ONTARIO SOCIETY OF PROFESSIONAL ENGINEERS

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ASHRAE
180 Technology Parkway NW
Peachtree Corners, GA
30092

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ASHRAE Standard 241P Advisory Public Review Draft Control of Infectious Aerosols

The Ontario Society of Professional Engineers (OSPE) is the advocacy body and voice of the engineering profession. Ontario currently has over 85,000 professional engineers, 250,000 engineering graduates, 6,600 engineering post-graduate students and 37,000 engineering undergraduate students. The engineering profession's commitment to safeguarding the public interest has always been extremely important, and in this context, there is no exception.

OSPE's Indoor Air Quality (IAQ) Advisory Group has published a series of guidance documents aimed at protecting indoor environments using adequate technology. These internationally acknowledged guiding principles were authored by a multidisciplinary group, including HVAC engineers, respiratory specialists and healthcare professionals.

ASHRAE Standard 241P, Control of Infectious Aerosols, sets forth essential guidelines for implementing HVAC measures aimed at mitigating the transmission of COVID-19, influenza, and other airborne viruses in various settings such as homes, offices, schools, and hospitals, particularly during periods of heightened risk. This standard serves as a resource in promoting healthier indoor environments, enhancing the safety and well-being of individuals in the places where we spend our time—whether it be work, home, or recreational spaces.

Below are the recommended modifications to the *ASHRAE Standard 241P, Control of Infectious Aerosols* put forth by members of the IAQ Advisory Group:

<u>Definition of Professional Person</u>

The proposed definition to be included in the "Definitions" section of the Standard is as follows:

"***A qualified person is an individual who possesses the necessary knowledge, skills, training, experience, and other qualifications required to perform specific types of work as stipulated in relevant legislation, government policies, or as specified by a government-recognized***

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organization. These qualifications may encompass holding an accreditation granted by the government, being a member of a professional association established under an Act, or meeting the criteria established by another organization deemed satisfactory by the government. The verification of these qualifications may be conducted through a process overseen by the government, a professional association, or another approved organization authorized to ensure compliance. Additionally, members of a professional association established under an Act may perform self-assessment to determine their ability to operate within their designated area of expertise in accordance with their code of ethics."

By including this comprehensive definition, the Standard aims to provide clarity and ensure a common understanding of the term "qualified person" within the context of its guidelines and requirements.

For more information, please refer to: https://www2.gov.bc.ca/gov/content/industry/natural-resource-use/doing-business-on-the-land-base/qualified-persons-in-the-nrs"

Section 4.2.3

In the compliance chapter of the standard, there is a specific requirement outlined as follows:

"*To be credited towards compliance with this standard, an air filter must have an E1 rating of at least 20% in accordance with ASHRAE Standard 52.2-2017. Any filter with an ePM1 rating from ISO Standard 16890 or certified by the manufacturer to be a High-Efficiency Particle Air (HEPA) filter is deemed to meet this requirement.*"

The IAQ Advisory Group recommends the following modification to enhance this requirement:

"***In order to be considered fully compliant with this standard, an air filter must demonstrate a weighted pathogen removal efficiency equal to or greater than 60%, as specified in Table A-1 of Normative Appendix A.***"

By incorporating this recommendation, the IAQ Advisory Group aims to further enhance the effectiveness and quality of air filtration systems in meeting the requirements of the standard, ensuring optimal indoor air quality and reducing the risk of transmission of airborne pathogens.

Section 6.1.1 - Arrangement of Air Inlets and Outlets.

In the air distribution and natural ventilation chapter of the standard, there is a specific requirement related to airflow distribution patterns, stated as follows:

"*Air inlets and outlets shall be arranged in a manner that reduces short-circuiting for the majority of the area served by the inlets and outlets.*"

We recommend the following modification to clarify this requirement:

"***Air inlets and outlets should be arranged in accordance with established standards that specifically address the reduction of short-circuiting for the majority of the area served by these components. Currently, there are no existing standards available that provide comprehensive guidelines for achieving optimal reduction of short-circuiting. Therefore, it is recommended that additional details and guidance be provided within the standard to address this crucial aspect.***"

By incorporating this recommendation, the IAQ Advisory Group aims to ensure that the standard provides clear and comprehensive guidance on reducing short-circuiting and optimizing airflow distribution patterns, thereby enhancing the overall effectiveness of air distribution and natural ventilation systems in promoting healthier indoor environments.

Section 6.1.3 - Directionality of Airflow.

In the air distribution and natural ventilation chapter of the standard, there is a specific requirement addressing airflow distribution patterns, which states:

"*Air moving devices and air inlets shall be designed such that no lateral flow with a velocity greater than 50 fpm occurs within the* breathing zone."

To further emphasize and enhance this requirement, the following recommendation is proposed:

"***It is recommended to ensure that there is no lateral airflow within the breathing zone exceeding a velocity of 50 fpm (0.25 m/s). This ensures that the air movement is effectively controlled and directed, maintaining a comfortable and safe environment for occupants.***"

By reinforcing this recommendation, we aim to emphasize the importance of preventing any excessive lateral airflow within the breathing zone, thereby promoting optimal air quality and ensuring the well-being of individuals within the space.

