

## **SECTION 01 81 13 - INDOOR AIR QUALITY REQUIREMENTS**

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### **PART 1 - GENERAL**

#### **1.01 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.

#### **1.02 SUMMARY**

- A. Section includes general requirements and procedures to promote adequate indoor air quality after construction.
  - 1. Testing indoor air quality before commencement of construction; existing building areas only.
  - 2. Testing indoor air quality after completion of construction.
- B. Related Sections:
  - 1. Division 1 Section - Commissioning Requirements
  - 2. Division 1 Section - Summary for work restrictions governing construction operations.
  - 3. Division 1 through 33 Sections for requirements specific to the work of each of these Sections. Requirements may or may not include reference to indoor air quality management plan.
- C. Attachments:
  - 1. Sample Indoor Air Quality Management Plan Template.
  - 2. Sample Indoor Air Quality Checklist.

#### **1.03 PROJECT GOALS**

- A. Dust and Airborne Particulates: Prevent deposition of dust and other particulates in HVAC ducts and equipment.
  - 1. Cleaning of ductwork is not contemplated under this Contract.
  - 2. General Contractor shall bear the cost of cleaning required due to failure to protect ducts and equipment from construction dust.
  - 3. Establish condition of existing ducts and equipment prior to start of alterations.
- B. Airborne Contaminants: Procedures and products have been specified to minimize indoor air pollutants.
  - 1. Furnish products meeting the specifications.
  - 2. Avoid construction practices that could result in contamination of installed products leading to indoor air pollution.

#### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Pre-installation Conference: Conduct conference at Project site. Review indoor air quality requirements and action plans for complying with requirements.
- B. Maintain Indoor Air Quality Management Action Plan, appropriately updated as work progresses.

#### **1.05 REFERENCE STANDARDS**

- A. ASHRAE Standard 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; 2012.
- B. ASHRAE Std 129 - Measuring Air-Change Effectiveness; 1997 (Reaffirmed 2002).
- C. ASTM E779 - Standard Test Method for Determining Air Leakage Rate by Fan Pressurization; 2010.

- D. CAL (EESR) - California Energy Efficiency Standards Residential Alternative Calculation Method (ACM) Approval Manual, Chapter 7; 2005.
- E. SMACNA (OCC) - IAQ Guidelines for Occupied Buildings Under Construction; 2<sup>nd</sup> edition, 2007.

#### **1.06 DEFINITIONS**

- A. Adsorptive Materials: Gypsum board, acoustical ceiling tile and panels, carpet and carpet tile, fabrics, fibrous insulation, and other similar products.
- B. Contaminants: Gases, vapors, regulated pollutants, airborne mold and mildew, and the like, as specified.
- C. Particulates: Dust, dirt, and other airborne solid matter.
- D. Wet Work: Concrete, plaster, coatings, and other products that emit water vapor or volatile organic compounds during installation, drying, or curing.

#### **1.07 SUBMITTALS**

- A. Indoor Air Quality Management Plan: A sample template is attached to these specifications. Such plan shall address the methods and procedures to be used during design and construction to obtain compliance with the following (also refer to SMACNA IAQ Guidelines for Occupied Buildings Under Construction):
  - 1. Submit not less than 60 days before enclosure of building.
  - 2. Identify potential sources of odor and dust.
  - 3. Identify construction activities likely to produce odor or dust.
  - 4. Identify areas of project potentially affected, especially occupied areas.
  - 5. Evaluate potential problems by severity and describe methods of control.
  - 6. Describe construction ventilation to be provided, including type and duration of ventilation, use of permanent HVAC systems, types of filters and schedule for replacement of filters.
  - 7. Describe cleaning and dust control procedures.
  - 8. Describe coordination with commissioning procedures.
- B. Interior Finishes Installation Schedule: Identify each interior finish that either generates odors, moisture, or vapors or is susceptible to adsorption of odors and vapors, and indicate air handling zone, sequence of application, and curing times.
- C. Duct and Terminal Unit Inspection Report.
- D. Indoor Air Quality Testing Plan: Identify:
  - 1. Testing agency qualifications.
  - 2. Locations and scheduling of air sampling.
  - 3. Test procedures, in detail.
  - 4. Test instruments and apparatus.
  - 5. Sampling methods.
- E. Indoor Air Quality Testing Reports: Show:
  - 1. Location where each sample was taken, and time.
  - 2. Test values for each air sample.
  - 3. HVAC operating conditions.
  - 4. Certification of test equipment calibration.
  - 5. Other conditions or discrepancies that might have influenced results.
  - 6. Interpretation of test results.
  - 7. Recommendations for improvement of indoor air quality or retesting.

