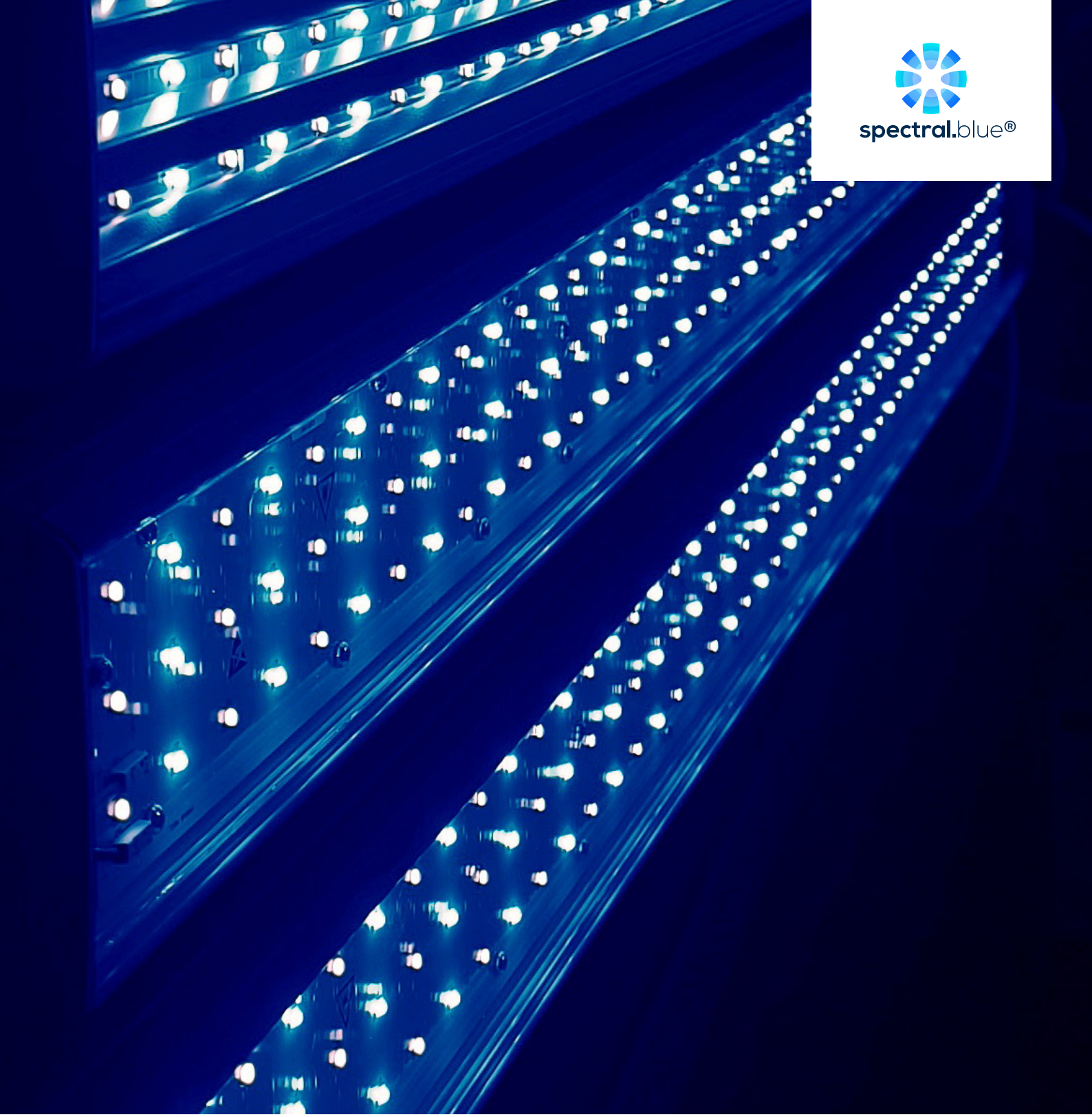


spectral.blue®

MULTI-WAVELENGTH ANTIMICROBIAL BLUE LIGHT (ABL)

