



Ultraviolet Horticultural LED Lighting

Advanced UV LED solutions with precise narrowband wavelengths across UVC, UVB, and UVA—designed for reproducible results in research and crop protection.



Two decades of innovation in LED lighting for plant science and commercial cultivation.

Valoya is a pioneer in horticultural LED lighting, dedicated to advancing plant science to improve food production for a growing global population.

Through deep plant research and patented lighting technologies, Valoya delivers precise, high-quality LED lighting solutions trusted by growers, researchers, and crop science leaders worldwide.



LED Lighting Pioneer



Valoya's Spectrum Standard

Valoya's LED fixtures meet the most rigorous quality standards in horticultural lighting, making them a trusted choice for researchers and growers. Spectral consistency is maintained across all form factors and product generations, ensuring reliable performance long term.



Research Grade LEDs

Valoya lights are built with proprietary, top-tier LED chips and patented spectra, delivering the highest spectral quality and performance consistency. High efficiency design ensures minimal heat impact on the crop, supporting stable, uniform growing conditions.



Photobiology Support Team

Valoya's Plant R&D team supports you at every stage—from designing a tailored light plan to ongoing optimization after installation. With deep crop and lighting expertise, we help you achieve the right setup from day one and maximize results throughout your cultivation cycle.



What is UV Radiation?

Ultraviolet (UV) radiation is a region of the electromagnetic spectrum with wavelengths ranging from 100 to 400 nm. Due to its shorter wavelength, UV radiation possesses higher photon energy than visible light, enabling it to drive photochemical and biological processes.

According to ISO standards, the UV spectrum is divided into three bands: UVC (100–280 nm), UVB (280–315 nm), and UVA (315–400 nm). Each of these regions exhibits distinct, and in some cases overlapping, properties and applications across scientific, industrial, environmental, and horticultural systems.