#### **1.08 QUALITY ASSURANCE**

- A. Firm Qualifications: The indoor air quality testing firm must have a minimum of five years experience specifically in the indoor environmental quality field and must have indoor environmental testing and consulting capabilities. Firm should be a licensed mold assessment

company (ACO) through the Texas Department of State Health Services, and should have a minimum of three mold assessment consultants (MACs) on staff. Additionally, the firm's consultants should maintain current certification in indoor environmental consulting (i.e. Certified Indoor Environmental Consultant (CIEC) through the American Council for Accredited Certification (ACAC) or other certifying association. The firm should employ a LEED-Accredited Professional, certified by the United States Green Building Council (USGBC).

- B. Laboratory Qualifications: The microbiology testing laboratory utilized by the consulting firm should have a minimum of five years experience, be a licensed mold analysis laboratory through the Texas Department of State Health Services, and should employ a degreed mycologist. The industrial hygiene laboratory utilized by the consulting firm should have a minimum of five years experience, and be accredited by the American Industrial Hygiene Association (AIHA).

## **PART 2 - PRODUCTS**

### **2.01 LOW-EMITTING MATERIALS**

- A. General: Provide low-emitting materials that comply with this article, and with requirements indicated in other specification Sections, whichever requirement is more stringent.
- B. For field applications that are inside the weatherproofing system, use adhesives and sealants that comply with the following limits for VOC content when calculated according to either U.S. EPA Method 24 or SCAQMD Method 304, 316A, or 316B:
1. Wood Glues: 30 g/L.
  2. Metal to Metal Adhesives: 30 g/L.
  3. Adhesives for Porous Materials (Except Wood): 50 g/L.
  4. Subfloor Adhesives: 50 g/L.
  5. Plastic Foam Adhesives: 50 g/L.
  6. Carpet Adhesives: 50 g/L.
  7. Carpet Pad Adhesives: 50 g/L.
  8. VCT and Asphalt Tile Adhesives: 50 g/L.
  9. Cove Base Adhesives: 50 g/L.
  10. Gypsum Board and Panel Adhesives: 50 g/L.
  11. Rubber Floor Adhesives: 60 g/L.
  12. Ceramic Tile Adhesives: 65 g/L.
  13. Multipurpose Construction Adhesives: 70 g/L.
  14. Fiberglass Adhesives: 80 g/L.
  15. Contact Adhesive: 80 g/L.
  16. Structural Glazing Adhesives: 100 g/L.
  17. Wood Flooring Adhesive: 100 g/L.
  18. Structural Wood Member Adhesive: 140 g/L.
  19. Special Purpose Contact Adhesive (contact adhesive that is used to bond melamine covered board, metal, unsupported vinyl, Teflon, ultra-high molecular weight polyethylene, rubber or wood veneer 1/16 inch or less in thickness to any surface): 250 g/L.
  20. Top and Trim Adhesive: 250 g/L.
  21. Plastic Cement Welding Compounds: 350 g/L.
  22. ABS Welding Compounds: 400 g/L.
  23. CPVC Welding Compounds: 490 g/L.
  24. PVC Welding Compounds: 510 g/L.
  25. Adhesive Primer for Plastic: 650 g/L.
  26. Sheet Applied Rubber Lining Adhesive: 850 g/L.

