Construction indoor air quality assessment

EQ2.2 | Possible point

Glossary

Intent

To prevent indoor air quality (IAQ) problems resulting from any construction or renovation projects to help sustain the comfort and well-being of construction workers and building occupants.

To reduce indoor air quality (IAQ) problems resulting from construction or renovation to promote the comfort and well-being of construction workers and building occupants.

To reduce indoor air quality (IAQ) problems resulting from construction or renovation to promote the comfort and well-being of construction workers and building occupants.

To reduce indoor air quality (IAQ) problems resulting from construction or renovation and promote the comfort and well-being of construction workers and building occupants.

To reduce indoor air quality (IAQ) problems resulting from construction or renovation to promote the comfort and well-being of construction workers and building occupants.

To reduce indoor air quality (IAQ) problems resulting from construction or renovation to promote the comfort and well-being of construction workers and building occupants.

To reduce indoor air quality (IAQ) problems resulting from construction or renovation to help sustain the comfort and well-being of construction workers and building occupants.

To prevent indoor air quality problems resulting from any construction or renovation projects and thus help sustain the comfort and well-being of construction workers and building occupants.

Reduce indoor air quality problems resulting from the construction/renovation process, to sustain long-term worker and occupant comfort and well-being.

Reduce the quantity of indoor air contaminants that are odorous, irritating and/or harmful to the comfort and well-being of installers and occupants.

Prevent indoor air quality problems resulting from any construction/renovation projects in order to help sustain the comfort and well-being of construction workers and building occupants.

To establish better quality indoor air in the building after construction and during occupancy.

To establish better quality indoor air in the building after construction and during occupancy.

To reduce indoor air quality (IAQ) problems resulting from construction or renovation to promote the comfort and well-being of construction workers and building occupants.

Requirements

Develop and implement an IAQ management plan for the construction and occupancy phases:

- During construction, meet or exceed the recommended control measures of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings Under Construction, 2nd Edition 2007, ANSI/SMACNA 008-2008 (Chapter 3).
- If the building undergoes a tenant improvement, develop and implement an IAQ management plan for the preoccupancy phases. Perform a flush-out procedure as follows:
  After construction ends and all interior finishes have been installed, install new filtration media and flush out the affected space. The flush out must be done by supplying a total outdoor air volume of 14,000 cubic feet per square foot of floor area while maintaining an internal temperature of at least 60° F and maintaining a relative humidity no higher than 60% where cooling mechanisms are operated. The affected space may be occupied only after the delivery of at least 3,500 cubic feet of outdoor air per square foot of floor area and the space has been ventilated at a minimum rate of 0.30 cfm per square foot of outdoor air or the design minimum outside air rate (whichever is greater) for at least 3 hours prior to occupancy until the total of 14,000 cubic feet per square foot of outdoor air has been delivered to the space. The flush-out may continue during occupancy.
- Protect stored on-site or installed absorptive materials from moisture damage.
- If permanently installed air-handlers must be used during construction, filtration media must be used at each return air grille, and must meet one of the following criteria below. Replace all filtration media immediately prior to occupancy.
  - Filtration media has a minimum efficiency reporting value (MERV) of 8, as determined by ASHRAE Standard 52.2-1999 (with errata but without addenda).
  - Equivalent filtration media Class F5 or higher, as defined by CEN Standard EN 779–2002, Particulate air filters for general ventilation, Determination of the filtration performance.
  - Equivalent filtration media with a minimum dust spot efficiency of 30% and greater than 90% arrestance on a particle size of 3–10 µg.
- Upon the completion of construction, HVAC and lighting systems must be returned to the designed or modified sequence of operations.

Develop an (IAQ) management plan and implement it after all finishes have been installed and the building has been completely cleaned before occupancy.

Option 1. Flush-out[1]

Path 1

After construction ends, prior to occupancy and with all interior finishes installed, install new filtration media and perform a building flush-out by supplying a total air volume of 14,000 cubic feet of outdoor air per square foot (4,500 cubic meters of outdoor air per square meter) of floor area while maintaining an internal temperature of at least 60° F (15° C) and relative humidity no higher than 60%.

OR

Path 2

If occupancy is desired prior to completion of the flush-out, the space may be occupied following delivery of a minimum of 3,500 cubic feet of outdoor air per square foot (1,000 cubic meters of outdoor air per square meter) of floor area. Once the space is occupied, it must be ventilated at a minimum rate of 0.30 cubic feet per minute (cfm) per square foot (0.1 cubic meters per minute per square meter) of outside air or the design minimum outside air rate determined in IEQ Prerequisite 1: Minimum Indoor Air Quality Performance, whichever is greater. During each day of the flush-out period, ventilation must begin a minimum of 3 hours prior to occupancy and continue during occupancy. These conditions must be maintained until a total of 14,000 cubic feet per square foot (4,500 cubic meters per square meter) of outside air has been delivered to the space.