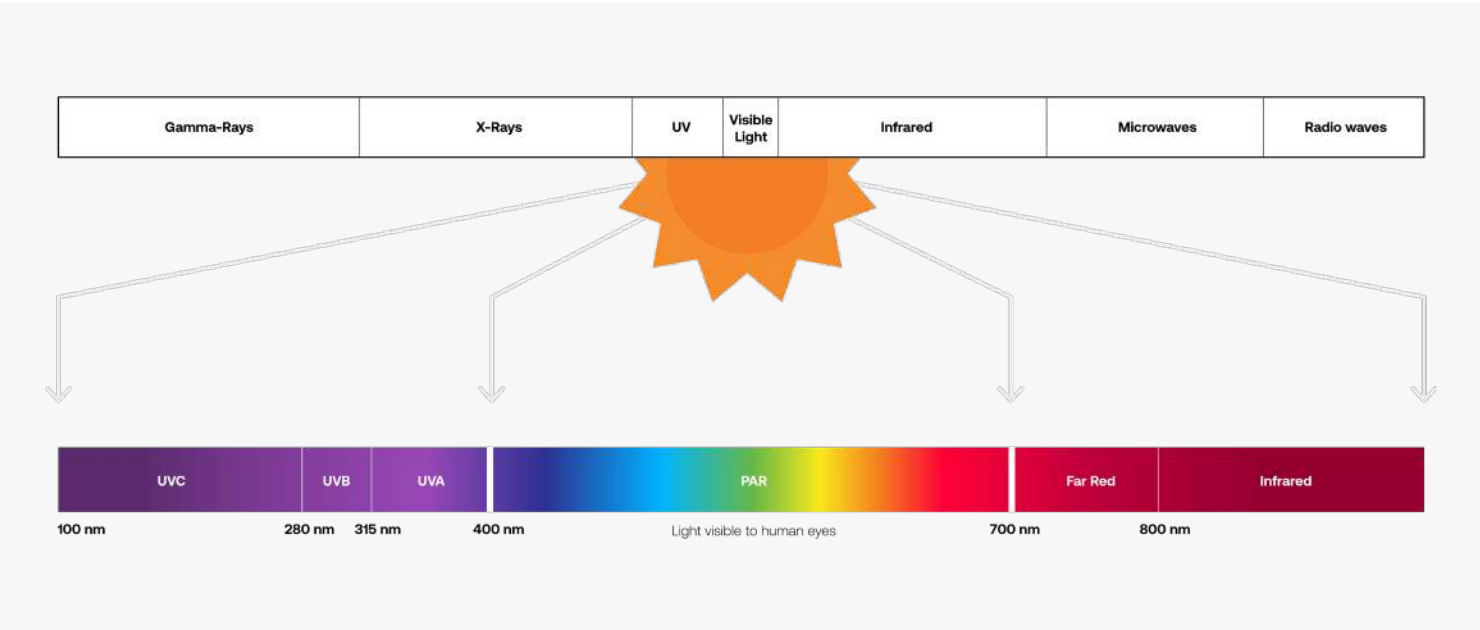


Figure 1. Spectral regions of electromagnetic radiation relevant for horticultural applications.

Key Characteristics of UV Radiation

- Invisible to the human eye
- Higher energy than PAR
- Capable of driving photochemical reactions
- Causes material and chemical degradation (e.g., polymers, coatings, pesticides)
- Influences biological systems (skin, microbes, and plants)
- Originates from natural (solar) and artificial sources (e.g., UV LEDs, mercury lamps, xenon-arc lamps, excimer lamps, lasers)

Table 1: Classification, Properties, and Applications of UV Radiation

	Wavelength (nm)	Key Properties	Typical Applications
UVA	315 – 400	Penetrates deeper into materials and tissues	Curing, imaging, fungal sporulation, plant growth and development
UVB	280 – 315	Can cause biological stress, sunburn upon prolonged exposure	Photobiology, plant signaling, vitamin- D synthesis, secondary metabolite accumulation, material and chemical degradation
UVC	100 – 280	Highly energetic, germicidal	Disinfection, sterilization

UV Radiation and Photoreceptors in Plants

Plants perceive UV radiation through multiple photoreceptors, including UV RESISTANCE LOCUS 8 (UVR8), cryptochromes (CRYs), phototropins (PHOTs), and ZEITLUPE (ZTL) proteins ⁽¹⁾. UVR8 is primarily involved in the perception of UVB radiation and short-wavelength UVA radiation (UVA2; 315–340 nm) ^(2,3), whereas CRYs, PHOTs, and ZTL proteins mainly mediate the perception of longer UVA wavelengths (UVA1; 340–400 nm) ^(3,4,5).

Through these photoreceptors, UV radiation regulates a wide range of physiological and developmental processes including plant morphology, photomorphogenesis, secondary metabolite biosynthesis and production, antioxidant responses and stress acclimation ⁽¹⁾. Plant responses to UV radiation are highly dependent on wavelength, irradiance, exposure duration, background light spectrum, plant species and environmental factors in which the plant has been growing.

