

GREENGUARD Environmental Institute
2211 Newmarket Parkway, Suite 110
Marietta, GA 30067
1.800.427.9681



Specification

Indoor Air Quality Management

This Master Specification section is intended for use in preparation of a project specification covering indoor air quality requirements. The specification includes the requirements of LEED-NC, LEED-EB and includes specifications for construction products, construction site management, construction sequencing, HVAC operation during construction, product installation, building flush-out and IAQ testing.

SECTION 01 3546

INDOOR AIR QUALITY MANAGEMENT

This section includes editing notes to assist the user in editing the section to suit project requirements. These notes are included as hidden text, and can be revealed or hidden by one of the following methods:

Microsoft Word: From the pull-down menus select TOOLS, then OPTIONS. Under the tab labeled VIEW, select or deselect the HIDDEN TEXT option.

Corel WordPerfect: From the pull-down menus select VIEW, then select or deselect the HIDDEN TEXT option.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Product requirements for indoor construction and finishing materials.
 2. Final Construction Products List.
 3. Construction site management.
 4. Indoor Environmental Consultant qualifications.
 5. Scheduling and product installation sequencing.
 6. Operation of HVAC systems during construction.
 7. Product installation.
 8. Building flush out.
 9. Indoor air quality testing.
 10. Documentation and reporting.

1.2 REFERENCES

- A. American Conference of Government Industrial Hygienists (ACGIH).
- B. American National Standards Institute/American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ANSI/ASHRAE):
1. 52.2 – Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.
 2. 55 – Thermal Environmental Conditions for Human Occupancy.
 3. 62.1 – Ventilation for Acceptable Indoor Air Quality.
 4. 62.2 – Ventilation and Acceptable Indoor Air Quality for Low-Rise Residential Buildings.

- C. GREENGUARD Environmental Institute (GREENGUARD) - Indoor Air Quality Certification Program.
- D. U.S. Green Building Council (USGBC) - Leadership in Energy and Environmental Design (LEED) 2009 for New Construction and Major Renovations.
- D. U.S. Green Building Council (USGBC) - Leadership in Energy and Environmental Design (LEED) 2009 for Commercial Interiors.
- E. Sheet Metal and Air Conditioning Manufacturer's Association International (SMACNA)
- F. United States Environmental Protection Agency (EPA):
 - 1. Compendium of Methods for the Determination of Air Pollutants in Indoor Air.
 - 2. National Ambient Air Quality Standard, Code of Federal Regulations, Title 40, Part 50.

1.3 DEFINITIONS

- A. Dry Products: Products used in a solid state, including gypsum board, carpet, acoustical panels and tiles, and textiles.
- B. MERV: Minimum Efficiency Reporting Value.
- C. Priority Products: Products known to be high chemical emitters, long term emitters, and those expected to present emissions in high amounts (high surface area).
- D. Threshold Limit Value (TLV): Industrial Work Place Standard as defined by ACGIH.
- E. Wet Products: Products used in a liquid or semi-liquid state, including adhesives, joint sealers, paints, and coatings.

1.4 SUBMITTALS

- A. Final Construction Products List:
 - 1. Submit list of proposed indoor construction and finishing products.
 - 2. Include strategies for minimizing use of wet products.
 - 3. Obtain approval by [Architect] [Interior Designer] [Commissioning Agent] [_____] prior to installation of products.
- B. Indoor Air Quality Test Report:
 - 1. Provide copies of Indoor Air Quality Test Report from Indoor Environmental Consultant.
 - 2. Include in report:
 - a. Study design including methodology for determination of air sampling locations and duration of sampling.
 - b. Summary of sampling and analytical methods employed.
 - c. Copy of field sampling logs.

- d. Summary of methods and results used to determine that ventilation system was started at normal daily start time and operated at minimum outside airflow rates for occupied mode for duration of air testing.
- e. Laboratory analytical data for each contaminant and summary table showing compliance with specified criteria.

1.5 QUALITY ASSURANCE

- A. Provide written notification of product requirements to subcontractors and suppliers of interior construction and finishing products.
- B. Indoor Environmental Consultant Qualifications:
 - 1. [Owner will] [Contractor shall] employ and pay for an Indoor Environmental Consultant to perform specified indoor air quality testing.
 - 2. Minimum 5 years experience in conducting indoor environmental quality evaluations of non-industrial buildings.
 - 3. Retain Certified Industrial Hygienist (CIH) on staff to review and sign test reports.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Storage Area:
 - 1. Designate secure storage area to facilitate protection of stored absorptive products.
 - 2. Clearly identify storage area. Keep dry, clean, and orderly; prevent contamination of products.
 - 3. Monitor storage areas for contamination; correct problems and implement preventative measures.
- B. Products:
 - 1. Protect absorptive products from moisture damage before, during, and after installation.
 - 2. Immediately remove products exhibiting stains, mold, mildew, or other evidence of water or moisture damage from site.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Interior Construction and Finishing Products; in purchasing products, give preference to:
 - 1. Products designed and manufactured in manner to produce least harmful and irritating effects.
 - 2. Products certified by GREENGUARD Environmental Institute as Low Emitting. For products that are not GREENGUARD Certified, provide a test, which at maximum is performed one year prior to installation, to ensure conformance to GREENGUARD standard emission values.
 - 3. Products providing lowest practical yet technologically achievable emissions of particulates and chemical vapors, as defined in following paragraphs.
- B. Maximum Chemical emission Values for Products In Commercial or Retail Buildings:

1. Emission rate calculations: Assume 32 cubic meters as volume for determination of product loading.
2. Product emission rates and modeling for predicted exposure concentrations: As measured in milligrams/square meter per hour ($\text{mg}/\text{m}^2 \cdot \text{hr}$) at anticipated loading (square meter/cubic meter [m^2/m^3] within building. Predicted indoor concentrations shall be based on building modeling parameters of 0.72 air changes per hour (ACH). The product shall produce indoor air concentration levels less than the amounts specified for each substance within seven (7) days of installation.
3. Total VOC emission rate: Maximum total volatile organic compounds (VOC) of 0.05 milligrams/cubic meter (mg/m^3).
4. Total aldehydes: Maximum 0.1 parts per million (ppm).
5. Formaldehyde: Maximum 0.05 parts per million (ppm).
6. 4-Phenylcyclohexene (4-PC): Maximum 0.0065 milligrams/cubic meter (mg/m^3) or 0.1 parts per billion (ppb).
7. Styrene: Maximum 0.07 milligrams/cubic meter (mg/m^3).
8. For individual Volatile Organic Compounds (VOCs) not listed above: Shall produce an air concentration level less than 1/10th of the Threshold Limit Value (TLV) at the anticipated product loading in the building within seven (7) days of installation.
9. Regulated pollutants: Maximum air concentration as promulgated by National Ambient Air Quality Standard for primary and secondary outdoor air pollutants.
10. Identified carcinogens and reproductive toxins: Below levels of no significant risk according to evaluation protocols established by EPA or approved State and public health organizations.

B. Maximum Chemical and Particle emission Values for Products In Educational, Daycare, Healthcare, or Otherwise Sensitive Environments:

11. Emission rate calculations: Assume 231 cubic meters as volume for determination of product loading.
12. Product emission rates and modeling for predicted exposure concentrations: As measured in milligrams/square meter per hour ($\text{mg}/\text{m}^2 \cdot \text{hr}$) at anticipated loading (square meter/cubic meter [m^2/m^3] within building. Predicted indoor concentrations shall be based on building modeling parameters of 0.9 air changes per hour (ACH) and a 0.9 ventilated volume fraction. The product shall produce indoor air concentration levels less than the amounts specified for each substance within seven (7) days of installation except for formaldehyde. Formaldehyde criteria are established so that emission levels reach 0.014 ppm (13.5 ppb) within 14 days of installation (meeting CA 1350 requirements).
13. Total VOC emission rate: Maximum total volatile organic compounds (VOC) of 0.022 milligrams/cubic meter (mg/m^3).
14. Total aldehydes: Maximum 0.043 parts per million (ppm).
15. Formaldehyde: Maximum 0.0135 parts per million (ppm) within 14 days of installation.
16. Total Phthalates: Maximum 0.01 milligrams/cubic meter (mg/m^3). Total phthalates are defined as the total response of a specific target list of phthalates including dibutyl (DBP), diethylhexyl (DEHD), diethyl (DEP), butylbenzyl(BBP), di-octyl (DOP), and dimethyl (DMP) phthalates (conducted using a modified phthalate specific analytical method, OSHA 104).
17. Total Particles: Maximum 0.02 milligrams/cubic meter (mg/m^3). This is applicable only to fibrous, particle-releasing products with exposed surface area in air streams (determined using a "forced air" test with specific test method).
18. For individual Volatile Organic Compounds (VOCs) not listed above: Shall produce an air concentration level less than 1/100 of the Threshold Limit Value (TLV) and less than 1/2 of the California Chronic REL at the anticipated product loading in the building within seven (7) days of installation.

PART 3 - EXECUTION

3.1 CONSTRUCTION SITE MANAGEMENT

- A. If weather or plumbing leaks result in interior of building becoming wet:
 - 1. Ensure that building is properly dried out prior to installation of any additional materials into the space.
 - 2. Inspect installed materials for mold and mildew.
 - 3. Affected materials less than 10 square feet in area: Remediate materials according to accepted industry practices.
 - 4. Affected materials 10 square feet or more in area: Employ certified remediation firm to remove materials from site.

