

SECTION 018119 – INDOOR AIR QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Moisture and air pollutants associated with construction activity can affect the health of building occupants and lead to occupant health problems and Sick Building Syndrome. This Contract requires the Contractor to develop an Indoor Air Quality (IAQ) Management Plan to remain in force during the construction period as part of the Owner's objective to attain a LEED certified project in accordance with the LEED Green Building Rating System of the U.S. Green Building Council.
 - 1. The general guidelines and requirements are described below for protective measures during construction and post-construction building IAQ testing.
 - 2. Each sub-contractor, and the construction personnel generally, must be familiar with these requirements.
 - 3. Both the Architect and Contractor shall take photographs of Contractor-provided protective measures to document compliance with IAQ management plan objectives.
- B. Additional information about protecting IAQ during the construction process can be found in the Sheet Metal and Air Conditioning National Contractors' Association (SMACNA) IAQ Guidelines for Occupied Buildings Under Construction, 2nd Edition 2007, available from SMACNA (703-803-2980 or www.smacna.org).

1.3 SUBMITTALS

- A. Comply with Division 1 Section "Sustainable Design Requirements".

PART 2 - REQUIREMENTS DURING CONSTRUCTION

2.1 PROTECTION

- A. Store all materials and equipment in a protected area (inside warehouse or storage trailer). Materials and equipment that are too large or heavy to store in a job site trailer shall be protected from water and dirt/dust/debris.
 - 1. Large equipment and materials (pipe, conduit, brick, block, air-handling equipment, etc.) may be stored outside if two layers of 8 mil poly are placed on the ground and the equipment or material is then elevated at least 4 inches to allow water to run off. The top and sides shall also be securely covered with two layers of 8 mil poly to prevent water penetration and dust/dirt accumulation.

- B. Protect HVAC equipment from collected dust and odors (which can “stick” to porous materials in the system and later be released). Units may not be stored in areas near painting, pressure washing, or excavation. Units may not be operated during cutting or grinding or masonry or concrete.
1. Refer to Division 23 Section “Particulate Air filtration” for construction filter requirements for protection of mechanical duct systems during construction.
 2. Ductwork shall be clean when installed. Cap ends with poly during transportation and construction to prevent contamination.
 3. The HVAC system shall not operate until the building walls, roof, glass, doors and filters are properly installed to prevent the induction of pollutants.
 4. If Owner authorizes use of permanent heating, cooling, and ventilating systems during construction period as specified in Division 1 Section “Temporary Facilities and Controls,” install filter media meeting one of the following requirements at each return-air inlet for the air-handling system used during construction:
 - a. Minimum Efficiency Reporting Value (MERV) of 8, as determined by ASHRAE Standard 52.2-1999 (with errata but without addenda); OR
 - b. Class F5 or higher, as determined by CEN Standard EN 779-2002, Particulate air filters for general ventilation, Determination of the filtration performance; OR
 - c. Minimum dust spot efficiency of 30% or higher and greater than 90% arrestance on a particle size of 3-10 μg .
 5. Immediately prior to testing and balancing, install new filters of the same type that are to be permanently installed. Testing and balancing shall not be performed when dust or odor generating activities are occurring.
 6. After construction ends, prior to occupancy, and with all interior finishes installed, replace filtration media at all locations where outside air is introduced to the mechanical system. Filtration media must meet one of the following requirements:
 - a. MERV of 13 or higher in accordance with ASHRAE Standard 52.2; OR
 - b. Class F7 or higher, as defined by CEN Standard EN 779-2002, Particulate air filters for general ventilation, Determination of the filtration performance; OR
 - c. Minimum dust spot efficiency of 80% or higher and greater than 98% arrestance on a particle size of 3-10 μg .
 7. The Architect must observe and approve the conditions of the building before final filters are replaced after Substantial Completion.

2.2 SOURCE CONTROL

- A. Minimize IAQ contaminants introduced by construction materials.
1. The Architect/Engineer has generally attempted to control the introduction of contaminants at the source by selecting materials to minimize such contamination. Some of the leading building product sources of air contamination are carpet, adhesives, paints, caulks, cleaning solutions, wall coverings, and furniture.
- B. Store waste construction materials a sufficient distance (a minimum of 30 feet away) from the building to avoid any contamination of building IAQ.

