Broadening the Spectrum: The Role of Germicidal UV in ASHRAE's Control of Infectious Aerosols Standard

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The COVID-19 crisis highlighted the challenge of controlling the spread of respiratory pathogens and underscored the need for improved indoor air quality. In May 2023, SecureBio responded to ASHRAE's request for public comment on an earlier draft of their Standard 241P. We applaud ASHRAE's initiative to devise guidance aimed at defining "minimum requirements for control of infectious aerosols to reduce the risk of disease transmission." However, we contended that the drafted standard fell short of realizing this objective.

In particular, we suggested the following:

1. The standard should more explicitly recognise *Germicidal Ultraviolet Light* (GUV) systems as an cost-effective, energy-efficient, and proven method for controlling infectious aerosols, and
2. The committee revisit and potentially remove elements of its specific guidance around GUV, lest it create confusion and put an undue burden on adopters of the technology.

See below for the detailed feedback we submitted to ASHRAE:

Suggestion 1: the standard should more explicitly recognise GUV systems as a cost-effective, energy-efficient, and proven method for controlling infectious aerosols

- Ultraviolet light possesses potent germicidal properties and has been employed for nearly a century to sterilize air, surfaces, and water (Reed 2010). Historically, the focus was predominantly on *upper-room GUV* systems emitting primarily at 254 nm. These systems continue to effectively curtail airborne diseases today, achieving 20+ equivalent-air-changes-per-hour (eACH) at a fraction of the cost of an equivalent improvement using mechanical ventilation or in-room air cleaners (Abboushi et al. 2022).
- *Far-UVC* systems, defined generally as those emitting between 200-235 nm, generally possess the same germicidal properties as the 254 nm systems while mitigating health risks from direct exposure. Far-UVC systems have been shown to be more efficient at inactivating viruses compared to the 254 nm systems. Furthermore, they are suitable for whole-room disinfection, as germicidal doses of 222 nm light are considered to be safe for human exposure under the recently increased ACGIH (American Conference of Governmental Industrial Hygienists) exposure limits[1] (Blatchley et al. 2022). Whole-room deployment of far-UVC further enhances efficacy, allowing for immediate disinfection of

[1] Preliminary data suggests that the exposure limits for far-UVC may even be raised in the future, provided proper filtering is used to restrict emissions outside the 200-235 nm range.

the breathing zone. In contrast, upper-room GUV and ventilation/filtration systems only disinfect air after it has been circulated, delaying the purification process and limiting the equivalent air-cleaning rate to the through-system flow rate. At current ACGIH TLVs, far-UVC can achieve up to 184 eACH (Eadie, E., Hiwar, W., Fletcher, L. et al. 2022).

- Both whole-room far-UVC and upper-room GUV systems present promising, cost-effective indoor air disinfection solutions, especially in situations where achieving high levels of disinfection indoors through ventilation and filtration alone proves impractical. Crucially, even ubiquitous installation of MERV-rated filters at 20 ACH would struggle to prevent another pandemic as infectious as SARS-CoV-2, let alone an agent as transmissible as mumps or measles. Given the inevitability of future pandemics and their potential to be considerably more harmful than COVID-19, any system that may be capable of reliably suppressing transmission in such an event deserves serious consideration, particularly because such suppression would additionally block the spread of many endemic human pathogens.
- Moreover, enhancing filtration efficiency with higher MERV-rated filters tends to significantly escalate energy demand, while augmenting ventilation rates necessitating significant and costly overhauls to building systems. By contrast, retrofitting a building or space with GUV technology is straightforward and economical, and will become more so as the technology's costs continue a significant downward trend. Recognizing these benefits, May 2023 guidance from the US Centers for Disease Control and Prevention encouraged the installation of GUV systems to "lower the concentration of viral particles in the air," and underlined their effectiveness in achieving high air change rates with minimal energy consumption, particularly in high-occupancy environments (CDC 2023).

We believe that any standard set forth with the goal of establishing minimum requirements for controlling infectious aerosols and reducing disease transmission risk should not exclude or minimize the crucial roles of upper-room and far-UVC GUV systems. When including these modalities, the ASHRAE standard should not seek to create guidelines inconsistent with existing safety guidance.

Suggestion 2: The committee revisit and potentially remove elements of its specific guidance around GUV, lest it create confusion and put an undue burden on adopters of the technology.

On the topic of safety, it would be prudent for the standard to align with existing guidelines without making modifications or contradictions. The current standard refers to ACGIH exposure guidelines but stipulates an assessment height of 2m, whereas ANSI/IES RP-44 recommends 1.8m. Similarly, the standard outlines that a system should not be used if it creates >5ppb of ozone, but ASHRAE 62.1 already has a total ozone requirement (70ppb). Installations that monitor ozone levels and utilize ventilation, upper-room 254nm, filters with decomposition catalysts, and other methods to keep levels below 70ppb should logically be acceptable. Given the rapidly evolving research on ozone safety, and existing guidelines, we urge caution when crafting new guidelines in this area.

On behalf of SecureBio, we appreciate the opportunity to offer our perspective. We welcome further dialogue on this submission or any related topic concerning infectious aerosol control. Please feel free to engage us for additional discussions or clarifications at your convenience.