Spectral Blue MWHI® Technology Brochure 2026

Introduction to Multi-Wavelength, High-Intensity antimicrobial blue light technology

Version A2, April 2026

Spectral Blue MWHI® antimicrobial blue light

Next-generation chemical-free & UV-free technology for whole room disinfection

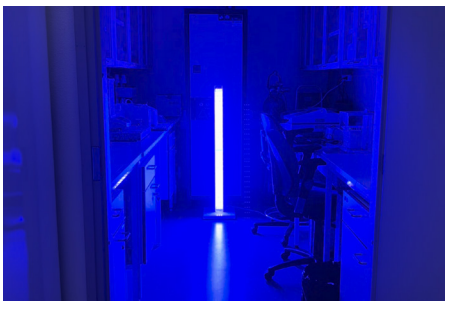
Spectral Blue MWHI® Multi-Wavelength, High-Intensity antimicrobial blue light (aBL) is a patented, fully automated next-generation disinfection technology. It's designed for demanding scientific and industrial customers such as pharmaceutical cleanrooms, food processing environments, and life science laboratories.

The chemical-free and UV-free solution provides continuous microbial control without operator input. It disinfects air, surfaces, equipment, and water. It's effective on bacteria, yeasts, and molds, including multi-resistant strains, biofilms, and spore-forming micro-organisms.

It reduces the need for chemicals and manual routines - allowing customers to reach two goals in one: enhanced hygiene conditions and more sustainable operations.

This brochure describes the key aspects of Spectral Blue:

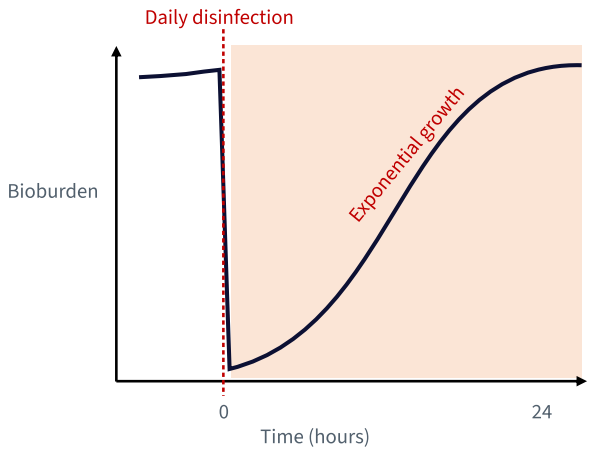
- Continuous disinfection
- Antimicrobial efficacy
- 3D disinfection planning
- Disinfection devices
- Science - how it works
- Health & safety
- Sustainability



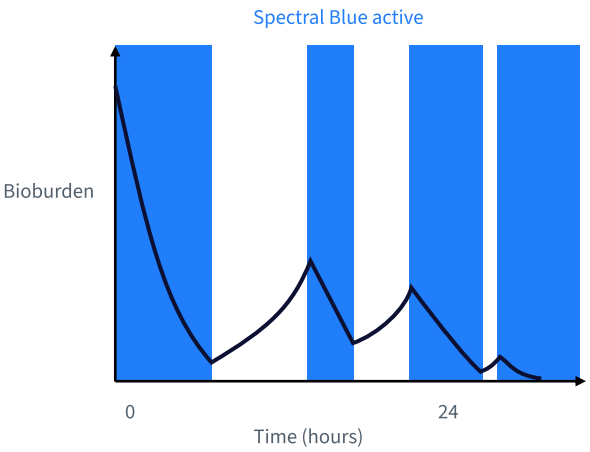
Continuous disinfection

A new way of thinking

Traditional manual disinfection with chemicals:
Can be faster but has no lasting effect.



Continuous disinfection with Spectral Blue:
Steadily drives bioburden down and
then keeps it low continuously.



Why traditional methods have gaps in contamination control

A chemical wipe-down can be very effective at reducing microbial levels, assuming coverage is thorough and the required contact times can be achieved. Yet such manual disinfection is labor-intensive, and chemicals themselves are expensive and often hazardous. Typically, doing one wipe-down per day is the maximum most facilities can realistically manage.

