

White Paper – Controlling Virus Spread Control through Air Filtration/Sterilization with UV-C Light

Since the Covid-19 virus was declared a Pandemic in March of 2020, the scientific community has been focussed on spread control/prevention and a vaccine. Hand sanitization, 2M physical distancing and masks will always be a part of spread prevention but what else can we do?

This paper focuses on air filtration utilizing UV-C radiation to reduce the risk of air borne transmission.

Filtration

The unit of measurement for a virus is microns – 1 micron = 1/1000th of a millimeter. A N95 mask or 95% H.E.P.A. filters air particulates down to 0.3 microns. So is any mask or filter effective against virus spread? The answer is “yes” because the virus itself cannot travel on it’s own. The virus becomes attached to water droplets or aerosols, (really small droplets), that are generated by breathing, talking, sneezing, coughing etc. These water droplets or aerosols consist of water, mucus, protein and other biological material making them larger than 1 micron. (typically 1 – 5 microns)

Even though N95 masks and 95% H.E.P.A. are rated to filter particulates to 0.3 microns, they can be effective in filtering much smaller particles due to two factors:

- 1/ Brownian Motion - the name of a physical phenomenon in which particles smaller than 0.3 microns move in an erratic, Zigzag kind of motion increasing the chance they will be snared by the mask/filter fibres.
- 2/ Electrostatic Absorption – particles are drawn to the fibre and trapped instead of just passing through.

UV-C Light

Ultraviolet purification has been utilized for many years in clean rooms, liquid treatment, domestic ponds, and in food preservation. UV-C works using a photolytic effect whereby the radiation destroys or inactivates the micro-organism so that it can no longer multiply. The ideal UV-C wavelength is 254 nanometers which effective in cell destruction, safe for human exposure, and will not generate ozone. UV-C radiation is generated using a low pressure mercury discharge lamp where on average, 35% of the input energy, watts, is converted to UV-C light. (watts), making it very efficient in the lighting world.

UV-C radiation cannot instantly destroy a cell so is ineffective on a virus or bacteria travelling through an air distribution system at a high velocity. A UV-C lamp emitting radiation on the inlet side of a H.E.P.A. filter is effective, where it bathes the face of the filter with trapped virus’s and bacteria with UV-C radiation.

Air Changes

No filtration or sterilization system can be effective if the air is not passing through it. A single zone portable air filtration/sterilization unit is effective in an area up to 1000 sq ft, 93 sq m before recirculation or “short cycling” becomes a problem. Multiple units would be needed to provide effective filtration/sterilization in larger areas to ensure complete filtration/sterilization.

Temspec Air Medic Air Filtration/Sterilization Unit

The Air Medic unit is a standalone unit offering 4 stages of air filtration/sterilization. (MERV 8 prefilter, 95% H.E.P.A. filter, activated carbon and UV-C light) The unit is available in 2 capacities, Model TIF-04, 250 CFM with 500 CFM purge mode for spaces up to 500 sq ft., 46 sq m, (medical/dental examination room) and TIF-09, 500 CFM model with 900 CFM purge mode for spaces up to 1000 sq ft., 93 sq m. (classroom, waiting room, board room)

References 1. Biological Effects of Ultraviolet Radiation W. Harm, Cambridge University Press 1980 2. The application of ultraviolet Germicidal radiation to control Transmission of Airborne Disease, Public Health reports/ March -April 2003 , VH118. 3. IES Lighting Handbook, Application Volume, 1987, 14-19.