Option 2. Air testing

Conduct baseline IAQ testing, after construction ends and prior to occupancy, using testing protocols consistent with the EPA Compendium of Methods for the Determination of Air Pollutants in Indoor Air or as the ISO method listed in the table below. Testing must be done in accordance with one standard; project teams may not mix requirements from the EPA Compendium of Methods with ISO.

Demonstrate that the contaminant maximum concentrations listed below are not exceeded:

Contaminant	Maximum Concentration	EPA Compendium method	ISO method
Formaldehyde	27 parts per billion	IP-6	ISO 16000-3
Particulates (PM10)	50 micrograms per cubic meter	IP-10	ISO 7708
Total volatile organic compounds (TVOCs)	500 micrograms per cubic meter	IP-1	ISO 16000-6
4-Phenylcyclohexene (4-PCH) *	6.5 micrograms per cubic meter	IP-1	ISO 16000-6
Carbon monoxide (CO)	9 parts per million and no greater than 2 parts per million above outdoor levels	IP-3	ISO 4224
*This test is required only if carpets and fabrics with styrene butadiene rubber (SBR) latex backing are installed as part of the base building systems.			

For each sampling point where the maximum concentration limits are exceeded, conduct an additional flush-out with outside air and retest the noncompliant concentrations. Repeat until all requirements are met. When retesting noncompliant building areas, take samples from the same locations as in the first test, although it is not required.

Conduct the air sample testing as follows:

- All measurements must be conducted prior to occupancy, but during normal occupied hours with the building ventilation system started at the normal daily start time and operated at the minimum outside air flow rate for the occupied mode throughout the test.
- All interior finishes must be installed, including but not limited to millwork, doors, paint, carpet and acoustic tiles. Movable furnishings such as workstations and partitions should be in place for the testing, although it is not required.
- The number of sampling locations will depend on the size of the building and number of ventilation systems. For each portion of the building served by a separate ventilation system, the number of sampling points must not be less than 1 per 25,000 square feet or for each contiguous floor area, whichever is larger. Include areas with the least ventilation and greatest presumed source strength.
- Air samples must be collected between 3 and 6 feet from the floor to represent the breathing zone of occupants, and over a minimum 4-hour period.

Develop an (IAQ) management plan and implement it after all finishes have been installed and the building has been completely cleaned before occupancy.

Option 1. Flush-out[1]

Path 1

After construction ends, prior to occupancy and with all interior finishes installed, install new filtration media and perform a building flush-out by supplying a total air volume of 14,000 cubic feet of outdoor air per square foot (4,500 cubic meters of outdoor air per square meter) of floor area while maintaining an internal temperature of at least 60° F (15° C) and relative humidity no higher than 60%.

OR

Path 2

If occupancy is desired prior to completion of the flush-out, the space may be occupied following delivery of a minimum of 3,500 cubic feet of outdoor air per square foot (1,000 cubic meters of outdoor air per square meter) of floor area. Once the space is occupied, it must be ventilated at a minimum rate of 0.30 cubic feet per minute (cfm) per square foot (0.1 cubic meters per minute per square meter) of outside air or the

design minimum outside air rate determined in IEQ Prerequisite 1: Minimum Indoor Air Quality Performance, whichever is greater. During each day of the flush-out period, ventilation must begin a minimum of 3 hours prior to occupancy and continue during occupancy. These conditions must be maintained until a total of 14,000 cubic feet per square foot (4,500 cubic meters per square meter) of outside air has been delivered to the space.

Option 2. Air testing

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Demonstrate that the contaminant maximum concentrations listed below are not exceeded:

Contaminant	Maximum Concentration	EPA Compendium method	ISO method
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*This test is required only if carpets and fabrics with styrene butadiene rubber (SBR) latex backing are installed as part of the base building systems.			

For each sampling point where the maximum concentration limits are exceeded, conduct an additional flush-out with outside air and retest the noncompliant concentrations. Repeat until all requirements are met. When retesting noncompliant building areas, take samples from the same locations as in the first test, although it is not required.

Conduct the air sample testing as follows:

- All measurements must be conducted prior to occupancy, but during normal occupied hours with the building ventilation system started at the normal daily start time and operated at the minimum outside air flow rate for the occupied mode throughout the test.
- All interior finishes must be installed, including but not limited to millwork, doors, paint, carpet and acoustic tiles. Movable furnishings such as workstations and partitions should be in place for the testing, although it is not required.
- The number of sampling locations will depend on the size of the building and number of ventilation systems. For each portion of the building served by a separate ventilation system, the number of sampling points must not be less than 1 per 25,000 square feet or for each contiguous floor area, whichever is larger. Include areas with the least ventilation and greatest presumed source strength.
- Air samples must be collected between 3 and 6 feet from the floor to represent the breathing zone of occupants, and over a minimum 4-hour period.

