ASHRAE 241-2023 Control of Infectious Aerosols

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SUMMARY

On June 24, 2023, ASHRAE approved the publication of Standard 241-2023 *Control of Infectious Aerosols*. The purpose of Standard 241 is "to establish minimum requirements for control of infectious aerosols to reduce risk of disease transmission in the occupiable space" of buildings by defining "the amount of *equivalent clean airflow* necessary to substantially reduce the risk of disease transmission during *infection risk management mode*". We provide a high-level overview of key aspects of the new standard as well as a discussion of its historical context and its potential impact on design and operation of buildings to achieve improved indoor air quality (IAQ).

Requirements for airborne infection risk management have been absent for a century from IAQ standards with the exception of those written for healthcare facilities and laboratories. In 1895, ASHRAE's predecessor society, the American Society of Heating and Ventilating Engineers (ASHVE), published ventilation recommendations intended to reduce disease transmission that were incorporated in a proposed a 1914 model law and included in 22 US state codes by 1922. Since the 1930s, however, IAQ standards have focused on perceived air quality and control of chemical and particulate contaminants that have reduced minimum ventilation rates by half.

More recently, the important role that indoor environments can play in disease transmission, has been described in ASHRAE's Position Document on *Infectious Aerosols* that was first published with the title *Airborne Infectious Diseases* in 2009. Unfortunately, this awareness did not lead to changes in standards. The great personal, societal, and economic consequences of the COVID-19 pandemic together with the evidence that poorly ventilated buildings can be high risk environments for airborne infection transmission brought the adequacy of existing IAQ standards under heavy scrutiny. Recognizing that indoor environments were not designed to mitigate risk of Covid-19 transmission, ASHRAE formed its Epidemic Task Force (ETF) early in 2020. In a matter of months, the ETF produced a large body of guidance that was well received and widely used. This guidance was not intended to set new enforceable minimum requirements but did lay the groundwork for their development, as a logical next step.

The development of Standard 241 began with the December 6, 2022 ASHRAE board motion authorizing development of a "comprehensive, consensus-based, code enforceable standard…to mitigate the risk from respiratory pathogens" on an aggressive six-month schedule requested by the US White House COVID-19 Response Team Coordinator, Dr. Ashish Jha. The committee of international experts formed to undertake this challenging task first met on February 28, 2023, delivered a public review draft on May 12 and, after evaluating over 1000 comments, recommended a final draft for publication, which was subsequently approved on June 24. This unprecedented development time of 116 days was made possible by the extraordinary commitment of the project committee and to its ability to

build on existing ASHRAE documents. Key aspects of the new standard are summarized below.

- Standard 241 applies to occupiable space in new buildings, existing buildings, and major renovations, including residential buildings and some portions of health care facilities. It sets requirements for outdoor air system and air cleaning system design, installation, commissioning, operation and maintenance.
- A prerequisite for meeting standard 241 is that minimum Indoor Air Quality be provided by complying with applicable IAQ standards such as ANSI/ASHRAE Standard 62.1, ANSI/ASHRAE Standard 62.2, or ANSI/ASHRAE/ASHE Standard 170 at the time of construction or major renovation.
- Standard 241 gives requirements that apply to *infection risk management mode* (IRMM), the operating mode when increased protection from infectious aerosol exposure is needed. Public health officials or other authorities may begin and end required use of IRMM, but it could also be used at the discretion of the building owner or occupant.
- *Equivalent clean airflow* requirements are the single most important aspect of Standard 241. The equivalent clean air flow requirement for a space is the product of space occupancy and its equivalent clean airflow rate for infection risk mitigation per person (ECA). Equivalent clean airflow is the "flow rate of pathogen-free air that, if distributed uniformly within the breathing zone would have the same effect on infectious aerosol concentration as the sum of actual outdoor airflow, filtered airflow, and inactivation of infectious aerosols". This provides the user of the standard great flexibility to determine how requirements are met.
- The standard provides extensive requirements for mechanical filters and air cleaners. These include required testing for both performance and safety. Mechanical filters must be at least MERV-A 11 or equivalent in order to receive credit for contributing to equivalent clean airflow requirements. Prescriptive infectious aerosol removal efficiency are provided. Other air cleaners and air disinfection technologies must be tested by in-duct or chamber methods described in Normative Appendix A of Standard 241. Safety testing requires measurement of formaldehyde, ozone, and particulate matter emissions and sets target levels.
- Standard 241 includes a variety of other requirements such as air distribution, natural ventilation and for assessment, planning, commissioning, operation, and maintenance of infectious aerosol control systems, which revolves around the development of a *Building Readiness Plan* that describes the engineering and non-engineering controls used to achieve equivalent clean airflow targets for a facility. Supporting guidance and tools are provided to assist in planning and commissioning.

Standard 241 is ground-breaking in a number of respects:

- By creating a special operating mode for use when conditions warrant (IRMM), it introduces the concept of resilience into indoor air quality standards.
- Expressing control requirements in terms of a quantity, equivalent clean air, that integrates the impact of multiple controls. This is also a concept that could be adapted and applied to other indoor air quality standards.
- The requirements for filter and air cleaner testing go well beyond what is found in existing standards. They are a major step in the direction of creating uniform and effective technology-agnostic criteria for characterizing filter and air filter performance and safety that will support their effective application.

KEYWORDS

Infectious Aerosols, COVID19, Air Cleaning, IAQ