However, even with the best effort, some microbes are always left behind. As soon as people re-enter the room and production continues, new microbes are introduced. Bioburden starts rising immediately, often reaching previous levels within hours.

Your facility is in its best hygienic condition only for a short moment each day, which increases the risk of hygiene deviations between cleaning and disinfection cycles. This is why once-a-day disinfection often fails to maintain consistently low bioburden and may be insufficient to prevent recurring contamination issues.

Inverting the bioburden curve—Spectral Blue works against bioburden 24/7

Spectral Blue has a key advantage over traditional methods: it enables continuous disinfection. This shifts hygiene control from a single daily disinfection event to continuously maintaining low bioburden.

Continuous disinfection provides a lasting effect and is well suited for environments where hygiene must be maintained throughout daily operations.

Spectral Blue devices typically operate based on room occupancy: they turn on automatically when the room is unoccupied and off when people return. This enables multiple disinfection cycles throughout the day without interfering with normal work.

Over time, these repeated cycles steadily drive the bioburden down and keep it low continuously. The effect reaches also microbes in hard-to-clean areas and within biofilms. The result is a consistently lower bioburden, as demonstrated by customers across multiple industries.

Proven efficacy

Laboratory results and real-world performance

Antimicrobial blue light (aBL) well-documented in peer-reviewed studies

The antimicrobial efficacy of visible blue light is backed by nearly 3,000 peer-reviewed articles. It has been extensively tested and documented against a wide range of micro-organisms, including bacteria, yeasts, molds, and several viruses—including multi-resistant strains and microbes within biofilms.

Multi-Wavelength light proven in lab tests

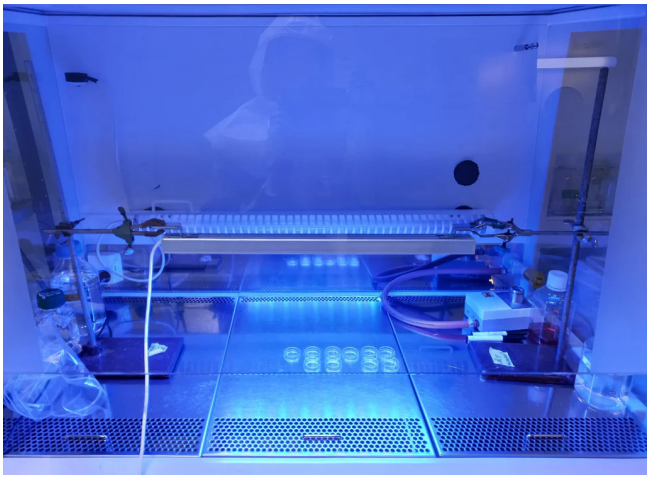
External laboratories—as well as several customer laboratories—have tested our devices against a wide range of pathogens, including *Escherichia coli*, *MRSA*, and *Listeria monocytogenes*.

Institutions such as Bonn University Hospital in Germany (a European reference laboratory), Harvard Medical School in Boston, USA, and the virus laboratory of the University of Helsinki, Finland, have also demonstrated the effectiveness of multi-wavelength blue light.