Develop an (IAQ) management plan and implement it after all finishes have been installed and the building has been completely cleaned before occupancy.

Option 1. Flush-out[1]

Path 1

After construction ends, prior to occupancy and with all interior finishes installed, install new filtration media and flush-out the building by supplying a total air volume of 14,000 cubic feet of outdoor air per square foot (4,500 cubic meters of outdoor air per square meter) of floor area while maintaining an internal temperature of at least 60oF (15° C) and, where mechanical cooling is operated, relative humidity no higher than 60%.

OR

Path 2

If occupancy is desired prior to completion of the flush-out, the space may be occupied following delivery of a minimum of 3,500 cubic feet of outdoor air per square foot (1,000 cubic meters of outdoor air per square meter) of floor area. Once the space is occupied, it must be ventilated at a minimum rate of 0.30 cubic feet per minute (cfm) per square foot (0.1 cubic meters per minute per square meter) of outside air or the design minimum outside air rate determined in EQ Prerequisite 1: Minimum IAQ Performance, whichever is greater. During each day of the flush-out period, ventilation must begin a minimum of 3 hours prior to occupancy and continue during occupancy. These conditions must be maintained until a total of 14,000 cubic feet per square foot (4,500 cubic meters per square meter) of outside air has been delivered to the space.

Option 2. Air testing

Conduct baseline IAQ testing after construction ends and prior to occupancy using testing protocols consistent with the EPA Compendium of Methods for the Determination of Air Pollutants in Indoor Air or the ISO method listed in the table below. Testing may be done in accordance with one standard; project teams may not mix requirements from the EPA Compendium of Methods with ISO.

Demonstrate that the contaminant maximum concentrations listed below are not exceeded.

Contaminant	Maximum Concentration	EPA Compendium method	ISO method
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4-Phenylcyclohexene (4-PCH) *	6.5 micrograms per cubic meter	IP-1	ISO 16000-6
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*This test is required only if carpets and fabrics with styrene butadiene rubber (SBR) latex backing are installed as part of the base building systems.

For each sampling point where the maximum concentration limits are exceeded, conduct an additional flush-out with outside air and retest the noncompliant concentrations. Repeat until all requirements are met. When retesting noncompliant building areas, take samples from the same locations as in the first test.

Conduct the air sample testing as follows:

- All measurements must be conducted prior to occupancy, but during normal occupied hours with the building ventilation system started at the normal daily start time and operated at the minimum outside air flow rate for the occupied mode throughout the test.
- All interior finishes must be installed, including but not limited to millwork, doors, paint, carpet and acoustic tiles. Movable furnishings such as workstations and partitions must be in place.
- The number of sampling locations will depend on the size of the building and number of ventilation systems. The number of sampling locations must include the entire building and all representative situations. Include areas with the least ventilation and greatest presumed source strength.
- Air samples must be collected between 3 and 6 feet (1 and 2 meters) from the floor to represent the breathing zone of occupants, and over a minimum 4-hour period.

Credit substitution available
You may use the LEED v4 version of this credit on v2009 projects. For more information check out this article.

Develop an (IAQ) management plan and implement it after all finishes have been installed and the building has been completely cleaned before occupancy.

Option 1. Flush-out[1]

Path 1

After construction ends, prior to occupancy and with all interior finishes installed, install new filtration media and perform a building flush-out by supplying a total air volume of 14,000 cubic feet of outdoor air per square foot (4,500 cubic meters of outdoor air per square meter) of floor area while maintaining an internal temperature of at least 60° F (15° C) and relative humidity no higher than 60%.

OR

Path 2

If occupancy is desired prior to completion of the flush-out, the space may be occupied following delivery of a minimum of 3,500 cubic feet of outdoor air per square foot (1,000 cubic meters of outdoor air per square meter) of floor area. Once the space is occupied, it must be ventilated at a minimum rate of 0.30 cubic feet per minute (cfm) per square foot (0.1 cubic meters per minute per square meter) of outside air or the design minimum outside air rate determined in IEQ Prerequisite 1: Minimum Indoor Air Quality Performance, whichever is greater. During each day of the flush-out period, ventilation must begin a minimum of 3 hours prior to occupancy and continue during occupancy. These conditions must be maintained until a total of 14,000 cubic feet per square foot (4,500 cubic meters per square meter) of outside air has been delivered to the space.

