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| v3 - LEED 2009

Indoor air quality procedure - alternative compliance path

EQpc68 | Required

1 result in**All** .

- Glossary

Intent

To contribute to the comfort and well-being of building occupants by establishing minimum standards for indoor air quality (IAQ).

Requirements

This prerequisite is available for pilot testing by the following LEED rating systems and building types:

- New Construction
  - Office
  - Multi-family Residential
  - Lodging
  - Warehouses
- Retail NC (excluding restaurants)
- Schools (excluding laboratories within school buildings)
- Commercial Interiors
- Retail CI (excluding restaurants)
- Existing Buildings Operations and Maintenance
  - Office
  - Retail (excluding restaurants)
  - Multi-family Residential
  - Lodging
  - Schools (excluding laboratories within school buildings)
  - Warehouses

Project types not listed above that are interested in pursuing this path, should contact USGBC before registration. See below for more information.

Note: The following Pilot Credit modifications apply to this prerequisite:

- Introductory phone call between project teams pursuing this path and GBCI reviewers.
- Project teams pursuing this pilot prerequisite will be required to fulfill all prerequisite requirements. Unlike with other pilot credits, documenting that a pilot credit is in need of major revision and in unachievable in its current form will not demonstrate compliance for IEQp1.
- No ID points will be awarded.
- If a project team registers and submits documentation noting that space in the project fails testing (chemical or perceived), corrective action must be taken until the project meets all requirements; it will not be acceptable to pursue the Ventilation Rate Procedure in IEQp1 once evidence of not meeting the pilot requirements is submitted. If, however, a project team decides that this path is too costly or otherwise onerous prior to submission, they may go back and use the traditional IEQp1 path.
- BD+C and ID+C projects will still need to meet local code requirements for ventilation if they differ from the IAQP.

Meet the minimum requirements of ASHRAE Standard 62.1-2007, Sections 4 through 6, Ventilation for Acceptable Indoor Air Quality (with errata). Determine the minimum outdoor air intake flow for mechanical ventilation systems using the In-door Air Quality Procedure, or a local equivalent, whichever is more stringent.

Combining the IAQP and VRP is not an acceptable means of compliance with this pilot prerequisite.

Prohibit smoking in the building.

Meet the following requirements for ventilation systems designed in accordance with Section 6.3 Indoor Air Quality (IAQ) Procedure:

1. *Contaminant Sources*. Identify the outdoor sources, indoor sources, and the expected emission rate for each of the contaminants and mixtures of concern listed in Table 1. Additionally, confirm that the top 10 contaminants by concentration in the building, as identified by mass spectrograph analysis, are included in Table 1. If they are not already included in Table 1, list them.
2. *Contaminant Concentration*. Refer to Table 1 for maximum allowable concentration limits for each contaminant of concern.
3. *Perceived Indoor Air Quality*. At least 80% of observers or occupants must determine the perceived indoor air quality to be “acceptable” using a Subjective Evaluation.
4. *Design Approach*. If adjustments will be made to the outdoor air flow rate, use mass balance analysis. Determine minimum outdoor airflow rates per steady-state mass-balance in Appendix D of the standard. Measure system level airflow rates before and after modifications are made.
5. *Non-Dilution Air Cleaning Technology*. If non-dilution air cleaning technol-ogy is utilized, use air cleaning technology consisting of sorptive active agents, in accordance with ASHRAE Standard 145.2-2011, Laboratory Test Method for Assessing the Performance of Gas-Phase Air-Cleaning Systems: Air Cleaning Devices. If electronic air cleaning technology is preexisting, continuous ozone monitoring shall be provided. Electronic air cleaning cannot be used as a means of chemical contaminant control.
6. *Air Testing*. Conduct contaminant-level testing for each of the contaminants of concern as follows:
   1. Each contaminant of concern shall be measured using the test methods in Table 1. If the top 10 contaminant concentrations are not listed in Table 1, separately mitigate these contaminants or provide a ruling by a cognizant health body that they have no known adverse health impact. Testing is to be completed during time of anticipated peak contaminant loading by an appropriately accredited professional. Use current versions of ASTM standard methods or ISO methods. The number of sampling locations depends on the size of the building and number of ventilation systems, but must include the entire building and all representative space uses.
   2. All measurements within each location shall demonstrate compliance with the maximum allowable concentration limits per Table 1. For each sampling point where the concentration exceeds the limit, take corrective action and retest for the noncompliant contaminants as the sampling points. Repeat until all requirements are met.
   3. Provide testing frequency as follows:
      - For initial certification, the testing must occur within the performance period.
      - For recertification, the testing must occur no less frequently than every two years. Project teams may test more frequently at their discretion.
      - Construction projects within an existing building must comply with the requirements under this prerequisite for ID+C projects.
      - Any adjustments to outside air volumes required to comply with the maximum allowable concentration limits must be implemented within the performance period. Outside air measurements at the affected air handling units must confirm the adjustments.
   4. Confirm complete implementation of maintenance plans for the following contaminants or document status of “no further remediation” required:
      - Asbestos Containing Materials (ACMs)
      - Lead
      - Radon
      - Mold
7. *Subjective Evaluation.* Distribute a seven-point scale questionnaire to at least 30% of the space/building occupants as described in IEQ Credit 2.1 Occupant Comfort – Occupant Survey. The questionnaire is to be designed to address perceived air quality particularly focusing on odors and irritation responses.
8. *Maintenance Program*. Implement and maintain an HVAC system maintenance program to ensure the proper operations and maintenance of HVAC components as they relate to outdoor air introduction and exhaust. Include any non-dilution methods used.
9. *System Testing.* Test and maintain operation of all building exhaust systems, including bathroom, kitchen and parking exhaust systems.