27. Aerosol Adhesive, General Purpose Mist Spray: 65 percent by weight.
  28. Aerosol Adhesive, General Purpose Web Spray: 55 percent by weight.
  29. Special Purpose Aerosol Adhesive (All Types): 70 percent by weight.
  30. Other Adhesives: 250 g/L.
  31. Architectural Sealants: 250 g/L.
  32. Nonmembrane Roof Sealants: 300 g/L.
  33. Single-Ply Roof Membrane Sealants: 450 g/L.
  34. Other Sealants: 420 g/L.
  35. Sealant Primers for Nonporous Substrates: 250 g/L.
  36. Sealant Primers for Porous Substrates: 775 g/L.
  37. Modified Bituminous Sealant Primers: 500 g/L.
  38. Other Sealant Primers: 750 g/L.
- C. For field applications that are inside the weatherproofing system, use paints and coatings that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24) and the following chemical restrictions:
1. Flat Paints, Coatings, and Primers: VOC not more than 50 g/L.
  2. Nonflat Paints, Coatings, and Primers: VOC not more than 50 g/L.
  3. Anticorrosive and Antirust Paints Applied to Ferrous Metals: VOC not more than 100 g/L.
  4. Clear Wood Finishes, Varnishes: VOC not more than 275 g/L.
  5. Clear Wood Finishes, Lacquers: VOC not more than 275 g/L.
  6. Floor Coatings: VOC not more than 50 g/L.
  7. Shellacs, Clear: VOC not more than 730 g/L.
  8. Shellacs, Pigmented: VOC not more than 550 g/L.
  9. Stains: VOC not more than 250 g/L.
  10. Flat Interior Topcoat Paints: VOC not more than 50 g/L.
  11. Nonflat Interior Topcoat Paints: VOC not more than 50 g/L.
  12. Primers, Sealers, and Undercoaters: VOC not more than 100 g/L.
  13. Dry-Fog Coatings: VOC not more than 150 g/L.
  14. Zinc-Rich Industrial Maintenance Primers: VOC not more than 100 g/L.
  15. Pretreatment Wash Primers: VOC not more than 420 g/L.
  16. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
  17. Restricted Components: Paints and coatings shall not contain any of the following:
    - a. Acrolein.
    - b. Acrylonitrile.
    - c. Antimony.
    - d. Benzene.
    - e. Butyl benzyl phthalate.
    - f. Cadmium.
    - g. Di (2-ethylhexyl) phthalate.
    - h. Di-n-butyl phthalate.
    - i. Di-n-octyl phthalate.
    - j. 1,2-dichlorobenzene.
    - k. Diethyl phthalate.
    - l. Dimethyl phthalate.
    - m. Ethylbenzene.
    - n. Formaldehyde.
    - o. Hexavalent chromium.
    - p. Isophorone.
    - q. Lead.

- r. Mercury.
  - s. Methyl ethyl ketone.
  - t. Methyl isobutyl ketone.
  - u. Methylene chloride.
  - v. Naphthalene.
  - w. Toluene (methylbenzene).
  - x. 1,1,1-trichloroethane.
  - y. Vinyl chloride.
- D. Do not use composite wood or agrifiber products or adhesives that contain any urea-formaldehyde resin.

## **2.02 AUXILLARY AIR FILTERS**

- A. MERV of 8, minimum, when tested in accordance with ASHRAE Standard 52.2.