Option 2. Air testing

Conduct baseline IAQ testing, after construction ends and prior to occupancy, using testing protocols consistent with the EPA Compendium of Methods for the Determination of Air Pollutants in Indoor Air or as the ISO method listed in the table below. Testing must be done in accordance with one standard; project teams may not mix requirements from the EPA Compendium of Methods with ISO.

Demonstrate that the contaminant maximum concentrations listed below are not exceeded:

Contaminant	Maximum Concentration	EPA Compendium method	ISO method
Formaldehyde	27 parts per billion	IP-6	ISO 16000-3
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*This test is required only if carpets and fabrics with styrene butadiene rubber (SBR) latex backing are installed as part of the base building systems.

For each sampling point where the maximum concentration limits are exceeded, conduct an additional flush-out with outside air and retest the noncompliant concentrations. Repeat until all requirements are met. When retesting, take samples from the same locations as in the first test.

Conduct the air sample testing as follows:

- All measurements must be conducted prior to occupancy, but during normal occupied hours with the building ventilation system started at the normal daily start time and operated at the minimum outside air flow rate for the occupied mode throughout the test.
- All interior finishes must be installed, including but not limited to millwork, doors, paint, carpet and acoustic tiles. Movable furnishings such as workstations and partitions should be in place for the testing.
- The number of sampling locations will depend on the size of the building and number of ventilation systems. The number of sampling locations must include the entire building and all representative situations. Include areas with the least ventilation and greatest presumed source strength.
- Air samples must be collected between 3 and 6 feet (1 and 2 meters) from the floor to represent the breathing zone of occupants, and over a minimum 4-hour period.

Develop an (IAQ) management plan and implement it after all finishes have been installed and the building has been completely cleaned before occupancy.

Option 1. Flush-out[1]

Path 1

After construction ends, prior to occupancy or within 14 days following occupancy and with all interior finishes installed, install new filtration media and perform a building flush-out by supplying a total air volume of 14,000 cubic feet of outdoor air per square foot (4,500 cubic meters of outdoor air per square meter) of floor area while maintaining an internal temperature of at least 60° F (15° C) and, where mechanical cooling is operated, relative humidity no higher than 60%.

OR

Path 2

If occupancy is desired prior to completion of the flush-out, the space may be occupied following delivery of a minimum of 3,500 cubic feet of outdoor air per square foot (1,000 cubic meters of outdoor air per square meter) of floor area. Once the space is occupied, it must be ventilated at a minimum rate of 0.30 cubic feet per minute (cfm) per square foot (0.1 cubic meters per minute per square meter) of outside air or the design minimum outside air rate determined in IEQ Prerequisite 1: Minimum Indoor Air Quality Performance, whichever is greater. During each day of the flush-out period, ventilation must begin a minimum of 3 hours prior to occupancy and continue during occupancy. These conditions must be maintained until a total of 14,000 cubic feet per square foot (4,500 cubic meters per square meter) of outside air has been delivered to the space.

Option 2. Air testing

Conduct baseline IAQ testing, after construction ends and prior to occupancy, using testing protocols consistent with the EPA Compendium of Methods for the Determination of Air Pollutants in Indoor Air or as the ISO method listed in the table below. Testing must be done in accordance with one standard; project teams may not mix requirements from the EPA Compendium of Methods with ISO.

Demonstrate that the contaminant maximum concentrations listed below are not exceeded:

Contaminant	Maximum Concentration	EPA Compendium method	ISO method
Formaldehyde	27 parts per billion	IP-6	ISO 16000-3
Particulates (PM10)	50 micrograms per cubic meter	IP-10	ISO 7708
Total volatile organic compounds (TVOCs)	500 micrograms per cubic meter	IP-1	ISO 16000-6
4-Phenylcyclohexene (4-PCH) *	6.5 micrograms per cubic meter	IP-1	ISO 16000-6
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*This test is required only if carpets and fabrics with styrene butadiene rubber (SBR) latex backing are installed as part of the base building systems.			

For each sampling point where the maximum concentration limits are exceeded, conduct an additional flush-out with outside air and retest the noncompliant concentrations. Repeat until all requirements are met. When retesting, take samples from the same locations as in the first test.

Conduct the air sample testing as follows:

- All measurements must be conducted prior to occupancy, but during normal occupied hours with the building ventilation system started at the normal daily start time and operated at the minimum outside air flow rate for the occupied mode throughout the test.
- All interior finishes must be installed, including but not limited to millwork, doors, paint, carpet and acoustic tiles. Movable furnishings such as workstations and partitions must be in place.
- The number of sampling locations will depend on the size of the building and number of ventilation systems. The number of sampling locations must include the entire building and all representative situations. Include areas with the least ventilation and greatest presumed source strength.
- Air samples must be collected between 3 and 6 feet (1 and 2 meters) from the floor to represent the breathing zone of occupants, and over a minimum 4-hour period.

