**BSR/ASHRAE Addendum c**
**to ANSI/ASHRAE Standard 62.2-2022**

**Public Review Draft**

# Proposed Addendum c to Standard 62.2-2022, Ventilation and Acceptable Indoor Air Quality in Residential Buildings

**First Public Review (March 2025)**
**(Draft shows Proposed Changes to Current Standard)**

This draft has been recommended for public review by the responsible project committee. To submit a comment on this proposed standard, go to the ASHRAE website at www.ashrae.org/standards-research--technology/public-review-drafts and access the online comment database. The draft is subject to modification until it is approved for publication by the Board of Directors and ANSI. Until this time, the current edition of the standard (as modified by any published addenda on the ASHRAE website) remains in effect. The current edition of any standard may be purchased from the ASHRAE Online Store at www.ashrae.org/bookstore or by calling 404-636-8400 or 1-800-727-4723 (for orders in the U.S. or Canada).

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**(This foreword is not part of this standard. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process. Unresolved objectors on informative material are not offered the right to appeal at ASHRAE or ANSI.)**

# FOREWORD

*The bulk of the proposed addendum is for the new IAQ Procedure (Normative Appendix D). This procedure is an alternative compliance method to Section 4, the Ventilation Rate Procedure (VRP), and thus is only for those who wish to take it. With low contaminant levels, for example, the IAQP would allow the dwelling to be operated at lower ventilation rates than the VRP. The section could also be used for those wishing to improve IAQ when sources were unusually high.*

*The IAQP appendix has two independent control parts that must be met: D1 and D2. D1 is the Bioeffluent Control System section. Since local and acute odors are presumed controlled by Section 5 of the standard, this section is based on bioeffluents and sets a minimum ventilation rate. One can meet this either with the "people" part of section 4 (7.5cfm/p based on bedrooms) or using a CO2 based (DCV) system that adjusts for the actual occupancy. This section will also provide a minimal ventilation to provide oxygen and dilute low-impact contaminants, but is not intended to provide sufficient control of contaminants of concern alone.*

*The second requirement, the Contaminant Control System section (D2), uses a normalized harm (DALY) metric on the contaminants of concern (CoCs.) For each of the CoCs, the user has the choice of making real-time measurements or using deemed values based on design or commissioning of the dwelling. It is possible to comply with this section using no real-time measurements, but if real-time measurements are used there must be something they control such as a filter, air cleaner or ventilation system. In any case, the user must show compliance with a harm budget. This section uses a harm budget approach rather than contaminant thresholds.*

*The project committee has determined that only 3 CoCs need be included in the harm budget: PM2.5, formaldehyde and nitrogen dioxide. This selection was primarily based on looking at harm intensities and typical indoor concentrations in homes after Morantes et al. Some contaminants that might have been considered were not included because they are principally outdoor contaminants or are otherwise not addressed by the existing VRP and thus would not be included in a method intended to be equivalent. Examples of such contaminants include ozone, radon, sulfur dioxide, mold and the coarse fraction of PM10.*

*The harm budget coefficients are derived from two sources. The Morantes work on harm intensities provides the relative weighting of each contaminant. The absolute scale of the coefficients is set to provide equivalence (on average) between the VRP and IAQP. That is, the scale is set such that the median home meeting the existing standard (i.e. the VRP) would just meet the harm budget.*

*This is accomplished using the median concentration from field studies done by LBNL and PNNL. The data continues to be extended and analyzed; for now, the reference concentrations used for PM2.5, formaldehyde, nitrogen dioxide are 8,20,6 micrograms per cubic meter respectively.*

*Real-time measurement for the 3 CoCs is allowed, but there are a variety of deemed values options provided, depending on the design. These values are generally higher than the median home, but can be lower should the design warrant. Sections D2.3-D2.5 delineate how to determine these values. For these sections the committee used the best published data it could find and applied engineering judgement for the situations used.*

*Compliance with the IAQP may include contaminant measurements either for real-time or commissioning purposes. Section D3 lists the specifications for such contaminant measurements.*

*Compliance with the IAQP may include air cleaning to reduce some contaminants. Section D4 lists the requirements for such air cleaning.*

***[Note to Reviewers: This addendum makes proposed changes to the current standard. These changes are indicated in the text by underlining (for additions) and ~~strikethrough~~ (for deletions) except where the reviewer instructions specifically describe some other means of showing the changes. Only these changes to the current standard are open for review and comment at this time. Additional material is provided for context only and is not open for comment except as it relates to the proposed changes.]***

