



Comparing UVC LED, Traditional UVC, Chemical Fogging, Misting & O₃

A Quick Guide to Sanitation Methods

Comparison Table For Ambulance Disinfection

Method	<u>Disinfection Time</u>	<u>After Use Down Time</u>	<u>Damage to Electronics</u>	<u>Damage to Interiors</u>	<u>Replacements/ Refills</u>	<u>PPE</u>
Fogging/Misting	40 Mins	Wipedown Of Chemicals	With Continued Use	With Continued Use	Yes	Yes
O3	40 Mins	O3 need to be eliminated	With Continued Use	No	No	Masks
UVC Tubes	10 Minutes	Possible Ozone	If Breakage Occurs	If Breakage Occurs	Yes	UV Eyewear
UVC LEDS	10 Minutes	Entry allowed after use	No	No	No	UV Eyewear

Chemical Fogging/Misting



Chemicals & Health

- “This is a hazardous proposition,” said Dr. Claudia Miller, an immunologist, allergist and co-author of Chemical Exposures: Low Levels and High Stakes. “Cleaners tend to go in with hugely toxic chemicals. We’re creating another problem for a whole group of people, and I’m not sure we’re actually controlling infections.”
- “In indoor spaces, routine application of disinfectants to environmental surfaces via spraying or fogging (also known as fumigation or misting) is not recommended. Spraying environmental surfaces in both health care and non-healthcare settings (e.g. patient households) with disinfectants will not be effective and may pose harm to individuals.” 2020 WHO Report
- “Do not perform disinfectant **fogging** for routine purposes in patient-care areas. ... a lack of microbicidal efficacy” CDC Report
- “The **Department** has to date not approved any biocidal products for use for the control of Covid-19 via **fogging/misting**/atomisation/aerosol devices” Irish Dept of Agriculture Report
- “**Misting** and **fogging** machines not **recommended** as disinfectants against COVID.” Date: Friday, October 30, 2020 Philippines Dept Of Health
- Concerns About Disinfectant Foggers, Mistlers, Electrostatic Sprayers Women's Voices Report
- Overuse of disinfectants can put schoolchildren at risk Times Union Article

Chemicals & Electronics/Interiors



- “Equipment designed to be cooled with fans will draw in the airborne agents and moisture, introducing the fogging chemical into sensitive electronic modules.” Carlos Garcia, Forensic Materials Scientist
- “Studies by the Environmental Protection Agency show that the chemicals most commonly used to spray disinfectants are corrosive and can damage sensitive electronic equipment.” [Claims Journal](#)
- “EPA reported that personal computers exposed to chlorine dioxide, methyl bromide and ethylene bromide experienced higher rates of functional failure than a control group that was not exposed.” See EPA Te

Costs associated with Fogging/ Misting

- Labour - Different spaces will have different time requirements. But as a rule there is the initial wipedown as with all other disinfection methods, then there is the putting on of all required PPE equipment. The Fogging itself might takes as little as 10 minutes to perform but there is a period when it needs to settle to be effective. After it has done its disinfection cycle a thorough wipedown is required to clear the area of residual chemicals. The entire process will take at least 40 minutes per space
- Machines - One time, relatively inexpensive with a lot of different makes and models on the market
- Refills - Ongoing, it is widely speculated that the heavy demand on the chemicals used for fogging and misting will lead to worldwide shortages which in the short term will increase their costs
- Replacement parts - Nozzles etc
- PPE - Even though a lot of organizations believe that wearing the PPE is not enough to combat the chemical mist entering our bodies it is necessary to wear and replace
- Turnaround time - downtime between deep cleans can be an issue
- Environmental Issues - as a lot more chemicals are released into our atmosphere and water supply, there will be legal, governmental and local authority restrictions as to their ongoing use
- Potential Legal Ramifications Environmental protection Agency Lawsuit / Beyond Pesticides

O₃ Systems



- Ozone is very reactive and corrosive, thus requiring corrosion-resistant material, such as stainless steel.
- Continued use Ozone will lead to corrosion in sensitive electronic equipment especially at areas where wires connect.
- It is extremely irritating and possibly toxic, so off-gases from the contactor must be destroyed to prevent worker exposure.
- Because of its toxicity, this chemical needs to be consistently monitored.
- Within the ozone system there are higher than fatal concentrations of ozone and the release of this gas would clearly be highly dangerous. Ozone detectors and other safety steps are essential.
- A related disadvantage is the need to ensure conformance with building regulations and fire codes concerning the storage of liquid, high-purity oxygen. Although it forms less THM's than chlorine based disinfectants if bromine is present in the water bromate will be formed. This is equally as dangerous.
- Ozone has a half-life of 20 minutes in air and water depending therefore leaving no residual kill of pathogens in the water after this time and another disinfectant must be added.



- **The Chemical Reaction Can Be Dangerous**

Even if ozone generators were proven to be effective at eliminating these chemicals, there are certain side effects everyone must be aware of. Many of the chemicals ozone reacts to results in a variety of harmful by-products. For example, when ozone was mixed with chemicals from new carpet in a laboratory setting, the ozone reduced many of the chemicals but created a variety of dangerous organic chemicals in the air. While the target chemicals were reduced, the dangerous byproducts rendered the process moved.

- **It Is Impossible to Predict Exposure Levels**

The EPA notes that it is increasingly difficult to determine the actual concentration of ozone produced by an ozone generator because so many different factors come into play. Concentrations will be higher if more powerful devices used in smaller spaces. Whether or not the interior doors are closed rather than open will affect concentrations as well. Additional factors which affect concentration levels include how many materials and furnishings are in the room to react with ozone, the level of outdoor air ventilation, and the proximity of a person to the ozone generating device.

Traditional UVC Tubes/Xenon



- Noise - Xenon cathode tubes create substantial noise when in operation. Fluorescent tubes less so but a distinct “humming” comes from the source
- Warm Up/Cool Down - Unlike LED technology, traditional UVC tubes are NOT instant strike. Exciting the gas to produce UVC requires electrical current to pass through a tube. The constant heating up and cooling down significantly shortens lifespan of the light source.
- Ozone creation - UV light wavelengths shorter than 240 nm will create ozone via photolysis of the oxygen molecule. UV light wavelengths between 240-280 nm will destroy ozone via photolysis of the ozone molecule.
- Mercury Vapor - Listed as one of the top 10 most hazardous materials by the WHO. Breakage and leakage of tubes resulting in mercury being released or ingested is a serious health risk. Disposal of tubes is a specialized procedure.
- Not easily transportable - By their very nature transportation of glass tubes is not recommended. Shatter proofing the tubes will lead to a major reduction in efficacy.

Traditional UVC Tubes/Xenon



- Expensive to purchase - because of the rigid nature of the tubes the ballasts and casing tend to add to unnecessary expense in manufacturing
- Expensive to replace parts - depending on the size and strength of the tube
- Wavelength further from Germicidal Peak - Peak germicidal absorption is 265nm, most traditional UVC lights operate at 254.3 nm, requiring longer exposure times
- Wasted light - As tubes emit UVC in 360 degrees it means 50% of their energy is being directed back at the light fixture. LED UVC on the other hand are directional so 100% of irradiation is towards the source.
- Heat - Traditional UVC tubes create heat towards the source, using up a lot of their energy in the process. LEDs on the other can control the flow of heat by using innovative heat sinks.