Table 1.

Contaminant Compound (CAS#)	Concentration Limit (µg/m3)	Test Method
Volatile Organic Compounds (VOCs)		
Acetaldehyde 75-07-0	140	
Benzene 71-43-2	60	
Carbon disulfide 75-15-0	800	
Carbon tetrachloride 56-23-5	40	
Chlorobenzene 108-90-7	1000	
Chloroform 67-66-3	300	
Dichlorobenzene (1,4-) 106-46-7	800	
Dichloroethylene (1,1) 75-35-4	70	
Dimethylformamide (N,N-) 68-12-2	80	ISO 16017-1, 2; ISO 16000-3, 6; ASTM D6345-10
Dioxane (1,4-) 123-91-1	3000	
Epichlorohydrin 106-89-8	3	
Ethylbenzene 100-41-4	2000	
Ethylene glycol 107-21-1	400	
Ethylene glycol monoethyl ether 110-80-5	70	
Ethylene glycol monoethyl ether acetate 111-15-9	300	
Ethylene glycol monomethyl ether 109-86-4	60	
Ethylene glycol monomethyl ether acetate 110-49-6	90	
Formaldehyde 50-00-0	33	BS-ISO 16000-3, 4; ASTM D5197; BS ISO 16000-4
Hexane (n-) 110-54-3	7000	
Isophorone 78-59-1	2000	
Isopropanol 67-63-00	7000	
Methyl chloroform 71-55-6	1000	
Methylene chloride 75-09-2	400	
Methyl t-butyl ether 1634-04-4	8000	
Naphthalene 91-20-3	9	
Phenol 108-95-2	200	ISO 16017-1, 2; ISO 16000-3, 6; ASTM D6345-10
Propylene glycol monomethyl ether 107-98-2	7000	

Styrene 100-42-5	900	
Tetrachloroethylene 127-18-4	35	
Toluene 108-88-3	300	
Trichloroethylene 79-01-6	600	
Vinyl acetate 108-05-4	200	
Xylenes-total 108-38-3, 95-47-6, and 106-42-3	700	
Inorganics		
Carbon Monoxide	9	ISO 4224
Ozone	147 (0.075 ppm)	ISO 13964; ASTM D5149-02
Particulate Matter PM2.5	15	ISO 7708
Ammonia	200	NIOSH Manual of Analytical Methods
Carbon Dioxide	700 above outdoor ppm	EPA compendium infared

Submittals

General

Register for Pilot ACP 68

- Participate in the LEEDuser pilot credit forum
- Complete the feedback survey:

Credits 1-27

Credits 28-38

Credits 39-41

Credits 42-56

Credits 57-67

EBOM specific:

In addition to the above, meet the following additional requirements:

Establishment

1. Provide a copy of the building maintenance plan implementing a regular IAQ Performance Method compliant with this Pilot Prerequisite. Describe the ventilation maintenance program, including a description of the periodic checks and scheduled maintenance performed, and whether the checks are manual, based on a building automation system, or both.
2. Confirm that the project team has performed or overseen tests in all project building exhaust systems during the performance period to verify proper function.

