Advice (i.e., tips) for the selection and operation of equipment for the UV disinfection of air and surfaces

Prepared by the International Ultraviolet Association (IUVA)

The International Ultraviolet Association (IUVA) is a non-profit association bringing together scientists, engineers, ultraviolet (UV) manufacturers, consultants and others with an interest in safe and effective treatments using UV light. IUVA has received many enquiries recently, as a result of the COVID-19 crisis, as to a whether or not IUVA has advice for the selection of . This list is intended to provide advice (i.e., tips) for those who are thinking of purchasing UV disinfection equipment; these tips should only be considered as suggestions.

Although the content of this document will have relevance in some sense around the world, it has been prepared largely for the North American market.

- **Buyer beware!** – there are few accepted standards for equipment designed for the UV disinfection of air and/or surfaces. As a result, there are many ads and promotions that claim amazing performance with little or no scientific backup.
- Ask the vendor for copies of scientific papers documenting that their unit will actually work as they claim. The scientific paper(s) should show actual reduction of a test microorganism in the environment that the unit is supposed to operate.
- Is the company registered with US Environmental Protection Agency (EPA) as a pesticide device producing establishment? See the website (https://www.epa.gov/compliance/national-list-active-epa-registered-foreign-and-domestic-pesticide-andor-device-producing)
- Does it have appropriate built-in UV safety sensors for automatic shutoff or is safe operation totally reliant on the operator?
- Does the device meet NIOSH, UL, IEEE and related safety standards?
- Does the device emit/generate ozone? If so, is it compliant with NIOSH requirements. How is the ozone mitigated? (We suggest avoiding ozone devices, as it is a safety hazard for operators, unless ozone is specifically part of the treatment process and is applied in a controlled and safe way).
- Is the device being used to disinfect medical devices? If so, is it compliant with US Food and Drug Administration (FDA) requirements (see FDA document 21CFR 880.6600)?
- If the device is a UV wand used to disinfect a surface (e.g., countertop or an envelope):

    - The technical specifications should give the UVC irradiance at a fixed distance from the UV front of the device (e.g., 10 mW/cm^2 at 2 cm).
    - The UV dose (irradiance multiplied by the exposure time in seconds) should be at least 40 mJ/cm^2 to inactivate viruses, so if the irradiance at the target surface is 10 mW/cm^2, the exposure time would have to be 4 seconds.
- With any UV device, DO NOT look at the UV light or expose your hands from the UV side. UV light is a source of skin burns/cancer, and can quickly damage the eyes.
- Remember that UV disinfection is based on "line-of-sight" between the UV lamp and the target surface. If the UV beams are shadowed by elements of texture on the surface, the shadowed sections may receive much reduced UV light or no light at all. The disinfection efficacy will therefore be determined by the UV dose that these sections are exposed to.
- Like any disinfection system, UVC devices must be used properly to be safe.
    - They all produce varying amounts of UVC light in wavelengths of 200 – 280nm. UVC light is much more energetic than normal sunlight, and can cause a severe sunburn-like reaction to your skin, and similarly, could damage the retina of your eye, if exposed.
    - Some devices also produce ozone as part of their cycle, others produce light and heat like an arc welder, others move during their cycles. Hence, in general machine-human safety needs to be considered with all disinfection devices
    - These considerations should be addressed in the operations manual, in the user training, and appropriate safety compliance.

Disclosure

The International Ultraviolet Association (IUVA) provides this advice as suggestions only; IUVA cannot be held responsible for any application or misuse of this advice.