

AIVC - New Standard, Guidelines, or Regulations for Ventilation due to COVID-19

# ASHRAE STANDARD 241

## *Control of Infectious Aerosols*

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# ASHRAE Standard 241-2023

## *Control of Infectious Aerosols*

### Purpose

- Requirements for control of infectious aerosols to reduce risk of airborne transmission
- Occupiable space in existing and new buildings, additions, and major renovations
- Non-residential, residential, and health care spaces
- Covers outdoor air and air cleaning system design, installation, commissioning, operation, maintenance
- Specify *equivalent clean air* to be provided in *infection risk management mode*

### Scope

- Based on reduction of *long range transmission* risk
- Does not establish overall requirements for acceptable indoor air quality but requires IAQ as a pre-requisite

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# Infection Risk Management Mode (IRMM)

The mode of operation in which measures to reduce infectious aerosol exposure documented in a building readiness plan are active

Decision on IRMM Enable / Disable: **Not specified in 241**

- Public health official
- Owner
- Occupant

Why not all the time?

- Potential Energy use and cost increase
- Infection risk and consequences of infection vary over a wide range

An example of **resilience** applied to IAQ



Normal

IRMM

# Equivalent Clean Airflow (ECA)

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

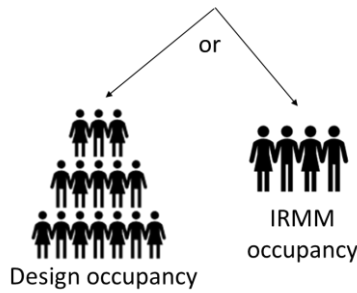
Concept on which the entire standard depends

- Determine ECA for infection risk mitigation (ECA<sub>i</sub>)
- Determine total ECA for spaces, systems (V<sub>ECAi</sub>)
- Analyze options to reach target in IRMM

Also adopted from Epidemic Task Force guidance (same as *equivalent outdoor air*)

ECAi depends on space type, number of people, activity

$$V_{ECAi} = ECAi \times P_{Z, IRMM}$$



Double table ECAi for high vocalization spaces

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| Occupancy Category                              | ECAi       |            |
|---|------------|------------|
|   | cfm/person | L/s/person |
| <b>Correctional Facilities</b>                  |            |            |
| Cell  | 30         | 15         |
| Dayroom   | 40         | 20         |
| <b>Commercial/Retail</b>                        |            |            |
| Food and beverage facilities                    | 60         | 30         |
| Gym   | 80         | 40         |
| Office  | 30         | 15         |
| Retail  | 40         | 20         |
| Transportation waiting                          | 60         | 30         |
| <b>Educational Facilities</b>                   |            |            |
| Classroom                                       | 40         | 20         |
| Lecture hall                                    | 50         | 25         |
| <b>Industrial</b>                               |            |            |
| Manufacturing                                   | 50         | 25         |
| Sorting, packing, light assembly                | 20         | 10         |
| Warehouse                                       | 20         | 10         |
| <b>Health Care</b>                              |            |            |
| Exam room                                       | 40         | 20         |
| Group treatment area                            | 70         | 35         |
| Patient room                                    | 70         | 35         |
| Resident room                                   | 50         | 25         |
| Waiting room                                    | 90         | 45         |
| <b>Public Assembly/Sports and Entertainment</b> |            |            |
| Auditorium                                      | 50         | 25         |
| Place of religious worship                      | 50         | 25         |
| Museum  | 60         | 30         |
| Convention                                      | 60         | 30         |
| Spectator area                                  | 50         | 25         |
| Lobbies   | 50         | 25         |
| <b>Residential</b> 2/12/2024                    |            |            |
| Common space                                    | 50         | 25         |
| Dwelling unit                                   | 30         | 15         |

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## Meeting the ECA target

Requirement can be met by

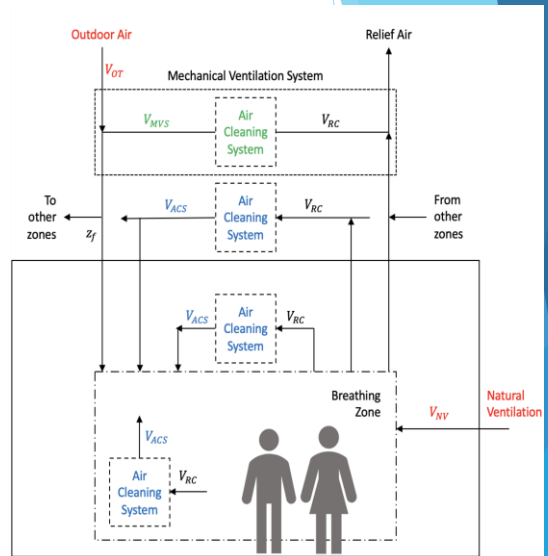
- Outdoor airflow - mechanical/natural
- ECA from multi-zone air cleaning systems
- ECA from in-room air cleaning systems

Approach allows maximum flexibility to user

Limitations on compliance

- Must have prerequisite minimum outdoor air
- To receive credit toward meeting requirements, mechanical filters must be MERV-A 11 or higher or equivalent (ePM2.5>50%)
- MERV 11 acceptable until 1/1/2025
- Hope to raise to ePM1>50%

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## Air Cleaning

Reducing infectious aerosol concentration through capture and removal or inactivation

### Air cleaning technologies

- Mechanical filters (including electret media)
- Germicidal ultraviolet light
- Reactive species - ionizers, photocatalytic oxidation, other oxidants

Mention of specific technologies in the standard is not endorsement!