- C. Smoking is prohibited within 25 feet of the building footprint.
- D. Adhesives, Sealants, and Sealant Primers (Credit EQ 4.1): For field applications that are inside the weatherproofing system, use adhesives, sealants, and sealant primers that comply with the South Coast Air Quality Management District (SCAQMD) Rule #1168. VOC limits correspond to an effective date of July 1, 2005 and rule amendment date of January 7, 2005. VOC limits are reprinted on page 471 of the LEED Reference Guide for Green Building Design and Construction (2009 Edition) and are available from the Architect upon request.
1. This standard uses the term “sealant” to describe surface filler, sealer type materials commonly referred to as “sealers” in the construction industry.
 2. The definition of sealant for the purposes of this specification is any material with adhesive properties that is formulated primarily to fill, seal, or waterproof gaps or joints between two surfaces. Sealants include sealant primers and caulks.
 3. For carpet adhesive, concrete, wood, bamboo and cork floor finishes, and tile setting adhesives, compliance can be demonstrated with the test results of:
 - a. Total volatiles fraction, based on one of the following, provided that water and exempt compounds are subtracted from total volatiles test results and the mass VOC content is calculated consistent with SCAQMD Rule 1113 and Rule 1168:
 - 1) ASTM D2369
 - 2) EPA method 24
 - 3) ISO 11890 part 1
 - b. Total volatile organic compounds (VOC) fraction, based on one of the following, provided that all VOCs with a boiling point up to 280°C are included, and exempt compounds are subtracted from total volatiles test results and the mass VOC content is calculated consistent with SCAQMD Rule 1113 and Rule 1168:
 - 1) ASTM D6886
 - 2) ISO 11890 part 2
- E. Paints and Coatings (Credit EQ 4.2): For interior field applications that are inside the weatherproofing system, use:
1. Architectural paints, coatings, and primers that do not exceed the VOC content limits established in Green Seal Standard GS-11, Paints, First Edition, May 20, 1993. VOC limits are reprinted on page 483 of the LEED Reference Guide for Green Building Design and Construction (2009 Edition) and are available from the Architect upon request.
 2. Anti-corrosive and anti-rust paints applied to interior ferrous metal substrates that do not exceed the VOC content limit of 250 g/L established in Green Seal Standard GC-03, Anti-Corrosive Paints, Second Edition, January 7, 1997
 3. Clear wood finishes, floor coatings, stains, sealers, and shellacs applied to interior elements that do not exceed the VOC content limits established in SCAQMD Rule #1113, Architectural Coatings, rules in effect on January 1, 2004. VOC limits are reprinted on page 483 of the LEED Reference Guide for Green Building Design and Construction (2009 Edition) and are available from the Architect upon request.
- F. Flooring Systems (Credit EQ 4.3):

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1. Carpet installed inside the weatherproofing system shall meet one of the following requirements:
 - a. Comply with the testing and product requirements of the Carpet and Rug Institute Green Label Plus program; OR
 - b. Maximum VOC concentrations are less than or equal to those specified in the California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 addenda, using the office scenario as defined in Table 7.5 within the practice. The additional VOC concentration limits listed in Section 9.1a must also be met; OR
 - c. Maximum VOC concentrations meet the California requirements specified above based on the following:
 - 1) California Department of Public Health (CDPH) Standard Method V1.1-2010 using test results obtained at the 14 day time point.
 2. Carpet cushion installed in the building shall meet the testing and product requirements of the Carpet and Rug Institute's Green Label program.
 3. Carpet adhesive shall meet the requirement of Credit EQ 4.1: VOC limit of 50 g/L.
 4. Hard surface flooring and wall base installed inside the weatherproofing system shall meet one of the following requirements:
 - a. Comply with the requirements of the FloorScore standard (as of November 2009 or more current) as shown with testing by an independent third party; OR
 - b. Demonstrate maximum VOC concentrations less than or equal to those specified in the California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 addenda, using the office scenario as defined in Table 7.5 within the practice; OR
 - c. Maximum VOC concentrations meet the California requirements specified above based on the following:
 - 1) CDPH Standard Method v1.1-2010 using test results obtained at the 14 day time point.
- Note: mineral based finish flooring products such as tile, masonry, terrazzo, and cut stone without integral organic-based coatings, and sealants and unfinished/untreated solid wood flooring, qualify for credit without any IAQ testing requirements. However, associated site-applied adhesives, grouts, finishes and sealers must be compliant for a mineral based or unfinished/untreated solid wood flooring system to qualify for credit.*
5. Concrete, wood, bamboo, and cork floor finishes such as sealer, stain and finish shall meet the requirements of SCAQMD Rule 1113, Architectural Coatings, rules in effect on January 1, 2004.
 - a. Compliance can be demonstrated with test results of:
 - 1) Total volatiles fraction, based on one of the following, provided that water and exempt compounds are subtracted from total volatiles test results and the mass VOC content is calculated with SCAQMD Rule 1113 and Rule 1168:

