports shall be in .pdf format including at least the following information:

Electrical Characteristics (Wattage, Input Voltage, THD, and Power Factor)

PPF and/or PPID

i.e. Sphere and/or Gonio test reports containing only a partial set of LM-79 metrics will not be accepted

Each LM-79 test report (sphere and gonio) require an accompanying TM-33 document

Version 3.0 – Additional Reporting Requirements

Accompanying ANSI/IES TM-33-18 document requirement changes

Requires “Catalog Number” in the Header Element for all new TM-33 documents

SQD and PPID images generated by these files using the **MyDLC Pre-submission tool**

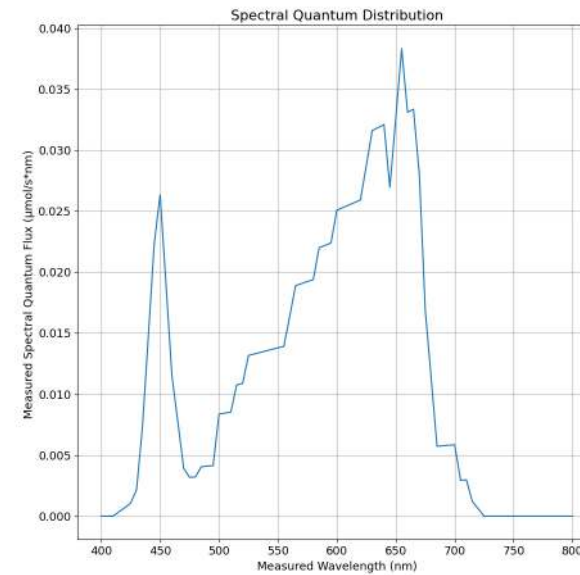
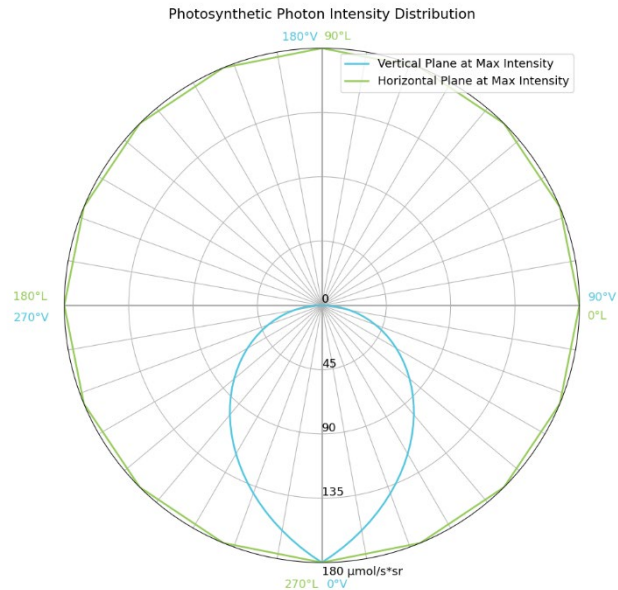
Please note that the DLC intends to provide an update to the graphing tool to support future changes to the ANSI/IES TM-33 standard as they occur

Version 3.0 – Reporting Requirements

The screenshot displays the user interface for the TM-33 Horticultural Lighting Presubmission Tool. At the top, the DLC logo is on the left, and navigation links for 'FIND PRODUCTS', 'ABOUT US', 'OUR WORK', 'RESOURCES', 'NEWS & EVENTS', and 'JOIN US' are on the right. A user profile for 'Kasey Holland DLC' is also visible. The main content area is titled 'TM-33 Horticultural Lighting Presubmission Tool'. It includes a sidebar with navigation options like 'NEW APPLICATION PORTAL', 'OLD APPLICATION PORTAL', 'Dashboard', 'QPL Search', 'Meet with DLC', 'News & Updates', 'Events & Webinars', 'Application Pre-submission Tools' (with sub-items for Hort and LUNA), 'Resources & Tools', 'QPL Data Access & API', and 'Profile Settings'. The main content area contains a description of the tool, a 'DOWNLOAD SAMPLE FILE' section with a 'Sample TM-33 File' link, and 'HELPFUL ARTICLES' such as 'Intro to the Hort Pre-submission Tool' and 'Hort Pre-Submission Tool Output Messages'. A central section titled 'Upload TM-33 .xml document' provides instructions and an 'UPLOAD TM-33' button. Below this is a 'Previous Session' table with columns for 'Date of Session', 'Files Uploaded', and 'Generated Files'. A row shows a session from 'May 16, 2022 - 12:35 PM' with one upload and generated files, accompanied by 'SHOW UPLOAD FILES (1)' and 'VIEW GENERATED FILES' buttons.

