Get the Facts Straight on UV Disinfection
Studies demonstrate that the effective UV wavelength for killing microorganisms is near 260nm. At this wavelength, pyrimidine dimerization, the primary mechanism for microorganism inactivation by UV-C light, occurs. The EPA reports that, “Pyrimidine dimers are the most common form of nucleic acid damage, being 1000 times more likely to occur than [other mechanisms of action].” Thus, pulsed-xenon UV devices that emit broad-spectrum UV actually generate non-useful UV energy, which is a detrimental to pathogen reduction. Additionally, other possible mechanisms of cellular damage, as described by pulsed-xenon manufacturers, are only marginally relevant for pathogen reduction. Furthermore, studies have shown that low-pressure mercury UV lamps operate at a significantly higher efficiency than pulsed-xenon UV lamps.1

The Clorox Healthcare® Optimum-UV Enlight® operates predominantly at 254nm UV-C, ensuring maximum pathogen reduction efficiency.

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1. UV Wavelength: Relative Effectiveness

<table>
<thead>
<tr>
<th>Wavelength (Nanometers)</th>
<th>UV Effect of 254 nm Wavelength:</th>
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<tbody>
<tr>
<td>200-320</td>
<td>Photochemical destruction of the DNA of microorganisms via absorption of UV-C light.</td>
</tr>
<tr>
<td>254</td>
<td>Shutdown of organism’s reproductive processes renders it non-pathogenic.</td>
</tr>
</tbody>
</table>

Myth
Broad-spectrum pulsed-xenon UV (200-320nm) is more effective than single wavelength UV-C (254nm)

Fact
Pulsed-xenon UV devices emit broad-spectrum UV and generate non-useful UV energy
A clear relationship exists between UV treatment duration, distance of pathogens from the device, and the percentage of microorganisms that are killed—pathogen reduction increases as the target surface gets closer to the UV device and is exposed to UV for longer. Many UV manufacturers, however, do not accompany their short cycle time recommendations with effective distance and pathogen reduction data verified by third party laboratory testing, making it difficult to objectively compare device performance. Should you hear a particularly short cycle time claim from a UV manufacturer, investigate whether the effective distance will reach target surfaces in your facility rooms to achieve the desired efficacy. If not, additional cycles and placements may be required.

The Clorox Healthcare® Optimum-UV Enlight® has been validated by a 3rd party micro-efficacy laboratory to kill more than 30 HAI-causing pathogens in 5 minutes at 8 feet.
UV technology fundamentally operates via line of sight. While some surface materials can reflect limited amounts of UV-C, many surfaces absorb most or all UV-C energy. Thus, if a target surface is “shadowed” and not in direct line of sight of the UV device (for example, those in a patient bathroom), that surface is likely to receive little to no UV treatment, limiting pathogen reduction efficacy. UV manufacturers with single placement protocols attempt to remedy this through significantly higher UV cycle times. However, 30+ minute cycle times place greater stress on room turnover, result in lengthy restarts if the UV treatment is inadvertently interrupted, and surfaces close to the UV device may become overexposed, potentially resulting in surface discoloration or damage.

Myth
A single placement of a UV device can disinfect all areas of a room as effectively as multiple placements

Fact
Placing a UV device in several locations increases the likelihood that all room surfaces are disinfected

The Clorox Healthcare® Optimum-UV Enlight® operates in 5 minute cycles in 1–3 room placements, ensuring both rapid UV treatment and complete surface coverage.
UV devices with automated cycle time determination promising uniform, efficient distribution of UV energy are often based on measurements of reflected UV light that are not surface-specific. They do not give the operator information about the dose delivered to specific high-touch or shadowed locations, nor the required dose to kill specific HAI-causing pathogens. Typically, these devices have lengthy 30+ minute UV treatment cycles that vary widely between rooms, impacting room turnover time and challenging workflow consistency. Conversely, consistent cycle times simplify UV device usage and validation of efficacy can more accurately be accomplished by measuring UV dose delivered to specific target surfaces, ensuring that UV protocol has been optimized for the room.
The Clorox Healthcare® Optimum-UV Enlight® leverages a single UV emitter with maximum-output UV-C lamps, resulting in only a few 5 minute cycles required to thoroughly disinfect a room.
The Clorox Healthcare® Optimum-UV Enlight® lamps are certified as non-hazardous waste by the EPA, and have a unique polymer encapsulation that prevents mercury from escaping in case of lamp breakage.

Myth

Pulsed-xenon lamps are safer because they do not contain mercury

Fact

Enlight® lamps contain less mercury than typical fluorescent lamps and are certified by the EPA as non-hazardous waste.