- B. For projects incorporating new construction in an existing space, follow the procedures outlined in the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) *IAQ Guidelines for Occupied Buildings Under Construction*, Chapter 3, also see section 3.3 below.

3.2 SCHEDULING AND PRODUCT INSTALLATION SEQUENCING

- A. Schedule shipment and delivery of products based on actual construction progress to minimize time products are stored on site.
- B. Prepare and staff building site for delivery of products.
- C. Inspect products upon delivery for conformance to Final Construction Materials List and to ensure that they are free from water and moisture damage and properly stored.
- D. Use the least practical amount of wet materials.
- E. Do not install dry materials until wet materials have been installed and allowed to dry to greatest extent practical.
- F. Choose drying times so that specified pollutant emission rates are achieved prior to installation of dry materials.
- G. Install solvent containing materials during periods during which building is unoccupied. Schedule installation as early as possible during construction to allow for maximum off-gassing prior to building occupancy or re-occupancy.
- H. Install high-VOC emitting products prior to installation of porous and fibrous products, or protect with polyethylene sheeting, properly sealed.
- I. Complete installation of interior finishing materials two to four weeks prior to building occupancy. Continuously flush out building with fresh air for two to four weeks.
- J. Provide temporary ventilation during touch-up operations; extend building flush-out for minimum of four days after touch-up is complete.

3.3 OPERATION OF HVAC SYSTEMS DURING CONSTRUCTION IN OCCUPIED BUILDINGS

- A. Depressurize construction area at rate at least 10 percent greater than rate of supply or pressurize existing spaces, whichever is more feasible.
- B. Erect supplemental containment barriers if pressurization is not adequate to control construction dust and odors in occupied areas.

- C. Ensure that construction equipment and staging areas are away from air intakes for existing construction.
- D. Temporarily seal intake dampers for existing space when high-emitting construction activities are performed near outdoor air intakes for existing construction.
- E. During demolition or construction in existing spaces:
 1. Do not operate building HVAC systems in affected areas.
 2. Temporarily seal supply and return openings with plastic sheeting.
 3. If system must be operational during demolition or construction, install temporary MERV 8 filters in return openings in accordance with LEED Guidelines; maintain in clean condition.

3.4 BUILDING FLUSH-OUT

- A. If building meets Clearance Criteria immediately following construction, building flush-out is not required.
- B. Following completion of interior finishes and installation of new furnishings, flush building with 100 percent clean outdoor air for two to four weeks prior to occupancy. If time does not permit a two to four week flush-out period, the design and construction team shall designate whatever time is available for building flush (even if it is as minimal as 24 hours).
- C. Install new MERV 13 filtration media prior to beginning the flush-out procedure.
- D. After flush-out, install new MERV 13 filtration media, except for those filters processing only outdoor air.

3.5 INDOOR AIR QUALITY TESTING

- A. Perform testing after completion of construction and installation of new furnishings, but before Owner occupancy, using protocols established by reputable standard setting or method development organizations such as state and federal agencies and reputable non-governmental organizations such as the GREENGUARD Environmental Institute or ASTM .
- B. Conduct testing prior to Owner occupancy but during normally occupied hours.
- C. Operate building HVAC system at normal daily start and stop times at minimum outside airflow for occupied mode for duration of testing.
- D. Number of Air Sampling Locations: Minimum of one per 25,000 square feet or for each contiguous floor area, whichever is greater. Include areas with least ventilation and greatest presumed source strength.
- E. At each location, collect samples at to 6 feet above floor over minimum 4 hour period.
- F. Demonstrate that contaminant concentrations do not exceed following maximum concentration limits:

Contaminant	Maximum Concentration Limit
Carbon Dioxide *	10,300/ventilation rate

Contaminant	Maximum Concentration Limit
Carbon Monoxide	9 ppm and maximum 2 ppm above outdoor levels
Total Volatile Organic Compounds (TVOC)	Maximum 500 micrograms/cubic meter
Formaldehyde	Maximum 27 parts per billion
4-Phenylcyclohexene (4-PCH)	Maximum 6.5 micrograms/cubic meter
Other Individual VOC's	Below odor and/or sensory irritation threshold and maximum 1/10 TLV
Total Aldehydes	Maximum 100 parts per billion
Total Particles (PM 10)	Maximum 50 micrograms/cubic meter

* Carbon dioxide monitoring is required only if building is occupied during testing. Ventilation rate is outdoor air requirement per person. Carbon dioxide measurement is differential between indoor and outdoor conditions, based on occupancy type as defined by ANSI/ASHRAE 62.1 and 62.2.

- G. For each sampling location where maximum concentration limit is exceeded, conduct additional flush-out with outside air and retest specific contaminant until maximum concentration limit is achieved. Collect samples for retesting from original sampling location.

END OF SECTION