## **PART 3 - EXECUTION**

### **3.01 CONSTRUCTION PROCEDURES**

- A. Prevent the absorption of moisture and humidity by adsorptive materials by:
1. Sequencing the delivery of such materials so that they are not present in the building until wet work is completed and dry.
  2. Delivery and storage of such materials in fully sealed moisture-impermeable packaging.
  3. Provide sufficient ventilation for drying within reasonable time frame.
- B. Begin construction ventilation when building is substantially enclosed.
- C. If extremely dusty or dirty work must be conducted inside the building, shut down HVAC systems for the duration; remove dust and dirt completely before restarting systems.
- D. When working in a portion of an occupied building, prevent movement of air from construction areas to occupied area. Provide pre-construction air filters to all return air registers in adjacent occupied areas.
- E. HVAC equipment and ductwork may NOT be used for ventilation during construction:
1. Provide temporary ventilation equivalent to 1.5 air changes per hour, minimum.
  2. Exhaust directly to outside.
  3. Seal HVAC air inlets and outlets immediately after duct installation.
- F. Do not store construction materials or waste in mechanical or electrical rooms.
- G. Prior to use of return air ductwork without intake filters clean up and remove dust and debris generated by construction activities.
1. Inspect duct intakes, return air grilles, and terminal units for dust.
  2. Clean plenum spaces, including top sides of lay-in ceilings, outsides of ducts, tops of pipes and conduit.
  3. Clean tops of doors and frames.
  4. Clean mechanical and electrical rooms, including tops of pipes, ducts, and conduit, equipment, and supports.
  5. Clean return plenums of air handling units.
  6. Remove intake filters last, after cleaning is complete.
- H. Do not perform dusty or dirty work after starting use of return air ducts without intake filters.
- I. Use other relevant recommendations of SMACNA (OCC) for avoiding unnecessary contamination due to construction procedures.

### **3.02 NONSMOKING BUILDING**

- A. Smoking is strictly prohibited within the building, and anywhere on Arlington Independent School District property including during construction and post-occupancy.
- B. Prohibit smoking of tobacco or other controlled substances, and of water vapor smoking ("electronic" cigarettes or similar), throughout construction on the entire project site.

### **3.03 INDOOR AIR QUALITY TESTING (IAQ)**

- A. On-site Observations
  - 1. A minimum of three visits and up to six site visits will be made to the site to conduct on-site observations during the construction phase relative to water intrusion issues or other building conditions that might cause future degradation to indoor air quality. These observations may include but are not limited to landscape grade and drainage, foundation height, exterior wall sealing, roof and wall enclosure penetrations, water or moisture intrusion, plumbing, storage and condition of absorbent building materials, sealing and hygiene of HVAC systems, control of particulates, etc.
  - 2. This phase may also include a review of specifications for building products such as paint, adhesives, carpet, and cabinetry for products that might degrade future indoor air quality when installed.
  - 3. A written report will be submitted to the Architect or Owner's representative after each on-site observation. The report will include project conditions on the day of inspection along with cited potential problems areas and photo-documentation as needed.
    - a. Critical Condition Report: If a condition is cited that may cause potential microbial contamination in area that is ready to be sealed or covered, a verbal report will be communicated to the Architect or Owner's representative within twenty-four (24) hours so the Contractor can have the condition corrected before work is continued.
    - b. Standard Report: A written report will be submitted to the Architect or Owner's representative within ten (10) working days of the site visit.
- B. Pre-Construction Inspection and Sampling: Perform indoor air quality testing before starting construction, as base line for evaluation of post-construction testing.
  - 1. If the construction project is an addition to an existing facility, pre-construction inspection and sampling will be conducted to determine baseline conditions within the existing facility.
  - 2. The testing conducted in item C-2 of the pre-occupancy testing below will be conducted in areas of the existing facility that will be adjoining the new construction.
  - 3. During construction activities on-site observations will include any impact to the indoor air quality of the existing facility.
- C. Pre-Occupancy Inspection and Sampling: Perform indoor air quality testing before occupancy.
  - 1. After substantial completion of the facility and before non-fixed furnishings are delivered, the firm will conduct an IAQ inspection and perform representative sampling for indoor air quality parameters. These measurements will establish background pre-occupancy conditions, and will be evaluated for acceptable levels. All samples collected will be area screening to determine the presence of the parameters of interest. If the screening results indicate significant positive results, additional investigation may be required.
  - 2. The air quality sampling includes the collection of samples for the determination of populations and concentrations of total fungal bioaerosols in the ambient air. The sampling also includes the collection of chemical samples for fixed gas analysis for total volatile organic compounds (TVOCs), methane, carbon dioxide, and carbon monoxide. Additional real-time monitoring will be conducted for the following parameters: temperature, relative humidity, carbon dioxide, carbon monoxide, radon, ozone, and large (>10 microns) and small particulates (2.5 to 10 microns).