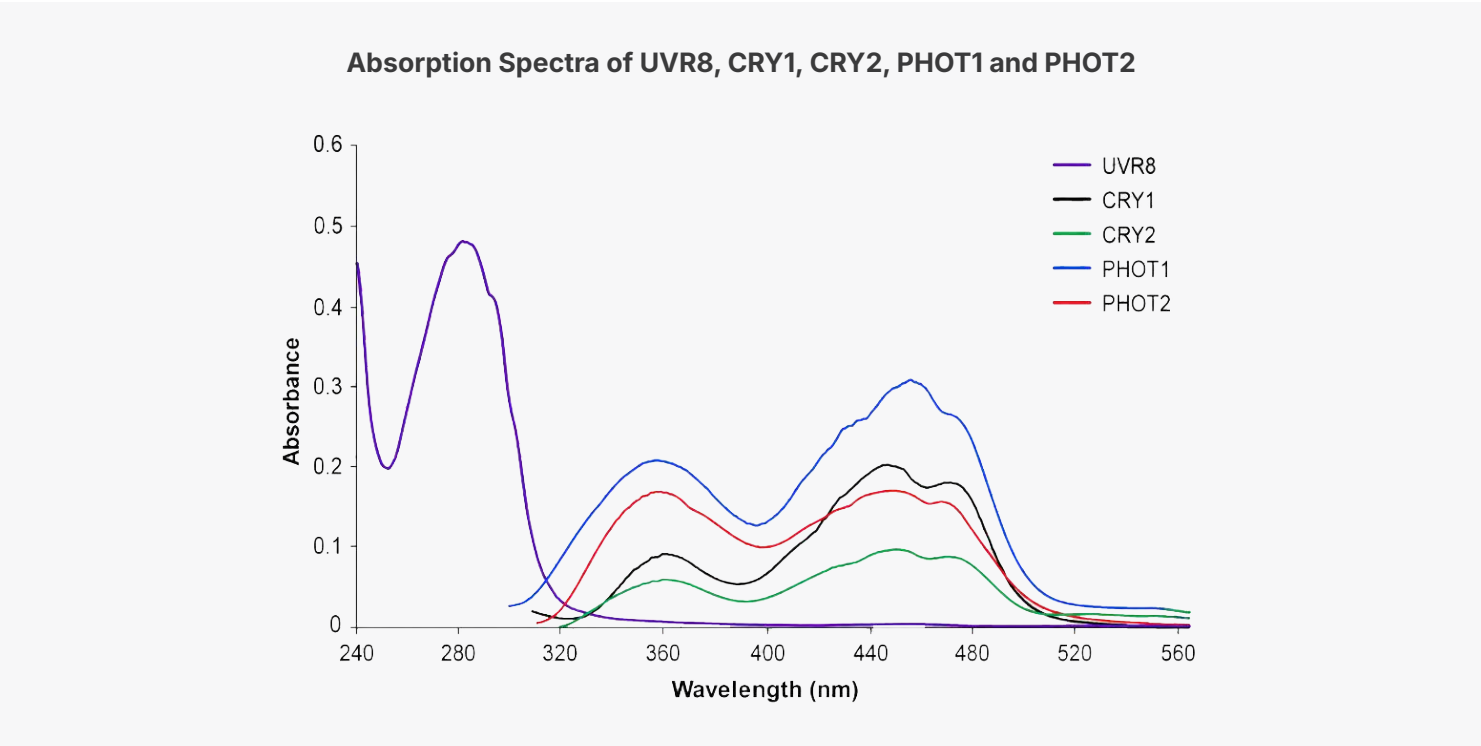


Figure 2. Absorption spectra of UVB and UVA photoreceptors (UVR8, CRY1, CRY2, PHOT1 and PHOT2). Adapted from ⁽⁶⁾.

CRY1, CRY2, PHOT1 and PHOT2 show strong absorption in the UVA region, with major absorption peaks centred approximately around 360–365 nm. Therefore, narrowband UVA LEDs at 365 nm is particularly suitable for maximizing photoreceptor-mediated UVA signalling in plants. Activation of these photoreceptors regulates several important physiological and developmental responses, including photomorphogenesis, stomatal opening, chloroplast movement, growth regulation, and accumulation of secondary metabolites ⁽⁷⁾.

Although the UVR8 photoreceptor exhibits strongest absorption in the shorter UVB region around 280 nm, this does not necessarily imply that 280 nm is the most suitable wavelength for horticultural UVB applications involving photoreceptor-mediated plant signalling. Shorter UVB wavelengths are highly energetic and can rapidly induce excessive stress responses, DNA damage, growth inhibition, and photodamage even at relatively low doses.

In practical horticultural applications, wavelengths around 308–310 nm are often more suitable because they effectively activate UVR8-mediated signalling while providing a more manageable balance between beneficial regulatory responses and excessive stress. Activation of UVR8 photoreceptor mediates several important signalling responses including induction of secondary metabolites, flavonoid biosynthesis, stress acclimation, photomorphogenesis, growth regulation, and enhancement of photoprotective mechanisms ⁽⁸⁾.