Develop an (IAQ) management plan and implement it after all finishes have been installed and the building has been completely cleaned before occupancy.

Option 1. Flush-out[1]

Path 1

After construction ends, prior to occupancy and with all interior finishes installed, install new filtration media and perform a building flush-out by supplying a total air volume of 14,000 cubic feet of outdoor air per square foot (4,500 cubic meters of outdoor air per square meter) of floor area while maintaining an internal temperature of at least 60° F

(15° C) and relative humidity no higher than 60%.

OR

Path 2

If occupancy is desired prior to completion of the flush-out, the space may be occupied following delivery of a minimum of 3,500 cubic feet of outdoor air per square foot (1,000 cubic meters of outdoor air per square meter) of floor area. Once the space is occupied, it must be ventilated at a minimum rate of 0.30 cubic feet per minute (cfm) per square foot (0.1 cubic meters per minute per square meter) of outside air or the design minimum outside air rate determined in IEQ Prerequisite 1: Minimum Indoor Air Quality Performance, whichever is greater. During each day of the flush-out period, ventilation must begin a minimum of 3 hours prior to occupancy and continue during occupancy. These conditions must be maintained until a total of 14,000 cubic feet per square foot (4,500 cubic meters per square meter) of outside air has been delivered to the space.

Option 2. Air testing

Conduct baseline IAQ testing after construction ends and prior to occupancy using testing protocols consistent with the EPA Compendium of Methods for the Determination of Air Pollutants in Indoor Air and as additionally detailed in the LEED Reference Guide for Green Building Design and Construction, 2009 Edition Healthcare Supplement.

Demonstrate that the contaminant maximum concentrations listed below are not exceeded. (INSERT TABLE 2, HC)

For each sampling point where the maximum concentration limits are exceeded, conduct an additional flush-out with outside air and retest the noncompliant concentrations. Repeat until all requirements are met. When retesting noncompliant building areas, take samples from the same locations as in the first test, although it is not required.

Conduct the air sample testing as follows:

- All measurements must be conducted prior to occupancy, but during normal occupied hours with the building ventilation system started at the normal daily start time and operated at the minimum outside air flow rate for the occupied mode throughout the test.
- All interior finishes must be installed, including but not limited to millwork, doors, paint, carpet and acoustic tiles. Movable furnishings such as workstations and partitions should be in place for the testing, although it is not required.
- The number of sampling locations will depend on the size of the building and number of ventilation systems. For each portion of the building served by a separate ventilation system, the number of sampling points must not be less than 1 per 25,000 square feet or for each contiguous floor area, whichever is larger. Include areas with the least ventilation and greatest presumed source strength.
- Air samples must be collected between 3 and 6 feet from the floor to represent the breathing zone of occupants, and over a minimum 4-hour period.

Develop and implement an indoor air quality (IAQ) management plan for the construction and occupancy phases.

During construction, meet or exceed the recommended design approaches of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) “IAQ Guideline for Occupied Buildings under Construction,” 1995, Chapter 3.

If the building undergoes a tenant improvement, develop and implement an IAQ management plan for the preoccupancy phases. Perform a flush-out procedure as follows: After construction ends and all interior finishes have been installed, install new filtration media and flush-out the affected space. The flush-out must be done by supplying a total outdoor air volume of 14,000 cubic feet per square foot of floor area while maintaining an internal temperature of at least 60 degrees F and maintaining a relative humidity no higher than 60% where cooling mechanisms are operated. The affected space may be occupied only after the delivery of at least 3,500 cubic feet of outdoor air per square foot of floor area and the space has been ventilated at a minimum rate of 0.30 cfm per square foot of outdoor air or the design minimum outside air rate (whichever is greater) for at least three hours prior to occupancy until the total of 14,000 cubic feet per square foot of outdoor air has been delivered to the space. The flush-out may continue during occupancy.

Protect stored on-site or installed absorptive materials from moisture damage.

If air-handlers must be used during construction, filtration media with MERV 8 must be used at each return air grille, as determined by ASHRAE 52.2–1999.
Replace all filtration media immediately prior to occupancy.

Upon the completion of construction, HVAC and lighting systems must be returned to the designed or modified sequence of operations.

Develop and implement an Indoor Air Quality (IAQ) Management Plan for the preoccupancy phases as follows:

- **Option A: Flush-out procedure:**

  After construction ends and with all interior finishes installed, as described in the CI Reference Guide, install new filtration media and flush-out the building by supplying a total air volume of 14,000 cu.ft. of outdoor air per sq.ft. of floor area while maintaining an internal temperature of at least 60oF and, where mechanical cooling is operated, relative humidity no higher than 60%.