Performance period

1. Documentation provided must confirm that required performance period miles-tones have been completed within the stated performance period for the project building.
2. If adjustments are made to the outdoor air flow, provide a table listing system level air flow rates before and after adjustments are made.

Additional questions

- Would the team apply this method to another building in the future? Why/why not?
- How did the cost of this method compare to the cost of the Ventilation Rate Procedure?

Background Information

Subjective evaluation - Panel

Panel participants may be regular occupants of the project building, visitors to the build-ing (i.e. customers of a retail establishment), or individuals with no connection to the project building. Composition of the panel in this regard is at the discretion of the project team.

Responses are to be collected via anonymous methods either written or electronic. The Perceived Indoor Air Quality test is considered “passing” if 80% or more of the panel renders the space “acceptable” at each interval. If less than 80% of the panel renders the space “acceptable”, appropriate corrective actions must be implemented to correct the deficiency. Corrective actions must be implemented within six (6) months of the con-clusion of the panel observations.
Subjective evaluation - Questionnaire

The questionnaire is to be designed to address perceived air quality particularly focusing on odors and irritation responses. The responses shall be tabulated. Respondent answers of -1, -2, or -3 on the seven-point scale will be considered as dissatisfied. If more than 20% of respondents are dissatisfied, appropriate corrective actions must be implemented during the performance period.

For EB: O+M projects, at least one occupant survey must be conducted during each monitoring period.

Space sampling for testing

Randomly select spaces to be tested, ensuring that each occupiable space type is adequately represented. Utilize HERS sampling methodologies for multi-family and lodging projects or APPA sampling methodologies for offices, retail, schools, warehouses, and existing buildings.

1. Minimum area and space counts noted in the applicable sampling methodology MUST be met.
    1. For HERS sampling procedures, randomly select one in seven (1 in 7) substan-tially similar spaces. Each sample group would consist of identical spaces, one out of every seven of which are to be tested. A minimum of three tests must be conducted in each sample group.
    2. For APPA, randomly select locations totaling at least 10% of the gross floor area of the building and 10% of the total count of substantially similar spaces provided at least five (5) spaces of each space type are included. For any space types with less than five (5) spaces, include all spaces of that type.
2. Note: different occupiable space types may be combined into common groups if the contaminants and mixtures of concern within those space types are expected to be the same with similar emission rates and the spaces are served by the same ventilation system.

For purposes of determining how many test locations are required, the following shall govern:

1. Testing must occur in at least one location per ventilation system, per occupiable space type. The location(s) selected for testing must represent the worst-case zone(s) where the highest concentrations of contaminants of concern are likely to occur.
    1. For offices, retail, schools, lodging, multi-family residential, and existing buildings, testing must occur within areas no larger than 5,000 square feet. For warehouses or large open spaces within other building types (i.e. ballrooms in lodging, gymnasiums in schools, etc.) a limit of 50,000 square feet may be used. If there is evidence that the air within the space is well-mixed and sources of contaminants of concern are uniform, project teams may test a single location within that space. Evidence would consist of one of following:

    1. Engineering verification of HVAC system with uniform ventilation distribution, and uniform source of contaminants within that space.
    2. Tracer gas analysis showing uniform air distribution, and initial contaminant measurements showing uniform levels of contaminants of concern.
2. Real-time sensors may be used to identify the worst-case zones for contaminants of concern; however, final testing results must be measured using the protocols below. Real-time sensor testing is not acceptable for final testing results.
3. Locations selected may be served by more than one ventilation system provided that each ventilation system serving the location is designed in accordance with Section 6.3.

Additional Resources

1. Reference to CHiPS database of contaminant generation rates
2. Spreadsheet Calculator for compliance purposes
3. Flow chart of compliance steps
4. Example Surveys
5. CEC/LBNL report, "Balancing energy conservation and occupant needs in ventilation rate standards for "Big Box" stores in California: predicted indoor air quality and energy consumption using a matrix of ventilation scenarios". It is available here

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