- a) ASTM D2369
 - b) EPA method 24
 - c) ISO 11890 part 1
 - 2) Total VOC fraction, based on one of the following, provided that all VOCs with a boiling point up to 280°C are included, and exempt compounds are subtracted from total volatiles test results and the mass VOC content is calculated consistent with SCAQMD Rule 1113 and Rule 1168:
 - a) ASTM D6886
 - b) ISO 11890 part 2
6. Tile setting adhesives and grout shall meet SCAQMD Rule 1168. VOC limits correspond to an effective date of July 1, 2005 and rule amendment date of January 7, 2005.
- a. Compliance can be demonstrated with test results of:
 - 1) Total volatiles fraction, based on one of the following, provided that water and exempt compounds are subtracted from total volatiles test results and the mass VOC content is calculated with SCAQMD Rule 1113 and Rule 1168:
 - a) ASTM D2369
 - b) EPA method 24
 - c) ISO 11890 part 1
 - 2) Total VOC fraction, based on one of the following, provided that all VOCs with a boiling point up to 280°C are included, and exempt compounds are subtracted from total volatiles test results and the mass VOC content is calculated consistent with SCAQMD Rule 1113 and Rule 1168:
 - a) ASTM D6886
 - b) ISO 11890 part 2
- G. Composite Wood Products (Credit EQ 4.4): Products containing composite wood, agrifiber, and laminating adhesives installed inside the weatherproofing system must contain no added urea formaldehyde resins. Materials considered fit-out, furniture, and equipment (FF&E) are not considered base building elements and are thus excluded from this restriction.

2.3 PATHWAY INTERRUPTION

- A. Erect barriers to contain construction areas to allow a portion of the building to be cleaned and then operate the HVAC system in that cleaned area. Barriers can range from simple dust curtains to temporary walls.
 1. Areas of building in which HVAC is operational shall be protected by physical barriers from areas of the building not approved for operation of the HVAC systems.
- B. The area within 30 feet of outdoor air intakes must remain free of dust, dirt, debris, and volatile materials while the HVAC system is running.

2.4 HOUSEKEEPING

- A. As dust accumulates at a construction site, it will become airborne when disturbed by nearby activity. Similarly, spills or excess applications of products containing solvents will increase odors at a construction site. Leaving the work site wet or even just damp for more than a day could result in the growth of mold and bacteria. Attention to site cleaning is, therefore, important to maintaining good IAQ during construction.
- B. These specific actions may be applicable in regard to controlling contaminants at the work site:
1. Suppress dust with wetting agents or sweeping compounds.
 2. Utilize an efficient dust collection method (e.g. a damp rag, wet mop, or vacuum equipped with a high efficiency particulate filter or wet scrubber will discharge less material back into the air than conventional vacuuming, sweeping, or dusting).
 3. Remove spills or excess applications of solvent-containing products immediately. Care should be taken as to selection of spot removers and cleaning agents near occupied areas (products must be low VOC emitters).
 4. Remove accumulated water and keep work areas as dry as possible (use dehumidification if necessary).
 5. Once building is enclosed, vacuum with HEPA filtered vacuum cleaners to prevent settled dust from becoming airborne again.
 6. Protect porous materials such as insulation from exposure to moisture. (Note: Replace items that remain damp for more than a few hours.)