  The space may only be occupied following delivery of a minimum of 3,500 cu.ft. of outdoor air sq. ft. of floor area to the space, and provided the space is ventilated at minimum rate of 0.30 cfm/sq.ft. of outside air or the design minimum outside air rate, whichever is greater, a minimum of three hours prior to occupancy and during occupancy, until the total of 14,000 cu.ft./sq.ft. of outside air has been delivered to the space.

  OR

- **Option B: IAQ test procedure:**

  Conduct baseline IAQ testing, after construction ends and prior to occupancy, using testing protocols consistent with the U.S. Environmental Protection Agency "Compendium of Methods for the Determination of Air Pollutants in Indoor Air" and as additionally detailed in the CI Reference Guide.

Demonstrate that the contaminants' concentration levels listed below are not exceeded: [INSERT TABLE HERE]

For each sampling point where the maximum concentration limits are exceeded based on the table above, conduct additional flush- out with outside air and retest the specific parameter(s) that were exceeded to indicate the requirements are achieved. Repeat procedure until all requirements have been met. When retesting non-complying building areas, take samples from the same locations as in the first test.

The air sample testing shall be conducted as follows:

- All measurements shall be conducted prior to occupancy, but during normal occupied hours, and with the building ventilation system starting at the normal daily start time and operated at the minimum outside air flow rate for the occupied mode throughout the duration of the air testing.
- The building shall have all interior finishes installed, including but not limited to millwork, doors, paint, carpet and acoustic tiles. Non-fixed furnishings such as workstations and partitions are required to be in place for the testing.
- The number of sampling locations will vary depending upon the size of the building and number of ventilation systems. For each portion of the building served by a separate ventilation system, the number of sampling points shall not be less than one per 25,000 sq.ft., or for each contiguous floor area, whichever is larger, and include areas with the least ventilation and greatest presumed source strength.
- Air samples shall be collected between 4 feet and 7 feet from the floor to represent the breathing zone of occupants and over a minimum 4 hour period.

All materials listed below that are used in the building interior, (i.e., inside of the exterior moisture barrier) must not exceed the following requirements:

- Adhesives, Sealants and Sealant Primers: South Coast Air Quality Management District (SCAQMD) Rule #1168 requirements in effect on January 1, 2003 and rule amendment dated October 3, 2003.
- Aerosol Adhesives: Green Seal Standard GC-36 requirements in effect on October 19, 2000.

Develop and implement an Indoor Air Quality (IAQ) Management Plan for the construction and occupancy phases of the building as follows:

- During construction, meet or exceed the recommended Design Approaches of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guideline for Occupied Buildings Under Construction, Second Edition - November 2007, Chapter 3.
- Protect stored on-site or installed absorptive materials from moisture damage.
- If air handlers must be used during construction, filtration media with a Minimum Efficiency Reporting Value (MERV) of 8 must be used at each return air grill, as determined by ASHRAE 52.2-1999.
- Replace all filtration media immediately prior to occupancy.
- Remove contaminants that may be remaining at the end of the construction period.

  - Conduct a minimum two-week building flush-out with new filtration media with 100% outside air after construction ends and prior to occupancy of the affected space. After the flush-out, replace the filtration media with new media, except for filters solely processing outside air.

  OR

  - After construction ends conduct a baseline indoor air quality testing procedure for the affected space in the building that demonstrates that the concentration levels for the chemical air contaminants are below specified levels. For each sampling point where the maximum concentration limits are exceeded conduct a partial building flush-out, for a minimum of two weeks, then retest the specific parameter(s) that were exceeded to indicate the requirements are achieved. Repeat procedure until all requirements have been met.

The air sample testing shall be conducted as follows:

- Air samples collected for every 25,000 square feet, or for each contiguous floor area, whichever is greater.
- Measurements conducted with the building ventilation system starting at normal daily start time and operated at the minimum outside air flow rate for the occupied mode throughout duration of the air testing.
- Building shall be fully finished and unoccupied. Furniture can be included in the testing if desired but it is not required.
- Test with time weight values of four hours with data logging.
- When re-testing non-complying building areas, take samples from the same locations as in first test.
- Copies of the IAQ testing results should describe the contaminant sampling and analytical methods, the locations and duration of contaminant samples, the field sampling log sheets and laboratory analytical data, and the methods and results utilized to determine that the ventilation system was started at the normal daily start time and operated at the minimum outside air flow rate for the occupied mode through the duration of the air testing.

Select one of the following two options, to be implemented after construction ends and the building has been completely cleaned. All interior finishes, such as millwork, doors, paint, carpet, acoustic tiles, and movable furnishings (e.g., workstations, partitions), must be installed, and major VOC punch list items must be finished. The options cannot be combined.