Application Areas

1. Crop Protection and Plant Health by UVC Radiation

Using UVC radiation to suppress pathogen development, reduce microbial contamination, improve post-harvest hygiene, and enhance crop resilience in controlled-environment agriculture.



Key Applications

- Surface disinfection and sterilization
- Pre-harvest disease control (e.g., powdery mildew)
- Post-harvest treatment to extend shelf life

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Recommended Solution:

LLCC UVC280

Peak wavelength at 280 nm

Why LLCC UVC280 Solution is a Good Fit?

The 280 nm wavelength lies close to the germicidal effectiveness region where nucleic acids exhibit strong UV absorption, enabling efficient microbial inactivation through DNA and RNA damage ⁽⁹⁾. Compared with the UVC mercury lamps, narrowband 280 nm LEDs provide targeted exposure with improved spectral control instant ON/OFF functionality, and easier integration into controlled horticultural systems. The relatively compact and directional nature of LED systems also enables localized treatment approaches for crop surfaces, chamber interiors, conveyor systems, or post-harvest environments.

2. Plant Research, Stress Signalling and Crop Quality Improvement by UVB Radiation

Using UVB radiation to regulate plant acclimation responses, morphology, pigmentation, and secondary metabolite accumulation through the induction of flavonoids, phenolics, antioxidants, and other protective pathways associated with crop quality and stress tolerance ⁽¹⁰⁾. UVB >300 nm has also been used to suppress intumescence in plants ⁽¹¹⁾.

Key Applications

- Photobiology, plant research, supplemental UVB
- Stress induction and acclimation
- Secondary metabolite production
- Treatment of plant disorders (e.g., intumescence)

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Recommended Solution:

LLCC UVB308

Peak wavelength at 308 nm

Why LLCC UVB308 Solution is a Good Fit?

The 308 nm wavelength closely targets the biologically active UVB region involved in UVR8-mediated signalling pathways in plants ^(1,12). At this wavelength, plants strongly activate acclimation and protective responses while still allowing controllable dosing under indoor cultivation conditions. The wavelength is also highly effective for inducing flavonoids, phenolics, antioxidants, pigmentation, and other secondary metabolites linked to crop quality and stress acclimation.

Because UVB responses are highly dose-dependent, narrowband 308 nm LEDs provide a major advantage over broadband fluorescent UVB lamps. Narrowband 308 nm is also an excellent retrofit solution for narrowband fluorescent UVB lamps whose emission range is between ~305–315 nm. LED systems enable more reproducible irradiance, adjustable exposure duration, dimming capability, and improved experimental control. This is particularly important in research applications where repeatability and precise UV dose delivery are critical.

3. Photomorphogenic and Metabolic Regulation by UVA Radiation

UVA radiation influences multiple physiological and developmental processes in biological systems, including photomorphogenesis, plant growth, stomatal regulation, and chloroplast responses ⁽⁷⁾. Exposure to UVA can also enhance pigmentation and stimulate the accumulation of secondary metabolites associated with plant quality and stress acclimation, albeit less effectively than UVB. In addition, UVA wavelengths play important roles in regulating fungal development and sporulation ⁽¹³⁾.

Key Applications

- Photobiology and supplemental UVA lighting
- Enhancement of plant performance
- Secondary metabolite accumulation
- Fungal sporulation

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Recommended Solution:

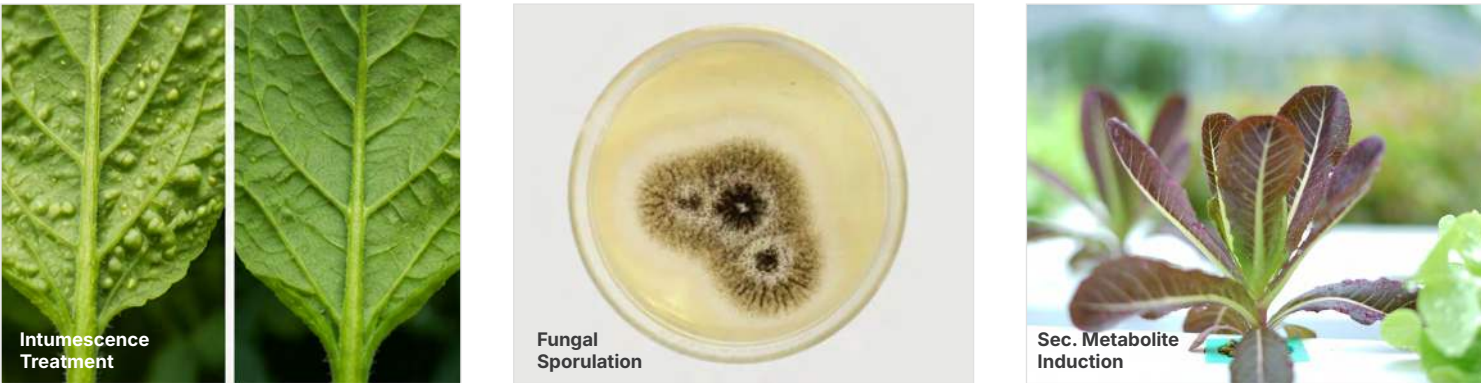
LLCC UVA365 and LLCC UVA385

Peak wavelength at 365 nm for LLCC UVA365 and 385 nm for LLCC UVA385

Why LLCC UVA365 and LLCC UVA385 are Good Fits?

The 365 nm and 385 nm wavelengths lie within the UVA region that strongly interacts with cryptochromes and phototropins, photoreceptors involved in photomorphogenesis and light-regulated developmental responses ^(1,6). Compared with UVB, UVA can generally be applied for longer durations and integrated more easily as supplemental lighting in controlled-environment agriculture.

365 nm provides stronger UVA signalling and photobiological activity, whereas 385 nm behaves closer to the blue-light region with lower biological hazard and suitability for continuous exposure strategies.



4. Solar Simulation

Solar UV radiation is the primary source of UV radiation in natural environments. However, wavelengths below ~290 nm are absorbed by the ozone layer and atmospheric oxygen and are not detectable at the Earth's surface. To be able to simulate sunlight for horticulture applications, a clear understanding of biologically relevant UV irradiance, PAR and FR component of sunlight is essential. The standard solar spectrum (AM1.5G) is widely used as a reference for this purpose.

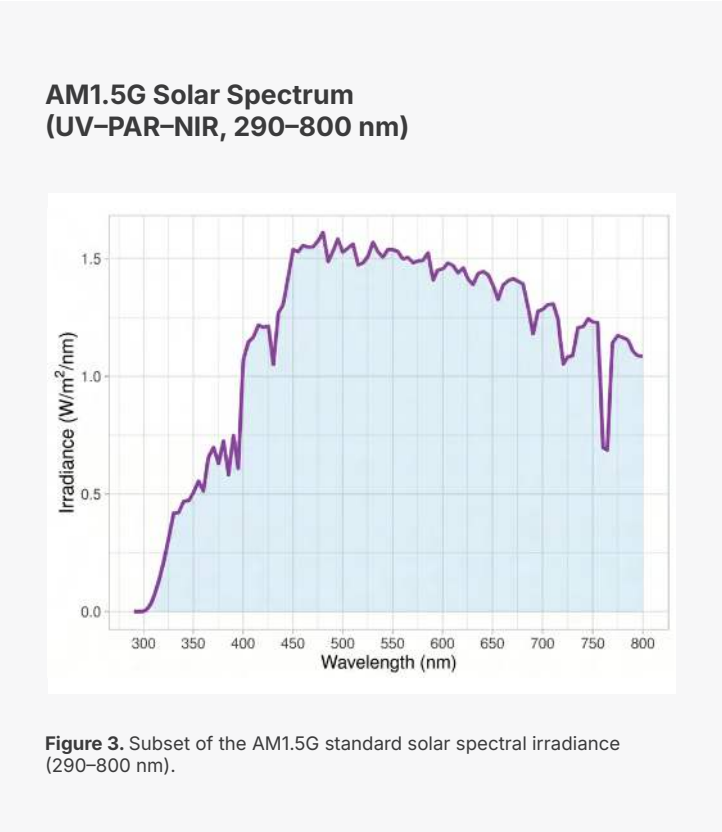


Table 2. Percentage contribution of different spectral regions to total solar irradiance (W m^{-2}) within the 290 – 800 nm range.