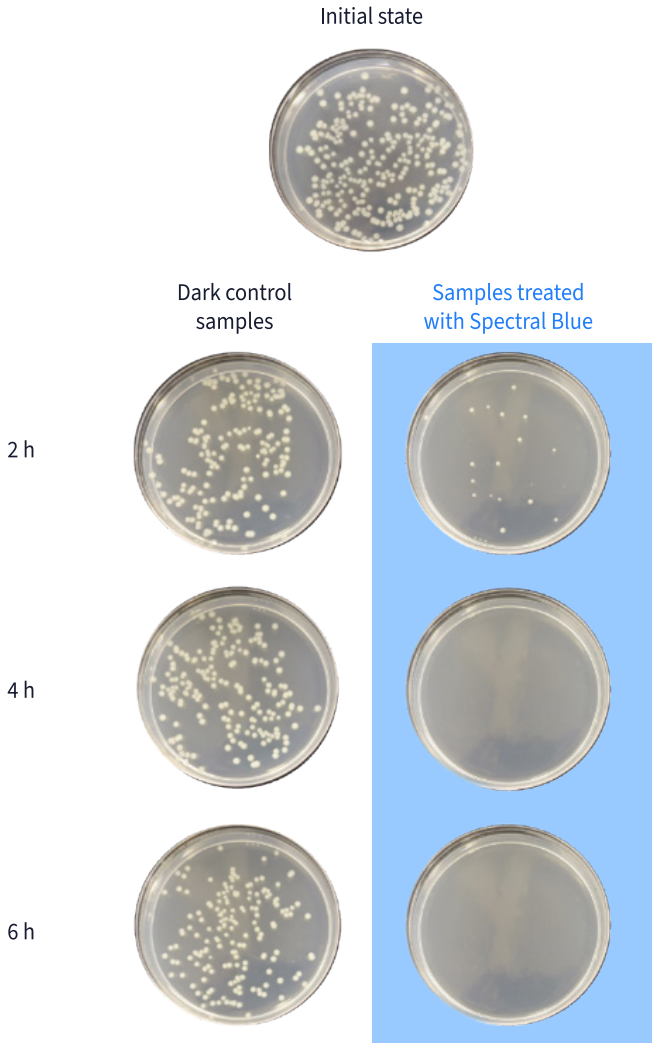
Proven performance in real-world use

Customers across different countries and multiple sectors—including pharmaceutical cleanrooms, food processing environments, and laboratories—have evaluated Spectral Blue and found it to be a highly capable environmental disinfection solution. In many cases, it has also helped reduce reliance on chemical disinfection.

Find key review articles, test results and learn all about the scientific foundation and performance of Spectral Blue at: www.spectral.blue/science



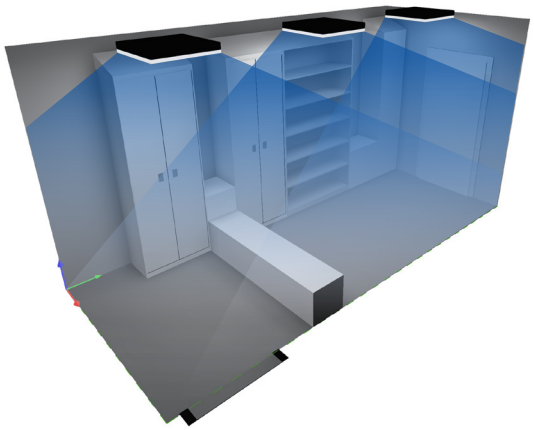
Laboratory test with Eschericia coli, 2019:

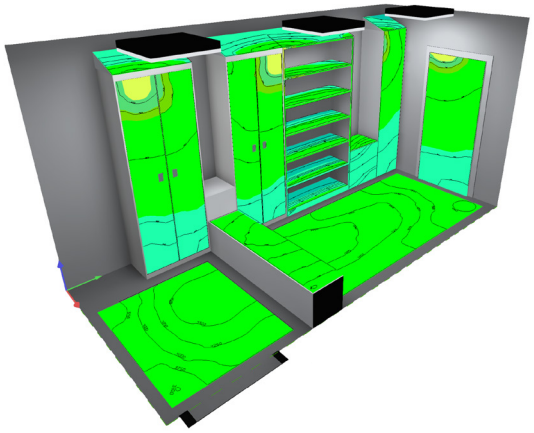


The inactivation of *Escherichia coli*. The bacteria were plated on agar and irradiated at a low intensity (0,7mW/cm2). The results were confirmed by conducting three separate tests, with each test utilizing three parallel samples from each point of analysis. 6-hour irradiation with Spectral Blue resulted in reduction of over 99,9 %.