Section 6.2.2.1

In the air distribution and natural ventilation chapter of the standard, there is a specific requirement addressing mechanical ventilation – Single Zone Ventilation systems, stated as follows:

"*The HVAC system* equivalent outdoor air *flow rate shall be calculated in accordance with equation 6-2.*"

We recommend reviewing and clarifying Equation 6-2, as it appears to be the same as Equation 6-3. Furthermore, it would be beneficial to **provide the definition of the parameters used in the equation** earlier in the standard to ensure better understanding and application.

By addressing this recommendation, we aim to enhance the clarity and accuracy of the calculation method for determining the HVAC system's equivalent outdoor air flow rate. Ensuring that Equation 6-2 is distinct from Equation 6-3 and providing clear definitions of the parameters will facilitate proper

implementation of the standard and promote consistency in calculating the outdoor air flow rate in HVAC systems.

Section 6.4.1

In the air distribution and natural ventilation chapter of the standard, there is a specific requirement regarding Air Cleaners – Direct Removals, stated as follows:

" *Air cleaning devices that act through the direct removal of infectious aerosols shall not be placed such that their inlets are within the jet of a ventilation system supply air outlet with a velocity greater than 50 fpm (0.8 m/s).*"

We recommend avoiding the placement of air cleaning devices that directly remove infectious aerosols in a manner where their inlets are within the jet of a ventilation system's supply air outlet with a velocity exceeding 50 fpm (0.25 m/s).

By adhering to this recommendation, the aim is to prevent the positioning of air cleaning devices in locations where their effectiveness may be compromised by being exposed to high-velocity supply air outlets. This will help ensure that the direct removal of infectious aerosols is optimized and supports the overall objectives of the standard in promoting healthier indoor environments.

Section 7.4 - In-Duct Air Cleaning Systems.

Section 7.4 of the standard is dedicated to In-Duct Air Cleaning Systems and presents detailed requirements and calculations pertaining to their application. To further enhance clarity, the IAQ Advisory Group recommends incorporating a reference to Normative Appendix A earlier in this section. This addition will provide clear guidance on how to determine the pathogen removal/inactivation efficiency (εPR).

Recommended Text: "*Where VH represents the HVAC system's equivalent outdoor air flow rate, measured in cfm (l/s), and εPR denotes the pathogen removal/inactivation efficiency, determined based on the methodology outlined in Normative Appendix A.*"

By including this clarification, professionals will have a more comprehensive understanding of how to calculate and assess the effectiveness of pathogen removal/inactivation in In-Duct Air Cleaning Systems.

Section 7.4.2.1

The determination of the HVAC system equivalent outdoor air flow rate(VH) should be carried out in accordance with section 7.4.1 instead of 7.41.

Recommendation: Amend the reference to section 7.41 to accurately reflect section 7.4.1.

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Section 8.2.3.6.1

Section 8.2 of the standard focuses on Assessment, Planning, and Implementation, with subsection 8.2.3.6.1 specifically addressing Outdoor Airflow Measurement. The following methods are identified for measuring, estimating, or identifying outdoor airflow quantities:

"*a. TAB report within 1.5 years of assessment, along with site observation of airflow at system.*
b. Methods in ANSI/ASHRAE Standard 111-2008 or equivalent as allowed by the AHJ to determine airflow.
c. CO2 decay or concentration readings (mechanical or natural ventilation)."

Recommendation: To enhance clarity and understanding, it is suggested to **provide an initial definition or explanation of TAB upon its first occurrence in the section**. Furthermore, it is recommended to **reference Normative Appendix B**, which offers a detailed method for calculating CO2 decay or concentration.

Section 8.2.3.6.5

This section is about Energy Recovery Ventilators (ERVs):

"*Energy recovery ventilators, if present, shall be assessed for proper airflow measurements and fan locations to determine if the ERV shall remain operational or require maintenance and upgrades to operate in IRMM.*"

Recommendation: To provide comprehensive coverage, it is recommended to **include Heat Recovery Ventilators (HRVs)** alongside Energy Recovery Ventilators (ERVs) in this section.

Section 9.1.3

Section 9 focuses on Operations and Maintenance, specifically addressing modes of operation in Section 9.1.3. It states:

"*The operator and building owner shall determine which mode of operation shall be used for the facility. Modes of operation shall be identified as one of the following:*
- *a.* Normal Mode
- *b.* IRMM
- *c. Temporary Shutdown. [Future Informative Appendix K – Temporary Shutdown]*"

Recommendation: To enhance the guidance provided, it is recommended that the **determination of the mode of operation for the facility takes into consideration the infection risk in the community and the facility**. Additionally, recommendations from the AHJ (Authority Having Jurisdiction) or public health agencies, following the precautionary principle, should be considered when making this decision.