	Wavelength Range (nm)	Percentage of Total Irradiance (%)
UVB	290–315	0.1
UVA	315–400	7
PAR	400–700	73
Far Red	700–800	20

Values represent the relative distribution of energy based on spectral irradiance integrated over each waveband. The classification includes UVB, UVA, PAR, and far-red (FR) radiation, which are commonly used in photobiology and plant science to describe wavelength-dependent biological responses.

These proportions are used in our solution to control UVB, UVA, PAR and FR to simulate sunlight conditions for environmental, photobiological, and degradation studies.

Key Applications

- Sunlight simulation in controlled environments
- Chemical degradation studies

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Recommended Solution:

4-channel LED-based Sun Simulator*

LLCC UVB308, LLCC UVA365, LLCC UVA385 along with SolrayX FR

Why These Solutions Are Good Fit?

Accurate representation of sunlight across the UV, PAR, and far-red (FR) regions is essential for sunlight simulation in horticultural applications. Replicating natural solar spectral proportions enables more realistic plant physiological and developmental responses under controlled environments.

In addition to horticultural applications, UV-based degradation testing of chemicals, pharmaceuticals, coatings, plastics, and other materials also requires sunlight simulation systems that closely resemble the spectral composition of natural sunlight.

** This product is still under development - reach out to Valoya directly to inquire further.*

Our LED Solutions

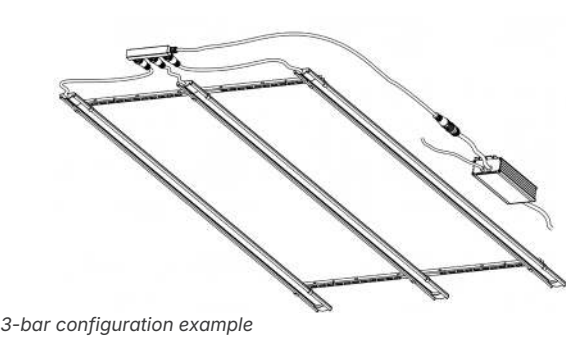
UV-Series

A complete, modular UV lighting solution offering precise monochromatic narrowband wavelengths across UVC, UVB, and UVA for advanced research, plant science, horticultural and industrial applications.

- UV-Series products span UVC, UVB and UVA wavelengths (narrowband peaks at 280, 308, 365, and 385 nm)
- The products are available in three different lengths 90 cm, 120 cm and 150 cm.
- The products are available as 1-bar, 2-bar, 3-bar and 4-bars sets.
- A set includes bars, driver, node and cable.
- Mounting rail kit and mounting hangers are available.
- Dimmers are available.

Table 3. UV-Series with its different nanometer wavelengths, form factor engths and bar configurations.

