



2021

# Behind the Update: ASHRAE *Handbook* Chapters on UV-C to Include Updated Best Practices, Guidance

During the COVID-19 pandemic, there have been many questions about proper use of germicidal ultraviolet light (UV-C) energy for surface and air inactivation.

The *Handbook* committee for ASHRAE Technical Committee, 2.9, Ultraviolet Air and Surface Treatment, has been meeting regularly to update the technical information in ASHRAE *Handbook*, said Dean Saputa, Associate Member ASHRAE, TC 2.9's Handbook Subcommittee chair. The updates will go into *Handbook Online* as supplemental sneak previews of future versions of the chapters.

The TC is working on the following updates:

- Bio-security and preparedness with different UV technologies using data from ASHRAE's Epidemic Task Force.
- The use of UV-C for surface decontamination including mobile roll-in-the-room UV-C devices.
- Dose and microbial response section to show a chart of well cited and documented microbes and the amount of UV-C energy it takes to inactivate at 90% and 99%.
- Devices that use UV-C lights for air purifiers, handhelds and other gadgets.
- Data on upper air germicidal UV fixtures including information about safety, commissioning and dosing.

## 1. Why did TC 2.9 decide to make these out-of-sequence changes now?

Due to the COVID-19 pandemic, members of TC 2.9 have fielded many inquiries on the proper application of germicidal ultraviolet light (UV-C) energy for surface and air inactivation. Several of our members are part of the ASHRAE Epidemic Task Force and have made major contributions to the filtration/disinfection portion of the ETF's guidance documents.

We wanted to share these important updates and application recommendations with the broader industry by updating the “Ultraviolet Air and Surface Treatment” chapter of the *Handbook—HVAC Applications*.

## 2. How did TC 2.9 decide which information to update?

We focused our attention on updating the most relevant sections having to do with pandemic response, such as adding a section on bio-security and mitigation by applying different UV products such as in-duct disinfection, upper room decontamination and mobile roll-in-the-room systems.

## 3. What are the biggest misconceptions right now regarding UV technologies?

Despite eight decades of peer-reviewed scientific research proving the airstream disinfection efficacy of germicidal UV-C, there remains doubt that UV-C can inactivate airborne pathogens. The members of TC 2.9 hope this pandemic has left no doubt that the 254 nm germicidal wavelength can inactivate the genetic material in the SARS-CoV-2 virus.<sup>1</sup> Moreover, when aerosolized, SARS-CoV-2 is likely to be more susceptible to UV-C damage than other coronaviruses such as SARS-CoV-1 (that led to the 2003 severe acute respiratory syndrome) or MERS-CoV<sup>2</sup> (that caused the 2012 Middle East respiratory syndrome).

Today, there are several approaches to using this decades-old technology to reduce microbes in the air and on surfaces, including airstream disinfection and upper room decontamination.

Germicidal UV-C air disinfection systems are installed in a building's HVAC ductwork to disinfect moving airstreams before they reach employees. Inactivation ratios over 99.9% on a first-pass basis have been demonstrated by the U.S. Environmental Protection Agency (EPA) and the U.S. National Homeland Security Research Center.<sup>3</sup> As air is recirculated, concentrations of infectious pathogens are further reduced by each subsequent pass (“multiple dosing”).

Upper Room UV-C is the oldest disinfection application of the germicidal wavelength for airborne inactivation and is recommended for improved control of highly contagious airborne diseases such as tuberculosis by the U.S. Centers for Disease Control and Prevention and the U.S. National Institute for Occupational Safety and Health.

## 4. What are your recommended best practices for using UV technologies?

We address three main applications of UV-C in our *Handbook*:

- in-duct surface and air disinfection;
- upper air or upper room decontamination; and
- mobile roll-in-the-room systems.

We currently guide readers to the [ASHRAE Position Document on Infectious Aerosols \(2020\)](#), which includes guidance on how to implement upper room and in-duct UVGI. The *Handbook* chapters can help users with proper installation, commissioning, safety and maintenance.

One best practice is to use a computer model to determine proper UV dosage. There are many factors that influence the sizing of airstream disinfection systems (and no “one-size-fits-all” scenario).

For example, the volume and velocity of air traveling through an HVAC system significantly impact the length of exposure to the germicidal wavelength (residence time)—a higher volume of air and/or faster-moving airstreams require greater UV intensity. Similarly, air temperature (cold air reduces the output of UV-C lamps); humidity (high RH decreases pathogen susceptibility to UV-C) and duct reflectivity, all play a role in determining the amount of UV-C energy necessary in any given application.

For upper room UV fixtures, the only consideration is a ceiling that is at least 8 ft (2.44 m) or higher and that the upper room area where the UV-C energy will be installed is free of obstructions (hanging televisions, signage, framing soffits, etc.) that might misdirect the UV energy.