3D disinfection planning

Optimal device placement through simulation





Every site is different and every microbial challenge is unique. Using a proprietary simulation model developed by our scientists, we create a 3D model of your space and Spectral Blue device placements. We verify the blue light coverage and optimize the setup, ensuring a solution that works in real operating conditions and delivers faster return on investment.

How the simulation process works

We simulate different device layouts and refine the design with you until the setup matches your goals — whether you want to reduce microbial burden, protect boundary areas, or reduce chemical disinfection.

What you will receive

You will get a clear recommendation for the optimal Spectral Blue MWHI® setup for your site, including:

- Recommended device type(s) and quantity
- Suggested placement for best coverage
- Price, either as an investment or as a monthly subscription fee

What we need from you

To get started, we only need basic information, such as:

- A floor plan or drawing (PDF or CAD if available — a sketch works too)
- Room dimensions and ceiling height
- Major equipment or furniture placement
- Notes on room usage and operational routines

Spectral Blue is your long-term partner in contamination control

Our approach is to help you strengthen hygiene performance, protect critical boundary areas, and achieve measurable, sustainable results in day-to-day operations. We measure success by the results you achieve.

Ready to let us run a simulation for you?

Simply send us your layout and requirements and we'll propose an optimized Spectral Blue MWHI® setup for your facility. The planning is a free service from us and there's no obligation to purchase.

Get your free planning service:

www.spectral.blue/free-planning

Spectral Blue MWHI® devices

Designed & made in Finland

Below are some examples of Spectral Blue products for different uses.

Plug & play devices

SALO & SALO XL
Biosafety cabinets & laminar hoods

OSLO
Laboratory workbenches, tables & equipment

BERLIN
Whole-rooms, equipment

Fixed installation devices

P100
Dual-mode ceiling panel device with white light included

L-series
Wall and ceiling installation. Available in IP44 and IP65.

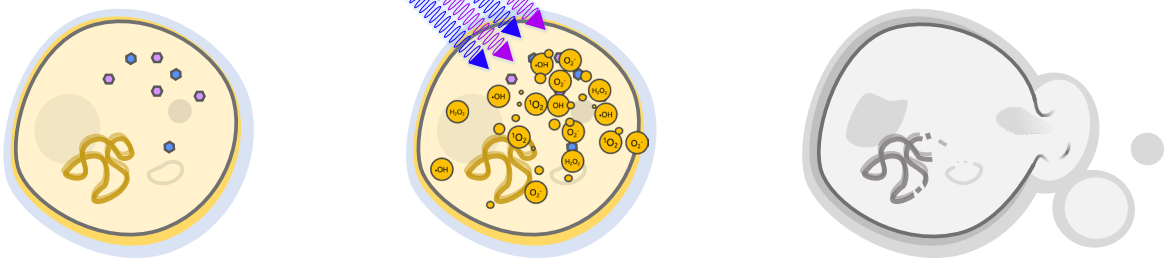
CL-series
Low-profile installation in wall-ceiling corner

Spectral Blue inside - OEM solutions

Equipment manufacturers can integrate Spectral Blue into their products to add continuous antimicrobial protection. OEM applications include operating theater ventilation systems, dental equipment, ambulances, aerospace systems, 3D bioprinters, grain handling equipment, and more.

The science & how it works

Multi-wavelength, High-Intensity MWHI blue light technology



Microbial cells contain light-absorbing compounds such as porphyrins and flavins.

Spectral Blue wavelengths activate the compounds. ROS start forming inside the cell.

The ROS damage the cell's vital structures, leading to microbial inactivation and death.

Blue light is not UV

Spectral Blue MWHI® is not ultraviolet. It uses safe visible blue light at 405 nm and 450 nm wavelengths, rather than UV-C which disinfects by directly damaging DNA. The mechanism is fundamentally different and is explained below.

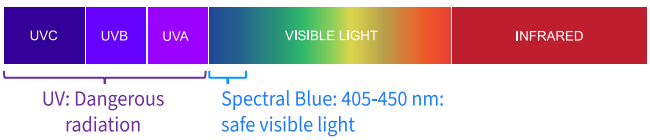
How it works

Spectral Blue MWHI® activates light-absorbing compounds naturally present in microbial cells. The most important compounds are porphyrins (absorbing 405 nm) and flavins (absorbing 450 nm).

