Proposal from Asthma and Allergy Foundation of America, International WELL Building Institute, and Johnson Controls

CO2 Sensor in Spaces

Proposal:

405.2 Monitoring. Group A, B, E, and I occupancies shall be equipped with carbon dioxide sensors. Carbon dioxide sensors installed in accordance with this section shall meet the requirements in Sections 405.2.1to 405.2.5.

Exception:

Occupiable zones less than 500 square feet.

Ventilation for ambulatory care facilities, Group I-1 and Group I-2 occupancies shall be designed and installed in accordance with this code, ASHRAE/ASHE 170 and NFPA 99.

405.2.1 Density. For every zone of occupiable space there shall be

- 1 sensor minimum for zones above 500 square feet
- 1 additional sensor for every multiple of 2000 square

405.2.2 Carbon dioxide sensor performance specifications. CO2 sensors shall be certified by the manufacturer to be accurate within ±75 ppm at concentrations of 600, 1000, and 2500 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. Upon detection of sensor failure, the system shall provide a signal that resets the ventilation system to supply the required minimum quantity of outdoor air to the breathing zone for the design zone population.

405.2.3 Multi-space sensor performance specifications. Besides 405.2.2, multi-space CO2 sensors that sequentially sample air from multiple spaces shall sample each space no less than once every five minutes.

405.2.4 Carbon dioxide detection threshold level exceeded. When the carbon dioxide concentration remains above the detection threshold level for a period of 30 minutes or

more, the occupants in the zone shall be alerted by visual notification devices or through a building monitoring system.

405.2.5 Carbon dioxide detection threshold level. The default detection threshold level for carbon dioxide above which triggers an alert in accordance with Section 405.2.4 shall be set to 1,100 parts per million. The end user can modify the detection threshold level based on specific operations and needs.

Reason:

Requiring CO_2 sensors in all commercial buildings strengthens indoor air quality (IAQ) management by providing a reliable, real-time indicator of ventilation effectiveness and occupant exposure to rebreathed air. Carbon dioxide concentration is widely recognized as a practical proxy for occupancy density and ventilation adequacy; elevated levels can indicate insufficient outdoor air delivery relative to occupant load.
https://www.ashrae.org/File%20Library/About/Position%20Documents/pd-on-indoor-carbon-dioxide-english.pdf

This proposal complements existing code requirements—specifically the IECC and ASHRAE 90.1, which already mandate demand-controlled ventilation (DCV) for many high-occupancy spaces—by ensuring that the underlying sensing infrastructure is consistently installed and available for verification, optimization, and commissioning. Rather than introducing new control strategies, this requirement ensures that ventilation performance can be measured, validated, and maintained over time, aligning with the increasing emphasis on fault detection, diagnostics, and operational transparency in modern codes.

https://codes.iccsafe.org/content/IECC2024V1.2/chapter-ce-4-commercial-energy-efficiency#IECC2024V1.2_CE_Ch04_SecC403.7.1

Additionally, CO_2 monitoring enhances system performance by identifying issues such as inadequate airflow, control failures, or improper system operation. Real-time monitoring enables corrective action that supports occupant health, comfort, and productivity, while maintaining energy-efficient operation.

This approach is further supported by the IMC Appendix E framework, which emphasizes clean air delivery and monitoring as a key component of improved indoor environmental quality.

Appendix E Clean Air Delivery And Monitoring - International Mechanical Code (IMC)

Overall, mandatory CO_2 sensing provides a practical, scalable pathway to healthier, more accountable, and higher-performing commercial buildings.

Paragraphs 405.2, 405.2.3, and 405.2.4 are from Appendix E Clean Air Delivery and Monitoring of the International Mechanical Code of 2024

Paragraphs 405.2.1 and 405.2.2 are modified from E101.1.1 from Appendix E Clean Air Delivery and Monitoring of the International Mechanical Code of 2024 to align with ASHRAE 62.1

Requirement for Demand Control Ventilation E101.1.2 from Appendix E Clean Air Delivery and Monitoring of the International Mechanical Code of 2024 has been left out as it is redundant in many places with requirement C403.7.1 Demand Control Ventilation in the International Energy Conservation Code 2024

Cost Impact:

The inclusion of CO_2 sensors in commercial buildings represents a low-cost enhancement that supports performance verification and long-term operational efficiency. Installed costs typically range from $250 to $600 per zone, remaining a negligible fraction of total construction cost. Furthermore, the cost impact is limited as the International Energy Conservation Code is already asking for Demand Control Ventilation in spaces above 1000 ft2 in ASHRAE zone 4

Because demand-controlled ventilation (DCV) is already required by code, this proposal does not introduce new energy strategies, but instead ensures that required systems can be measured, verified, and properly maintained over time. By identifying over-ventilation, under-ventilation, or control faults, CO_2 monitoring helps avoid unnecessary energy use and supports persistence of intended energy performance.

Beyond energy impacts, improved ventilation performance and IAQ are strongly linked to economic outcomes. Studies show that better indoor air quality can significantly enhance workforce productivity by 8 to 11 percent through improved cognitive function and reduce absenteeism by 20 to 50 percent

In the context of Seattle's Building Performance Standard (BPS), CO_2 sensors provide critical, low-cost data infrastructure to support ongoing compliance and performance tracking. Continuous monitoring enables building owners to validate ventilation effectiveness, document operational performance, and respond proactively to deficiencies—strengthening transparency, accountability, and long-term performance outcomes aligned with BPS goals.

Overall, this requirement ensures that code-mandated systems deliver their intended value, offering a highly cost-effective measure with strong lifecycle financial benefits and minimal upfront cost impact.

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