# Addendum c to 62.2-2022

***Revise Section 10 References as shown below. The remainder of Section 10 is unchanged.***

**10. REFERENCES**

| | | |
|---|---|---|
| **ASHRAE**<br>**180 Technology Pkwy.**<br>**Peachtree Corners, GA 30092**<br>**(800) 527-4723; www.ashrae.org** | | |
| *ANSI/ASHRAE Standard 145.2-2016* | *Laboratory Test Method for Assessing the Performance of Gas-Phase Air-Cleaning Systems: Air-Cleaning Devices.* | D4.2 |
| **ASTM International**<br>**100 Barr Harbor Drive**<br>**P.O. Box C700**<br>**West Conshohocken, PA 19428-2959**<br>**(610) 832-9500** | | |
| *ASTM D5197(2016)* | *Standard Test Method for Determination of Formaldehyde and Other Carbonyl Compounds in Air (Active Sampler Methodology)* | D3.1 |
| **International Organization for Standardization (ISO)**<br>**Ch. de Blandonnet 8, CP 401**<br>**CH-1214 Vernier, Geneva, Switzerland**<br>**+41 22 749 01 11; www.iso.org** | | |
| *ISO 10121-2:2013* | *Test methods for assessing the performance of gas-phase air cleaning media and devices for general ventilation -- Part 2: Gas-phase air cleaning devices (GPACD)* | D4.2 |

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|---|---|---|
| *ISO Standard 16000-3 (2011)* | *Indoor air -- Part 3: Determination of formaldehyde and other carbonyl compounds in indoor air and test chamber air -- Active sampling method.* | D3.1 |
| *ISO 16890 (2016)* | *Air Filters for General Ventilation* | D4.1 |

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|---|---|---|
| *EPA IP-6 (1990)* | *Determination of Formaldehyde or other Aldehydes in Indoor Air in Compendium of Methods for the Determination of Air Pollutants in Indoor Air* | D3.1 |
| *EPA TO-11 (1999)* | *Determination of Formaldehyde in Ambient Air Using Adsorbent Cartridge Followed by High Performance Liquid Chromatography (HPLC) [Active Sampling Methodology] in Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air*, Second Edition | D3.1 |

***Add a new Normative Appendix D as shown below. Note that this is a completely new appendix and is not shown in underline. Existing appendices will be re-lettered accordingly.***

**(This is a normative appendix and is part of the standard.)**

**NORMATIVE APPENDIX D**
**Indoor Air Quality Procedure**

**D Overview.**
The requirements of this appendix shall be applicable where selected by the designer as the compliance path for Section 4.

The dwelling unit systems shall meet the requirements for Sections D1 and D2. Where air cleaning efficiencies or contaminant measurements are part of the design, the appropriate Sections of D3 and D4 are also required.

**D1 Bioeffluent Control System** A mechanical ventilation system shall be installed and operated that either meets Section D.1.1 or D.1.2.

**D1.1 Base Ventilation System**. A dwelling unit mechanical ventilation system in compliance with Section 4.1 through 4.4 or Section 4.5 is required. It shall be operated at a rate no less than that specified in Section 4.1, calculated with a floor area of zero. Use of Section 4.1.4, Ventilation rate reduction for particle filtration) is not permitted.

**D1.2 CO2 Controlled Ventilation System.** A dwelling unit mechanical ventilation system shall be provided that complies with Section 4.2, Section 4.4, and that limits the carbon dioxide concentration to not more than 1600 ppm.

If air mixing is provided that supplies air to most of the habitable spaces, the measurement is permitted to be at a single central location provided that air handling system or equipment operates at least 15 minutes per hour; otherwise the measurement shall be the maximum of those made within each room of the habitable space.

This section shall not be used in the presence of air cleaning technology that would remove carbon dioxide.

**D2 Contaminant Control System.** A contaminant control system that maintains an annual average Contaminant Rating (CR) of no more than 100 shall be installed and operated in accordance with the requirements of this section. Such a system shall be permitted to provide air cleaning, filtration or other forms of source control as well as additional ventilation; it shall be permitted to be integrated with other HVAC equipment or to be independent.

**D2.1 Contaminant Control Equation.** Equation D-1 shall be used to determine the contaminant rating

$$CR = W_{PM2.5}\, C_{PM2.5} + W_{NO2}\, C_{NO2} + W_{HCHO}\, C_{HCHO} \qquad \text{D-1}$$

*where*
CR is the contaminant rating [-]
$C_{PM2.5}$ is the concentration of PM2.5 [µg/m$^3$] as determined in accordance with Section D2.2 or D2.3
$C_{NO2}$ is the concentration of Nitrogen Dioxide [µg/m$^3$] as determined in accordance with Section D2.2 or D2.5
$C_{HCHO}$ is the concentration of Formaldehyde [µg/m$^3$] as determined in accordance with Section D2.2 or D2.4
$W_{PM2.5}$ is the PM2.5 weighting: 10.3 [m$^3$/µg]
$W_{NO2}$ is the Nitrogen Dioxide weighting: 1.0 [m$^3$/µg]
$W_{HCHO}$ is the Formaldehyde weighting: 0.7 [m$^3$/µg] A

**D2.2 Real-Time Concentration Measurements.** Use of real-time concentration measurement methods shall be permitted for use in Equation D-1. If any real-time measurements are in use, the contaminant control system shall calculate the contaminant rating in real time, at least once every 15 minutes, and have appropriate means of reducing it, such as through increased ventilation, particle filtration, or air cleaning. If real-time concentrations are not being used for a particular contaminant, one of the alternative concentration determinations shall be used.