Option 1. Flush-out (1 point)

OR

Option 2. Air testing (2 points)

After construction ends and before occupancy, but under ventilation conditions typical for occupancy, conduct baseline IAQ testing using protocols consistent with the methods listed in Table 1 for all occupied spaces. Use current versions of ASTM standard methods, EPA compendium methods, or ISO methods, as indicated. Laboratories that conduct the tests for chemical analysis of formaldehyde and volatile

organic compounds must be accredited under ISO/IEC 17025 for the test methods they use. Retail projects may conduct the testing within 14 days of occupancy.

Demonstrate that contaminants do not exceed the concentration levels listed in Table 1.

Table 1. Maximum concentration levels, by contaminant and testing method

Contaminant	Maximum concentration	Maximum concentration (Healthcare only)	ASTM and U.S. EPA methods	ISO method
Formaldehyde	27 ppb	16.3 ppb	ASTM D5197; EPA TO-11 or EPA Compendium Method IP-6	ISO 16000-3
Particulates (PM10 for all buildings; PM2.5 for buildings in EPA nonattainment areas, or local equivalent)	PM10: 50 micrograms per cubic meter PM2.5: 15 micrograms per cubic meter	20 micrograms per cubic meter	EPA Compendium Method IP-10	ISO 7708
Ozone (for buildings in EPA nonattainment areas)	0.075 ppm	0.075 ppm	ASTM D5149 - 02	ISO 13964
Total volatile organic compounds (TVOCs)	500 micrograms per cubic meter	200 micrograms per cubic meter	EPA TO-1, TO-15, TO-17, or EPA Compendium Method IP-1	ISO 16000-6
Target chemicals listed in CDPH Standard Method v1.1, Table 4-1, except formaldehyde	CDPH Standard Method v1.1–2010, Allowable Concentrations, Table 4-1	CDPH Standard Method v1.1–2010, Allowable Concentrations, Table 4-1	ASTM D5197; EPA TO-1, TO-15, TO-17, or EPA Compendium Method IP-1	ISO 16000-3, 16000-6
Carbon monoxide (CO)	9 ppm; no more than 2 ppm above outdoor levels	9 ppm; no more than 2 ppm above outdoor levels	EPA Compendium Method IP-3	ISO 4224

ppb = parts per billion; ppm = parts per million; µg/cm = micrograms per cubic meter

Conduct all measurements before occupancy but during normal occupied hours, with the building ventilation system started at the normal daily start time and operated at the minimum outdoor airflow rate for the occupied mode throughout the test.

For each sampling point where the concentration exceeds the limit, take corrective action and retest for the noncompliant contaminants at the same sampling points. Repeat until all requirements are met.

Select one of the following two options, to be implemented after construction ends and the building has been completely cleaned. All interior finishes, such as millwork, doors, paint, carpet, acoustic tiles, and movable furnishings (e.g., workstations, partitions), must be installed, and major VOC punch list items must be finished. The options cannot be combined.

Option 1. Flush-out (1 point)

OR

Option 2. Air testing (2 points)

After construction ends and before occupancy, but under ventilation conditions typical for occupancy, conduct baseline IAQ testing using protocols consistent with the methods listed in Table 1 for all occupied spaces. Use current versions of ASTM standard methods, EPA compendium methods, or ISO methods, as indicated. Laboratories that conduct the tests for chemical analysis of formaldehyde and volatile organic compounds must be accredited under ISO/IEC 17025 for the test methods they use. Retail projects may conduct the testing within 14 days of occupancy.

Demonstrate that contaminants do not exceed the concentration levels listed in Table 1.

Table 1. Maximum concentration levels, by contaminant and testing method

Contaminant	Maximum concentration	Maximum concentration (Healthcare only)	ASTM and U.S. EPA methods	ISO method
Formaldehyde	27 ppb	16.3 ppb	ASTM D5197; EPA TO-11 or EPA Compendium Method IP-6	ISO 16000-3
Particulates (PM10 for all buildings; PM2.5 for buildings in EPA nonattainment areas, or local equivalent)	PM10: 50 micrograms per cubic meter PM2.5: 15 micrograms per cubic meter	20 micrograms per cubic meter	EPA Compendium Method IP-10	ISO 7708
Ozone (for buildings in EPA nonattainment areas)	0.075 ppm	0.075 ppm	ASTM D5149 - 02	ISO 13964
Total volatile organic compounds (TVOCs)	500 micrograms per cubic meter	200 micrograms per cubic meter	EPA TO-1, TO-15, TO-17, or EPA Compendium Method IP-1	ISO 16000-6
Target chemicals listed in CDPH Standard Method v1.1, Table 4-1, except formaldehyde	CDPH Standard Method v1.1–2010, Allowable Concentrations, Table 4-1	CDPH Standard Method v1.1–2010, Allowable Concentrations, Table 4-1	ASTM D5197; EPA TO-1, TO-15, TO-17, or EPA Compendium Method IP-1	ISO 16000-3, 16000-6
Carbon monoxide (CO)	9 ppm; no more than 2 ppm above outdoor levels	9 ppm; no more than 2 ppm above outdoor levels	EPA Compendium Method IP-3	ISO 4224