Peak Wavelength (nm)	Bar Configuration	Product Name		
		90 cm	120 cm	150 cm
UVC 280	1-bar	LLCC90-1 UVC280	LLCC120-1 UVC280	LLCC150-1 UVC280
	2-bar	LLCC90-2 UVC280	LLCC120-2 UVC280	LLCC150-2 UVC280
	3-bar	LLCC90-3 UVC280	LLCC120-3 UVC280	LLCC150-3 UVC280
	4-bar	LLCC90-4 UVC280	LLCC120-4 UVC280	LLCC150-4 UVC280
UVB 308	1-bar	LLCC90-1 UVB308	LLCC120-1 UVB308	LLCC150-1 UVB308
	2-bar	LLCC90-2 UVB308	LLCC120-2 UVB308	LLCC150-2 UVB308
	3-bar	LLCC90-3 UVB308	LLCC120-3 UVB308	LLCC150-3 UVB308
	4-bar	LLCC90-4 UVB308	LLCC120-4 UVB308	LLCC150-4 UVB308
UVA 365	1-bar	LLCC90-1 UVA365	LLCC120-1 UVA365	LLCC150-1 UVA365
	2-bar	LLCC90-2 UVA365	LLCC120-2 UVA365	LLCC150-2 UVA365
	3-bar	LLCC90-3 UVA365	LLCC120-3 UVA365	LLCC150-3 UVA365
	4-bar	LLCC90-4 UVA365	LLCC120-4 UVA365	LLCC150-4 UVA365
UVA 385	1-bar	LLCC90-1 UVA385	LLCC120-1 UVA385	LLCC150-1 UVA385
	2-bar	LLCC90-2 UVA385	LLCC120-2 UVA385	LLCC150-2 UVA385
	3-bar	LLCC90-3 UVA385	LLCC120-3 UVA385	LLCC150-3 UVA385
	4-bar	LLCC90-4 UVA385	LLCC120-4 UVA385	LLCC150-4 UVA385



3-bar configuration example

Key Advantages

- Full UV coverage (UVC, UVB, UVA) in one platform
- Narrowband precision for reproducible results
- Modular and scalable design
- Application-focused solutions for research and industry
- High wall-plug efficiency and long operational lifetime
- Stable spectral output over product lifetime
- Designed for controlled environments and scientific use
- Safe and precise UV delivery (with appropriate safety measures)

Custom Solutions

Standard products are available as narrowband sources. Customized broadband UV solutions can be developed based on specific project requirements.

Replacement of Mercury-Based UV Lamps

Traditional UV fluorescent and mercury vapor lamps contain elemental mercury, which is hazardous to both human health and the environment.

RoHS Directive and UV Lamps

The EU RoHS Directive (Restriction of Hazardous Substances Directive 2011/65/EU) restricts the use of hazardous materials in electrical and electronic equipment, including mercury.

Historically, many UV lamps received temporary exemptions until February 24, 2027 because suitable alternatives were not available, especially for UV disinfection, UV curing, phototherapy, industrial UV applications and horticultural UV applications.

However, UV LED technology has advanced rapidly, especially in, UVC LEDs (~265–280 nm), UVB LEDs (~305–310 nm) and UVA LEDs (~365–405 nm). Because alternatives now exist, the EU has been progressively removing these exemptions.

Table 4. Replacement of mercury-based UV lamps

Conventional Source	LED Solution
UVC 254 nm mercury lamp	LLCC UVC280
UVB narrowband fluorescent lamp	LLCC UVB308
UVA narrowband fluorescent lamp	LLCC UVA365
Broadband UV lamps	Customized UV LED solutions

Photobiological Safety Considerations for UV LED Systems According to IEC 62471-6:2022

Ultraviolet (UV) radiation can pose risks to human health and materials if not handled properly. Appropriate safety measures should always be followed when working with UV sources. The IEC 62471-6:2022 standard classifies UV lamps and lamp systems into four risk groups based on safe exposure limits ⁽¹⁴⁾.

Table 5. Emission limits for Actinic UV hazard and Near-UV hazard based on IEC 62471-6:2022.

UV Hazard Type	Wavelength Range (nm)	Emission limits (Wm ⁻²)			
		Risk Group 0 / Exempt	Risk Group 1	Risk Group 2	Risk Group 3
Actinic UV hazard for the skin and eye (E _s)	180–400	≤ 0.001	≤ 0.003	≤ 0.03	> 0.03
Near-UV hazard for the eye (E _{UVA})	315–400	≤ 10	≤ 33	≤ 100	> 100

In addition to irradiance-based risk groups, IEC 62471-6:2022 also defines exposure dose limits for UV radiation. UV dose is determined by both irradiance and exposure duration.