**D2.3 Alternative Concentration Determination for PM2.5.** Unless real-time measurement is being used, the concentration of PM2.5 in Eq. D-1 shall be 12 µg/m$^3$ divided by the Particle Reduction Factor based on the daily average Filtered Air Delivery Rate, determined in accordance with Section 7.6.

**D2.4 Alternative Concentration Determination for Formaldehyde.**

Unless real-time measurement is being used, the concentration of formaldehyde in Eq. D1 shall be determined by a commissioning study in accordance with D2.4.2 or default values in accordance with D2.4.1.

**D2.4.1** The default value for a dwelling unit in which composite wood products covered by EPA TSCA Title VI are certified to TSCA Title VI shall be 25 µg/m$^3$. Otherwise the default value shall be 50µg/m$^3$.

**D2.4.2** The commissioning study shall be conducted post-occupancy as follows:

a. The systems intended to comply with this appendix shall be run for at least 24 hours according to the proposed system design and with the dwelling unit thermal conditioning systems operating to provide thermal comfort. The dwelling shall be occupied or unoccupied, and exterior doors and windows shall be closed. Furniture shall be present within the dwelling unit.
b. For the subsequent time period of not less than 24 hours, under the same conditions as D2.4.2a, the average concentration shall be measured and then used in Eq. D-1. For direct measurement, samples shall be taken not less than every 30 minutes.

**D2.5 Alternative Concentration Determination for Nitrogen Dioxide.** Unless real-time measurement is being used, the concentration of nitrogen dioxide in Eq. D-1 shall be determined as follows:

a. Where there is no combustion equipment in the dwelling unit, the concentration shall be set to 10μg/$m^3$.
b. Where all the combustion equipment in the dwelling unit is either in the kitchen or vented, the concentration shall be set to 20 μg/$m^3$.
c. Where D2.5.a and D2.5.b are not met and Section D.1.2 is being complied with, the concentration shall be set to 40 μg/$m^3$.
d. Otherwise, Section D2.5 shall not be used.

**D3. Contaminant Measurements**: Devices used to determine concentrations inside the dwelling unit shall comply with Sections D3.1, D3.2 or D3.3. Where calibration is not addressed by Sections D3.1, D3.2 or D3.3, devices shall be calibrated in accordance with device manufacturer's recommendations. The reported value shall not be less than instrument resolution.

**D3.1 Formaldehyde:** Formaldehyde concentrations shall be measured using the following test methods: ISO 16000-3; EPA TO-11; EPA IP-6; ASTM D5197 or equivalent. It is permitted to measure formaldehyde using an instrument that has an accuracy of 5 μg/$m^3$ at a reading of 25 μg/$m^3$ provided it has a cross-sensitivity to ethanol less than 1.5%.

**D3.2 Carbon Dioxide**: Where CO2 sensors are used in the dwelling unit, the CO2 sensors shall be certified by the manufacturer to be accurate within ±100 ppm at concentrations of 1600 ppm when measured at sea level at 77°F (25°C). Sensors shall be factory calibrated and certified by the manufacturer to require calibration not more frequently than once every five years.

**D3.3 Other Contaminants:** Devices that measure contaminants other than formaldehyde or carbon dioxide shall have a minimum accuracy of 5 μg/$m^3$ plus 15% of reading at the default concentration in section D2.

**D4. Air cleaning**: Removal efficiencies shall be determined and reported in accordance with Section D4.1 or Section D4.2, as applicable.

**D4.1 Particulates**: Particulate matter filters shall report an efficiency in accordance with ASHRAE Standard 52.2, AHRI 680, or ISO 16890.

**D4.2 Gases:** Gas phase air cleaners shall report a removal efficiency for any compound they claim to address included in the design in accordance with any of the following:

1. ASHRAE Standard 145.2
2. ISO 10121-2
3. Testing by methods in Section 6.1.2,10.4, and 10.5 and reported as required in Section 11 of ASHRAE Standard 145.2
4. Testing to a consensus standard approved by the authority having jurisdiction.
5. For technologies with compounds not covered by Sections D4.2.1, D4.2.2, D4.2.3, or D4.2., tests developed to demonstrate the removal efficiency shall be performed by a third-party. The custom efficiency test shall be conducted for all compounds included in the design and shall comply with the following:
    a. Test of the background concentration without the air cleaning in operation
    b. Test of the output concentration with the air cleaning in operation
    c. Be conducted under air cleaning operating conditions that matches the intended design operating conditions

    ***Informative Note:*** *Air cleaning operating conditions include fan voltage, flow rate, and other settings that are consistent with the manufacturer's operating specifications*.

d. Be conducted using the relevant laboratory methods for analysis and quantification as specified in Section D3.

Any custom efficiency test description covering Sections D4.2.1, D4.2.2, D4.2.3, or D4.2.4 and challenge test concentration shall be documented and approved by the authority having jurisdiction. All test results along with relevant equipment settings shall be provided upon request.

**D5. Fault Detection.** On the failure of any sensor, air cleaner, or active controller, the dwelling-unit ventilation system shall automatically revert to a Section 4-compliant mode within one hour unless the system would continue to meet the requirements of D1 and D2 without that component.