Measures to reduce mercury in hospitals are typically aimed at high mercury content devices that contact patients, such as blood pressure monitors (70-90k mg of mercury) and thermometers (500 mg of mercury). By comparison, Enlight® UV-C lamps contain less than 14 mg of mercury per lamp, half the amount found in typical overhead fluorescent lamps. At this level, Enlight® lamps have been certified by the EPA as non-hazardous waste, safe for handling and disposal under federal law. As an extra precaution, Enlight® lamps are polymer-encapsulated, ensuring no staff or patient exposure to mercury from lamp breakage. Information asserting that the EPA, WHO, or other regulatory and healthcare organizations require elimination of mercury-based UV-C lamps from hospitals is false. While pulsed-xenon lamps do not contain mercury, they can emit toxic ozone known to cause lung damage, requiring a frequently replaced ozone filter to safely operate the UV device.

Amount of mercury found in a typical T8 fluorescent bulb

Polymer Encapsulation on broken lamp

The Clorox Healthcare® Optimum-UV Enlight® lamps are certified as non-hazardous waste by the EPA, and have a unique polymer encapsulation that prevents mercury from escaping in case of lamp breakage.
Surface compatibility with UV is affected by the wavelength of light that the device emits and the amount of light surfaces are exposed to. UV-C is short wavelength UV and only penetrates into surfaces with a depth less than 20 microns. This means that UV-C will not damage common hospital surfaces since it doesn’t penetrate as far into the surface as other forms of UV light that extend further along the UV spectrum, including those generated by pulsed-xenon. While some UV devices require lengthy UV cycles that are more likely to cause surface damage, the Enlight® operates via short cycles that have been shown to have no known surface compatibility issues. Any surface changes that might occur are generally cosmetic, similar to normal fading over time, and will not impact the function of the equipment or surface. Information asserting that Enlight® has significantly damaged hospital surfaces or equipment is likely misleading and should be verified with those facilities.

### Optimum-UV Enlight® Compatibility Testing

<table>
<thead>
<tr>
<th>Polymers</th>
<th>Glass</th>
<th>Metals</th>
<th>Hard Porous Surfaces</th>
<th>Soft Surfaces</th>
</tr>
</thead>
<tbody>
<tr>
<td>e.g., Mattress covers, Electronic screens</td>
<td>e.g., Glass partitions</td>
<td>e.g., Stainless steel fixtures</td>
<td>e.g., Glazed ceramic tiles, Formica counters</td>
<td>e.g., Polyester privacy curtains</td>
</tr>
<tr>
<td>★★★/★★★</td>
<td>★★★</td>
<td>★★★</td>
<td>★★★/★★★</td>
<td>★★★/★★★</td>
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The Clorox Healthcare® Optimum-UV Enlight® has been tested against a wide range of healthcare materials, including metals, plastics, rubber and counter surfaces, and been found to produce no damage upon prolonged exposure to UV-C.
Myth
UV devices can subject staff and patients to harmful UV exposure

Fact
UV-C devices can be safely implemented when used according to manufacturer instructions

While UV-C does not penetrate skin significantly or cause the damage associate with UV-A and UV-B radiation, excessive exposure can cause temporary skin and eye discomfort. However, when used according to manufacturer instructions in unoccupied rooms, UV-C devices with robust safety features can safely be deployed. UV-C is transmitted through air and quartz, but is absorbed by ordinary glass, so viewers behind a window are protected. Furthermore, Clorox Healthcare testing has shown that exposure through typical under-door gaps does not pose a hazard. UV-C devices often include safety features to prevent UV exposure, including motion sensors that shut the device off automatically if a person enters the room during UV treatment, as well as warning signs to deter entry during use. Safety features should be a key consideration parameter when evaluating UV systems.

The Clorox Healthcare® Optimum-UV Enlight® features integrated 360° infrared motion sensors that shut the device off automatically upon entry, as well as a hard case and door hanging sign that can block entry at up to 3 doors of the room being treated.
The Clorox Healthcare® Optimum-UV Enlight® passed EPA testing concluding that all lamp emissions are negligible, and well below EPA-established limits for volatile organic compound (VOC) emissions in the air.

Xenon-based lamps emit ozone, a toxic gas known to cause lung damage, at levels that are unsafe for humans to breathe in. For this reason, whole room disinfection devices containing xenon lamps require a frequently replaced ozone filter to safely operate the UV device. In contrast, mercury-based lamps do not emit ozone or unsafe levels of volatile organic compounds (VOCs) that can create ozone in the air. Every device manufacturer should provide testing results demonstrating that their system lamps do not release VOCs in the air at levels above EPA-established limits. In addition to chemical emissions, pulsed-xenon devices emit pulsing sound and light that has been reported to be disruptive and irritating to patients and hospital staff. Mercury-based devices do not flash or produce excess noise when in operation.

**Myth**

UV system lamps emit harmful compounds into the air

**Fact**

Mercury-based lamps do not emit ozone or unsafe levels of VOCs


3. https://practicegreenhealth.org/about/press/blog/unauthorized-mercury-communication