ppb = parts per billion; ppm = parts per million; µg/cm = micrograms per cubic meter

Conduct all measurements before occupancy but during normal occupied hours, with the building ventilation system started at the normal daily start time and operated at the minimum outdoor airflow rate for the occupied mode throughout the test.

For each sampling point where the concentration exceeds the limit, take corrective action and retest for the noncompliant contaminants at the same sampling points.

Repeat until all requirements are met.

Develop an IAQ management plan and implement it after all finishes have been installed and the building has been completely cleaned before occupancy.

OPTION 1. Flush-Out[29]

PATH 1

After construction ends, prior to occupancy and with all interior finishes installed, install new filtration media and, perform a building flush-out by supplying a total air volume of 14,000 cubic feet of outdoor air per square foot (4,500 cubic meters of outdoor air per square meter) of floor area while maintaining an internal temperature of at least 60° F (15°C) and relative humidity no higher than 60%.

OR

PATH 2

If occupancy is desired prior to completion of the flush-out, the space may be occupied following delivery of a minimum of 3,500 cubic feet of outdoor air per square foot (1,000 cubic meters of outdoor air per square meter) of floor area. Once the space is occupied, it must be ventilated at a minimum rate of 0.30 cubic feet per minute (cfm) per square foot (0.1 cubic meters of outside air per minute per square meter) of outside air or the design minimum outside air rate determined in IEQ Prerequisite 1: Minimum Indoor Air Quality Performance, whichever is greater. During each day of the flush-out period, ventilation must begin a minimum of 3 hours prior to occupancy and continue during occupancy. These conditions must be maintained until a total of 14,000 cubic feet per square foot (4,500 cubic meters of outside air per square meter) of outside air has been delivered to the space.

OR

OPTION 2. Air Testing

Conduct baseline IAQ testing after construction ends and prior to occupancy using testing protocols consistent with the EPA Compendium of Methods for the Determination of Air Pollutants in Indoor Air and as additionally detailed in the LEED 2011 Reference Guide for India. (OR) Use a local standard to get testing protocols consistent with the above EPA standard by substituting appropriate benchmarks and metrics for establishing a baseline, and measuring performance relative to that baseline.

The following guidelines outline the methodology for establishing acceptable benchmarks and metrics pertaining to this credit's requirements by using an equivalent local standard.

Demonstrate that the contaminant maximum concentration levels listed below are not exceeded:

Contaminant	Maximum Concentration
Formaldehyde	27 parts per billion
Particulates (PM10)	50 micrograms per cubic meter
Total volatile organic compounds (TVOCs)	500 micrograms per cubic meter
4-Phenylcyclohexene (4-PCH)*	6.5 micrograms per cubic meter
Carbon monoxide (CO)	9 part per million and no greater than 2 parts per million above outdoor levels
* This test is only required if carpets and fabrics with styrene butadiene rubber (SBR) latex backing are installed as part of the base building systems.	

For each sampling point where the maximum concentration limits are exceeded, conduct an additional flush- out with outside air and retest the noncompliant concentrations. Repeat until all requirements are met. When retesting noncompliant building areas, take samples from the same locations as in the first test, although it is not required.

Conduct the air sample testing as follows:

- All measurements must be conducted prior to occupancy, but during normal occupied hours with the building ventilation system started at the normal daily start time and operated at the minimum outside air flow rate for the occupied mode throughout the test.
- All interior finishes must be installed, including but not limited to millwork, doors, paint, carpet and acoustic tiles. Movable furnishings such as workstations and partitions should be in place for the testing, although it is not required.
- The number of sampling locations will depend on the size of the building and number of ventilation systems. For each portion of the building served by a separate ventilation system, the number of sampling points must not be less than 1 per 25,000 square feet (1 per 2,300 square meters) or for each contiguous floor area, whichever is larger. Include areas with the least ventilation and greatest presumed source strength.
- Air samples must be collected between 3 and 6 feet (between 1 and 2 meters) from the floor to represent the breathing zone of occupants, and over a minimum 4-hour period.

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[29] All finishes must be installed prior to flush-out.