UV Dose (J m⁻²) = Irradiance (W m⁻²) × Exposure Time (s)

Table 6. Exposure dose limits for Actinic UV hazard and Near-UV hazard based on IEC 62471-6:2022.

UV Hazard Type	Relevant UV Region (nm)	Exposure Dose Limit (J m ⁻²)	Notes
Actinic UV hazard for the skin and eye (E _s)	180–400	30	Spectrally weighted using the actinic UV hazard function
Near-UV hazard for the eye (E _{UVA})	315–400	10,000	Relevant for prolonged ocular exposure to UVA radiation

Disclaimer: Always refer to IEC 62471-6:2022 for more information on Photobiological Safety of Lamps and Lamp Systems and understanding UV hazard type and exposure dose limit.

Key Safety Guidelines



- Avoid direct exposure to UV radiation, especially to eyes and skin
- Use appropriate personal protective equipment (PPE), including UV-blocking eyewear, gloves, and protective clothing
- Ensure proper shielding and enclosure of UV light sources during operation
- Limit exposure time and maintain safe distances from active UV sources
- Use interlocks and warning systems where applicable to prevent accidental exposure
- Operate systems in controlled environments with trained personnel



Important Note

UVC and UVB radiation are particularly hazardous and can cause skin burns and eye damage. UVA radiation, despite being less energetic, can also cause long-term biological effects with prolonged exposure.

References

1. Rai et al., (2021). Perception of solar UV radiation by plants: photoreceptors and mechanisms. *Plant Physiol.* 186 (3), 1382–1396.
2. Rizzini et al., (2011). Perception of UV-B by the Arabidopsis UVR8 protein. *Science.* 332: 103–106.
3. Rai et al., (2020). The photoreceptor UVR8 mediates the perception of both UV-B and UV-A wavelengths up to 350 nm of sunlight with responsivity moderated by cryptochromes. *Plant Cell Environ.* 43: 1513–1527.
4. Briggs and Huala (1999). Blue-light photoreceptors in higher plants. *Annu Rev Cell Dev Biol.* 15: 33–62.
5. Christie et al., (2015). Plant flavoprotein photoreceptors. *Plant Cell Physiol.* 56: 401–413.
6. Vanhaelewyn et al., (2020). Ultraviolet radiation from a plant perspective : the plant-microorganism context. *Front. Plant Sci.* 11.
7. Verdaguer et al., (2017). UV-A radiation effects on higher plants: Exploring the known unknown. *Plant Sci.* 255: 72–81.
8. Podolec et al., (2021). Perception and signaling of ultraviolet-B radiation in plants. *Annu Rev Plant Biol.* 72:793–822.
9. Kowalski (2009). Ultraviolet germicidal irradiation handbook: UVGI for air and surface disinfection. Springer.
10. Shi and Liu (2021). How plants protect themselves from ultraviolet-B radiation stress. *Plant Physiol.* 187(3):1096–1103.
11. Kubota et al., (2017). UV-B radiation dose requirement for suppressing intumescence injury on tomato plants. *Sci. Hortic.* 226: 366–371.
12. Jenkins (2017). Photomorphogenic responses to ultraviolet-B light. *Plant Cell Environ.* 40: 2544–2557.
13. Leach (1962). Sporulation of diverse species of fungi under near-ultraviolet radiation. *Can. J. Bot.* 40: 151–161.
14. International Electrotechnical Commission (2022). Photobiological safety of lamps and lamp systems - Part 6: Ultraviolet lamp products. IEC 62471-6:2022. *Can. J. Bot.* 40: 151–161.

Research-Grade Horticultural Lighting

Two decades of innovation in LED lighting for plant science and commercial cultivation.

Headquarters

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Greenlux Lighting Solutions Oy

Mekaanikonkatu 1
00880 Helsinki
FINLAND



www.valoya.com



+358 29 3700 670



sales@greenlux.com

Valoya North America



sales.us@valoya.com

Valoya India



sales.india@valoya.com

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