SQD and PPID images generated by Pre-submission Tool will be required for new applications or update applications requiring a new LM-79 test report

Version 3.0 – Reporting Requirements



Error messages are those that appear when no plot is created. These indicate issues that must be resolved before the data can be plotted. If an error message appears that is not included in this document or is null, please contact horticulture@designlights.org.

Warning messages are those that appear when plots are generated. This indicates that there may be an issue with the TM-33 file that will impact qualification, but none of these issues affect the plot that is produced.

Surveillance Testing



Surveillance Testing

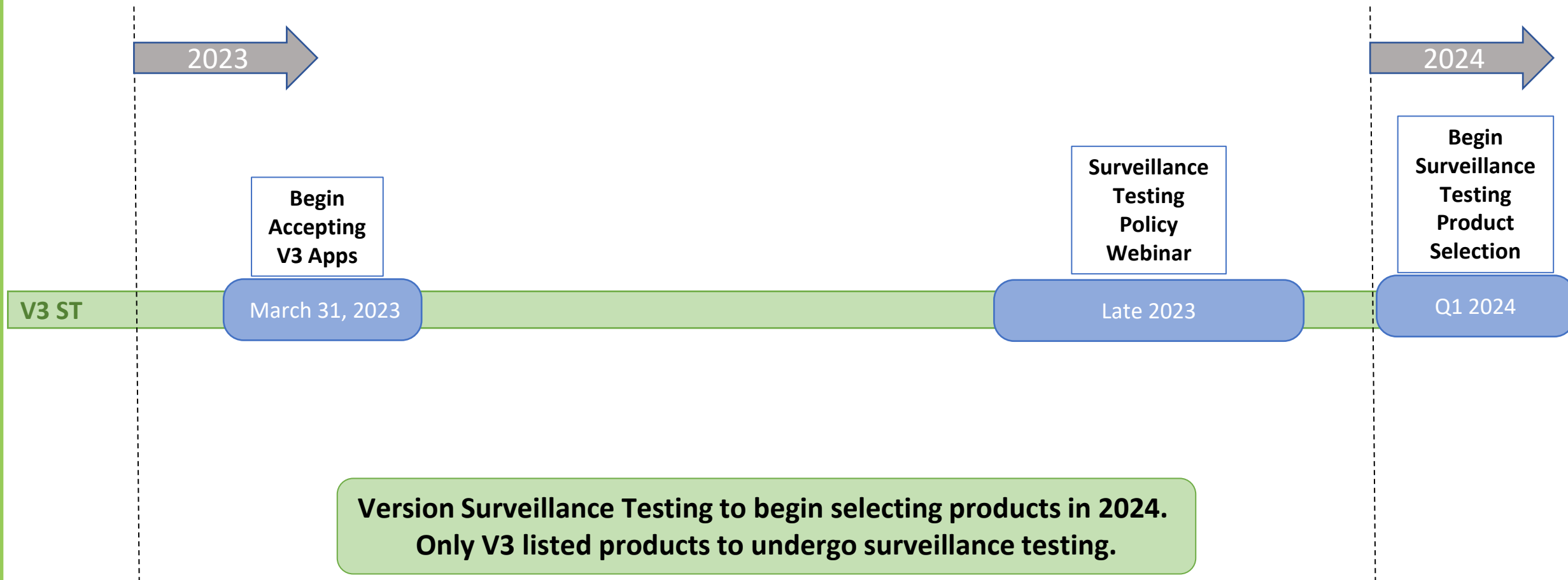
Objective

Protect the integrity and value of the Hort QPL for all stakeholders by actively monitoring the validity of data and other information submitted to the DLC Hort QPL

Verify the Product Meets the Technical Requirements

Verify Accuracy of the QPL Product Data

Surveillance Testing Proposed Timeline



Hort V3 Review

- **V3 Baseline Requirements**
 - Efficacy Increase
- **V3 Topic Review**
 - Application Information
 - Controllability
 - LM-79 & TM-33 Reporting
 - Surveillance Testing

Q&A

Upcoming Hort webinars

**Hort V3.0 Submission Guidance
& Family Grouping Updates**

Coming Q1 2023

Hort Surveillance Testing

Coming 2023