3. Testing in a school facility will include the collection of samples in representative areas of the classroom wings (to include a minimum of 20% of the classrooms), and if part of the new construction, in the cafeteria, library, administration offices, gymnasium, and locker rooms. Additionally, two outdoor samples will be collected on each day of testing for comparison purposes.
  4. If significant areas of rubber-backed carpeting and/or composite fixed furnishings are present in the facility, testing will also be conducted in representative areas for 4-phenylcyclohexene and formaldehyde in the ambient air. This testing will not be conducted if carpeting and fixed furnishings have been installed which are certified to be free of these chemicals.
  5. If foundation treatment for termite control has been applied, testing of the ambient air for the applied pesticide will be conducted in a minimum of three representative first floor locations of the facility.
  6. Testing for lead-based paint and asbestos-containing materials will not be conducted unless there is an indication that lead-based paint and/or asbestos-containing materials may be present in the existing structure, and that it may be impacted by the new construction activities.
  7. A report of findings and any recommendations will be provided within fifteen (15) working days of the sampling event.
- D. Do not start pre-occupancy indoor air quality testing until:
1. All construction is complete, including interior finishes.
  2. HVAC systems have been tested, adjusted, and balanced for proper operation.
  3. Cleaning of inside of HVAC ductwork, if specified elsewhere, has been completed.
  4. New HVAC filtration media have been installed.
- E. Post-Occupancy Inspection and Sampling:
1. At five (5) months and eleven (11) months following substantial completion, but prior to the one (1) year project inspection, the testing conducted in item C-2 of the pre-occupancy testing above will be repeated.
  2. A report of findings and any recommendations will be provided within fifteen (15) working days of the sampling event.
- F. Indoor Air Quality Acceptance Criteria
1. Upon completion of the project, the indoor air quality testing firm will provide a report of findings to the Architect or Owner's representative indicating any IAQ parameters that do not meet the acceptance criteria.
  2. The following criteria will be used to determine acceptance:
    - a. Fungal Bioaerosols – measure in relation to outdoor air, generally not higher than outdoor air, and containing indoor populations and concentrations of fungi that are considered normal and typical. Use professional judgment of testing firm.
    - b. Carbon Monoxide – measure in ppm, in relation to outdoor air. Not more than 2 ppm over outdoor air levels, and less than 9 ppm.
    - c. Carbon Dioxide – measure in ppm, in relation to outdoor air. Not more than 700 ppm higher than outdoor air.
    - d. Methane – measure in ppm. Not more than 5 ppm.
    - e. Total Volatile Organic Compounds (TVOCs) – measure in ppm as methane, or milligrams per cubic meter (mg/m<sup>3</sup>) – not more than outdoor air, and less than 5 ppm (calculated as methane) or 3 mg/m<sup>3</sup>.
    - f. Total Particulates – measure in total particle counts – total particle counts generally less than one-half (1/2) of outdoor air. Particle counts broken down to small (2.5 to 10 microns) and large (>10 microns).
    - g. Radon – less than 2 picoCuries per liter (pCi/L).
    - h. Ozone – no more than outdoor air, and less than 0.1 ppm.