## Air Cleaning Effectiveness and Safety

Lack of information and standards related to air cleaning systems was a major problem during the COVID19 pandemic:

- Effectiveness - ability to remove or inactivate infectious aerosols
- Safety - adverse effects of direct exposure (UV-C, oxidants), secondary contaminants (particles, ozone); not required for purely mechanical filtration

Standard 241 establishes backup minimum requirements for effectiveness and safety testing in Normative Appendix A

- For when no applicable standard exists

Goal is a level playing field for all technologies

# Building Readiness Plan (BRP)

## Reduced detail for dwellings

Documents the engineering and non-engineering controls that facility systems will use for the facility to achieve its goals

Summarizes results of assessment and planning exercises and documents measures to be implemented in IRMM

Direct descendant of ASHRAE Epidemic Task Force guidance



# Assessment, planning, and implementation

Builds on ASHRAE Epidemic Task Force Building Readiness guidance

Applies commissioning practices to infection risk mitigation systems

Requirements for developing the Building Readiness Plan

- optional for dwellings

Assessment of existing  $V_{E,CAI}$  to determine need for additional controls

Supporting information

- **Tracer particle test procedure for determining  $V_{E,CAI}$  in-place** (appendix)
- Checklists for assessment and commissioning (appendix)
- Building Readiness Plan template (appendix)
- Equivalent clean air calculator (download at [ashrae.org/241-2023](https://www.ashrae.org/241-2023))
- Guidance on assessing energy recovery ventilators (download)
- Guidance on preventing re-entry of contaminated air (download)

# Operations

(Requirements are optional for dwellings)

BRP on site, accessible, current

Essential supplies stocked

Operator training

Occupant communication

Operating modes in place:

- Normal - occupied/unoccupied
- IRMM - occupied/unoccupied
- Temporary shutdown

Temperature and humidity

- maintain design set points when occupied

Operating schedules

- On for all occupied hours
- No on-off control of HVAC fans

Flushing not required between occupancy periods

# Maintenance

Maintenance tasks and frequencies for all occupancies and system types follow ASHRAE/ACCA Standard 180 plus additional requirements →

Frequency of some checks increased for IRMM

Table 9-2 Minimum Maintenance Activity and Frequency for Additional Engineering Controls and Associated Components While in Use

| Engineering Control  | Inspection/Maintenance Task   | Frequency   |
|--|---|---|
| In-room air cleaners   | Verify unit is in appropriate location and operating as intended per the BRP. Confirm that the air cleaner is operating at the speed or setting assumed in the $V_{ECM}$ calculation.<br>Maintain systems and equipment and verify performance per manufacturer's instructions.<br>Visually inspect intake for debris and clean as necessary. | Monthly   |
| Ultraviolet (UV) germicidal irradiation  | Maintain systems and verify performance and safety per manufacturer's instructions and in accordance with ANSI/IES RP-44-21 <sup>11</sup> and ANSI/IES RP-27.1.22 <sup>20</sup> or equivalent.<br>Adjust, clean, and replace equipment as needed.   | Assess quarterly or per manufacturer's recommended interval |
| All air cleaning systems and equipment (including in-room, in-duct, and UV air cleaners) | Maintain systems and equipment and verify performance per manufacturer's instructions.<br>Adjust, clean, and replace equipment as needed.<br>If equipment cannot be repaired, remove equipment from service and use a substitute engineering control to maintain $V_{ECM}$ in occupied space.   | Assess quarterly or per manufacturer's recommended interval |
| Separation space   | The designated temporary separation areas shall be tested for negative pressure whenever an infected individual is present.   | As used   |

## Summary

1. Assess facility - condition and existing *equivalent clean air* delivered
2. Determine target equivalent clean air required by space and system
3. Determine need for additional equivalent clean air in *Infection Risk Management Mode (IRMM)*
4. Determine the best option for providing required equivalent clean air using outdoor air, particle filtration, and air cleaners tested as required, and operational measures
5. Prepare a Building Readiness Plan to document assessment and decisions
6. Perform repair and maintenance as needed and required
7. Make upgrades if needed
8. Apply IRMM when needed

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## Thank You

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