This activation triggers a cascade of reactions that produces reactive oxygen species (ROS) inside the cell. The ROS cause widespread, non-specific damage to vital cellular structures, resulting in microbial inactivation and death. The mechanism is indirect, causing intracellular oxidative damage.

These wavelengths also travel well through water and other clear materials such as glass and plastics. The light can also penetrate biofilms, allowing it to efficiently attack colonies protected within biofilms.

The spectrum of light



Reactive oxygen species (ROS) & oxidative stress

The intracellular ROS formation under blue light follows two main pathways, often referred to as Type I and Type II reactions. In simple terms, these are two ways activated compounds interact with oxygen and nearby molecules, forming highly reactive oxygen-based species.

These reactions can form several ROS (some of which are often called free radicals), such as singlet oxygen, superoxide, and hydrogen peroxide. Because ROS attack multiple cellular targets at the same time, microbes have limited ability to repair the damage quickly. This multi-target effect also makes it difficult for microorganisms to develop resistance compared to single-target antimicrobial mechanisms.

Workplace health & safety

No photobiological risk to skin or eyes

Spectral Blue's multi-wavelength blue light is an effective and safe disinfection method for professional environments. It avoids many of the health and material risks associated with traditional disinfection methods.

Eye safety

Spectral Blue devices are evaluated using the internationally recognized Blue Light Hazard (BLH) standard (IEC/EN 62471:2006 and IEC/EN TR 62778:2014). Each device is assigned a risk group rating (RG0–RG2).

Spectral Blue devices are safe for workers' eyes when used as intended. To minimize eye strain, we recommend installing the devices so that workers do not look directly into bright light sources from close range. In typical use, the devices operate based on room occupancy—allowing disinfection to run automatically without disturbing work.

Skin safety

Clinical studies on visible blue light (401–470 nm) have shown minimal or no harmful effects on healthy human skin under realistic exposure conditions.

Spectral Blue intensity used for whole-room disinfection is safe for workers' skin when used as intended. Blue light is also widely used in medical therapies, such as treating newborn jaundice and acne.

Residues & air quality

Blue light disinfection is clean—it does not leave chemical residues on surfaces or generate hazardous fumes.

Unlike UV radiation, visible blue light does not produce ozone. It is also not known to degrade most plastics and other polymers in the same way, avoiding the risk of material aging and particle shedding from surfaces.

Children & physically impaired people

Young children or people with certain physical impairments may inadvertently look directly at bright blue light sources for prolonged periods. In settings where these groups are present, use motion sensors and position devices on the ceiling or in locations that ensure a safe viewing distance. Where possible, select devices classified as RG0 or RG1 under IEC/EN 62471.

Sustainability

A cleaner way to maintain hygiene

Blue light disinfection is a green technology

Organizations are seeking healthier, more sustainable ways of working—reducing chemical use, saving water, and eliminating toxic substances.

Spectral Blue provides disinfection without chemicals, helping reduce the consumption, transport, storage, and disposal of hazardous substances. This supports safer operations and lowers the environmental footprint associated with routine chemical use.

Spectral Blue is based on energy-efficient, mercury-free LED technology with a long service life (up to 50,000 hours), reducing maintenance needs and replacement waste over time compared to UV lamps.

Sustainability success stories

Phillips-Medisize reduced manual chemical disinfection by 80% in a cleanroom material airlock during an evaluation of Spectral Blue technology.

Hankkija's laboratory reduced daily chemical disinfection significantly, relying on detergents for routine room cleaning.

Eurofins Scientific Finland and **Finnamyl** selected Spectral Blue over UV-C in their laboratories to support more sustainable and safer operations.

Find these are more customer success stores at:
www.spectral.blue/testimonials

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Spectral Blue MWHI® is a next-generation disinfection technology patented in the USA, Europe, and China