2.5 SCHEDULING

- A. Sequence construction to reduce absorption of VOCs by materials that act as sinks or contaminant sources. Complete application/installation of wet and odor-emitting materials before installing sink materials. Examples of types of these materials include, but are not limited to:
1. Wet (Source) Materials:
 - a. composite wood products, millwork
 - b. adhesives, sealants, and glazing compounds
 - c. wood preservatives, finishes, and paint
 - d. control or expansion joint fillers
 - e. all hard finishes requiring adhesive installation
 - f. gypsum board and associated finish processes
 2. Fuzzy (Sink) Materials:
 - a. carpet and padding
 - b. fabric wall-covering
 - c. insulation exposed to air stream
 - d. acoustic ceiling materials
 - e. fabric-covered acoustic wall panels

PART 3 - REQUIREMENTS BEFORE OCCUPANCY

3.1 OPTION 1: BUILDING FLUSH-OUT

- A. 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 volume of 14,000 cu. ft. (4,300,000 L) of outdoor air per sq. ft. (sq. m) of floor area while maintaining an internal temperature of at least 60 deg F (16 deg C) and a relative humidity no higher than 60 percent.
- B. If occupancy is desired prior to flush-out completion, the space may be occupied following delivery of a minimum of 3,500 cu. ft. (1,070,000 L) of outdoor air per sq. ft. (sq. m) of floor area to the space. Once a space is occupied, it shall be ventilated at a minimum rate of 0.30 cfm per sq. ft. (1.52 L/s per sq. m) of outside air or the design minimum outside air rate determined in EQ Prerequisite 1, whichever is greater. During each day of the flush-out period, ventilation shall begin a minimum of three hours prior to occupancy and continue during occupancy. These conditions shall be maintained until a total of 14,000 cu. ft./sq. ft. (4,300,000 L/sq. m) of outside air has been delivered to the space.

3.2 OPTION 2: BUILDING IAQ TESTING

- A. After construction ends, prior to occupancy and with all interior finishes installed, install new filtration media and conduct baseline IAQ testing, using testing protocols consistent with the US Environmental Protection Agency 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).
 - 1. Demonstrate that the contaminant maximum concentrations listed below are not exceeded:

| Contaminant | Maximum Threshold |
|--|--|
| Airborne Mold and Mildew (Non-Viable Spore Trap) | Indoor levels shall not exceed outdoor levels. Take indoor samples at each sampling location and 1 outdoor sample for comparison. |
| Carbon Monoxide (CO) | 9 parts per million and no greater than 2 parts per million above outdoor levels. Take indoor readings at each sampling location and 1 outdoor reading for comparison. |
| Formaldehyde | 27 parts per billion |
| Particulates (PM 10) | 50 micrograms per cubic meter |
| Total Volatile Organic Compounds (TVOC) | 500 micrograms per cubic meter |
| 4-Phenylcyclohexene (4-PCH)* | 6.5 micrograms per cubic meter |

*This test is only if carpets and fabrics with styrene butadiene rubber (SBR) latex backing material are installed as part of the base building systems.

- 2. Conduct air sample testing as follows:
 - a. All measurements shall be conducted prior to occupancy but during normal occupied hours, and with 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 air testing.
- b. All interior finishes must be installed, including but not limited to millwork, doors, paint, carpet and acoustic tiles. Non-fixed furnishings such as workstations and partitions are not required to be in place for the testing.
 - c. Number of sampling locations will vary depending on the size of building and number of ventilation systems. For each portion of building served by separate ventilation system, the number of sampling points shall not be less than one per 25,000 sq. ft. (2,300 sq. m) or for each contiguous floor area, whichever is larger, and shall include areas with the least ventilation and greatest presumed source strength.
 - d. Air samples shall be collected between 3 and 6 feet (0.9 and 1.8 m) from the floor to represent the breathing zone of occupants, and over a minimum four-hour period.
- B. For each sampling point where the maximum concentration limits are exceeded, conduct additional flush-out with outside air and retest the specific parameter(s) exceeded to indicate the requirements are achieved. Repeat procedure until all requirements have been met. When retesting non-compliance building areas, take samples from the same locations as in the first test.

END OF SECTION 018119