Section 9.1.9

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The standard establishes the following in regard to Air Distribution:

"*Operator shall confirm that air distribution type listed below complies with the strategies listed in Section 6 Air Distribution.*

a. *Mixing ventilation.*
b. *Displacement ventilation.*
c. *Personal Ventilation*
d. *Barriers. May not be used unless actual in-space measurements show reduced concentrations in occupied spaces.*
e. *The operation of the ventilation systems shall provide air movement that is generally from clean to less-clean areas (e.g., air shall not be transferred from spaces where occupants congregate to spaces intended for personal use), regardless of the modes of operation. If any form of variable-air-volume or DCV system is used for energy*"

Recommendation: To prevent any confusion, it is advisable to **physically separate spaces designated for isolation from areas intended for personal use**. This separation helps to ensure clarity and minimize the risk of improper ventilation practices.

Section 10.4:

Section 10 of the standard focuses on Residential Buildings. Specifically, numeral 10.4 addresses the need for separation areas for vulnerable occupants and outlines the actions to be taken when creating such areas:

"*1. Select separation area: If available the separation area shall be on a low floor in the home during the heating season, but on a high floor during the cooling season. When possible, the separation area shall have its own restroom facilities.*
2. *Separate HVAC Systems: A separate HVAC system shall be used for the separation area. If necessary, portable room heaters (or room air conditioners) shall be used in the separation area. If there is a forced-air system that would mix the air between the household and the separation area, all registers, return grills or supply grills shall be sealed, unless it is not possible to provide ventilation or maintain thermal comfort conditions any other way.*
3. *Operate Supply Ventilation: Separate supply ventilation shall be provided in the separation area. When there is no permanently installed supply fan available, window-installable products shall be used to provide supply ventilation. Minimize use of operable windows anywhere in the home. 5. Operate Portable Air Cleaner: Portable air cleaners shall meet the requirements of 10.1.1.2.*"

Recommendation: To further enhance the effectiveness of the separation area, it is recommended to **include the following action as an additional step:**

- ***Operating portable air cleaners: Portable air cleaners used in the separation area should meet the requirements outlined in 10.1.1.2. This will help ensure improved air quality and provide an added layer of protection for vulnerable occupants***.

The Standard includes **Appendix A**, which focuses on determining air cleaning system effectiveness and safety. The IAQ Group has provided the following recommendations to enhance this section:

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A1.4.1.3

Section A1, which covers the "Testing Procedure," specifically addresses the tests for bioaerosol removal effectiveness using the bacteriophage MS2 (host Escherichia coli) as the test microorganism:

"*Testing shall be performed with the non-enveloped bacteriophage MS2 (host Escherichia coli). The test microorganism shall be aerosolized by nebulizing a microbial suspension to produce discrete particles.*"

The IAQ Group recommends considering the potential impact of particle size distribution when aerosolizing the microbial suspension using different nebulizing methods.

To ensure accurate and comprehensive testing, it is important to **acknowledge that different nebulizing methods may result in variations in particle sizes.** These variations can potentially affect the removal rate of the bioaerosols. Therefore, it is advisable to carefully evaluate the nebulizing method and its impact on the particle size distribution to obtain reliable and representative results.

By recognizing the potential influence of particle size distribution, the testing procedure can be refined to account for variations in nebulizing methods. This will enhance the accuracy and reliability of the bioaerosol removal effectiveness testing, providing more valuable insights into the performance of air cleaning systems.

A1.6.2.1

Section A1.6, which addresses reporting requirements, specifies:

"*The pathogen removal efficiency of fibrous media filters shall be permitted to be determined in accordance with Equation A-2 or Table A-1.*"

The IAQ Group recommends **providing additional clarity on how the particle size distribution is determined for the three specified ranges** and suggesting the **inclusion of a table that outlines the weights and calculation method for Table A-1**. This table can also outline the calculation method used to derive the values presented in Table A-1. By doing so, users can easily comprehend the basis for the pathogen removal efficiency determination, ensuring consistency and accuracy in reporting.

B1.5.1 2a

Normative Appendix B, which pertains to assessment, planning, and implementation, includes the requirements for the Existing Building Assessment. In particular, B1.5 focuses on ventilation, and B1.5.1 specifically addresses outdoor airflow measurement methods. The IAQ Group recommends the following improvement:

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In B1.5.1, it is advised to include the unit for the temperature difference of 20 degrees mentioned in method 2a. **The sentence should be modified as follows:**

a. OA% ratio calculated based on temperatures if RAT (room air temperature) and OAT (outdoor air temperature) are at least 20 degrees Fahrenheit (or Celsius) apart.

By including the unit (Fahrenheit or Celsius) for the temperature difference, it ensures clarity and accuracy in the measurement requirements.

The Ontario Society of Professional Engineers (OSPE) thanks ASHRAE for allowing the opportunity for public review. OSPE welcomes the opportunity for further discussion and collaboration on this matter. If there are any questions, please contact advocacy@ospe.on.ca.

Sincerely,

Stephanie Holko, P.Eng., MBA
President and Chair
Ontario Society of Professional Engineers

Sandro Perruzza
Chief Executive Officer
Ontario Society of Professional Engineers