- i. Formaldehyde – measure in parts per billion (ppb) – less than 50 ppb.
  - j. 4-Phenylcyclohexene – measure in micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ) – not more than 3  $\mu\text{g}/\text{m}^3$ .
  - k. Pesticides – note presence and level of specific pesticide applied.
  - l. Lead – have paint supplier or contractor provide documentation of lead-free paint.
- G. If air samples show concentrations higher than those specified, ventilate with 100 percent outside air and retest at no cost to Owner.

END OF SECTION 01 81 13



## **SECTION 01 81 13A - SAMPLE IAQ MANAGEMENT PLAN TEMPLATE**

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### **1.01 SUMMARY**

- A. Intent of IAQ Management Plan:
- B. Personnel and Responsibilities:
  - 1. Contractor:
  - 2. IAQ Representative:
  - 3. Subcontractors:
- C. Plan Documentation:
  - 1. Where file maintained:
  - 2. Documentation Provided to Owner at Closeout:
    - a. Meeting minutes
    - b. Schedule of temporary use of building mechanical equipment
    - c. Schedule of filter change outs by location and filter type
    - d. Supporting data including photographs
    - e. Cut sheets for filtration media used
    - f. Test reports
    - g. Cleaning reports
- D. Referenced Standards:
  - 1. SMACNE IAQ Guidelines for Occupied Buildings Under Construction

### **1.02 HVAC EQUIPMENT AND DUCTWORK**

- A. Sealing Ductwork and Air Handling Equipment
- B. Use of Mechanical Systems During Construction
- C. Filter Replacement and Tracking
- D. Duct Cleaning

### **1.03 SOURCE CONTROL**

- A. Use of Low Emission Interior Products
- B. Equipment Operation
- C. Work Practices
- D. Local Temporary Exhaust
- E. Covering or Sealing of Pollutant Sources
- F. Pathway Interruptions
  - 1. Controlling pollution at entrances
  - 2. Protection of stored materials
  - 3. Protection of materials during and after installation
  - 4. Preventing contamination of completed areas from work under construction
- G. Housekeeping measures during construction

**1.04 SEQUENCING FINISH APPLICATIONS**

A. Finish Applications

B. Procedures

**1.05 AIR QUALITY TESTING**

A. Air Quality Testing

END OF SECTION 01 81 13A

**SECTION 01 81 13B - SAMPLE IAQ CHECKLIST**

**IAQ CONSTRUCTION MANAGEMENT CHECKLIST TEMPLATE**

Project Name \_\_\_\_\_ Date \_\_\_\_\_

Address \_\_\_\_\_

Completed by \_\_\_\_\_

ITEM	DATE BEGUN OR COMPLETED	RESPONSIBLE PARTY	LOCATION	COMMENTS
<b>HVAC PROTECTION DURING CONSTRUCTION</b>				
Merv filter for air Supply intake when in use				
Merv filter at return air opening system when in use				
Filters replaced when loaded during construction				
Filters replaced prior to occupancy				
Supply diffusers sealed off during dust producing work				
Supply diffusers and return air system opening sealed off when HVAC system is not in use to prevent accumulation of dust and debris				
Mechanical room not used for storage of construction or waste materials				
Periodic dust inspection conducted during construction activities				
Ducts professionally cleaned				
<b>SOURCE CONTROL</b>				
Low VOC products used in accordance with specifications				
No idling of motor vehicles where emissions may be drawn into building				
Equipment cycled off when not in use				
Pollutant sources exhaust to outside of building and prevented from recirculating back into building				
Containers containing wet products are kept covered to the extent practical				

Containers of waste material that release dust or odors are kept covered				
On site stored materials protected from elements to prevent absorption of moisture				
<b>PATHWAY INTERRUPTION</b>				
Dust curtains or temporary enclosures provided to prevent dust from migrating to other areas				
Pollutant sources located as far as possible from occupied areas where feasible				
Work areas isolated to prevent contamination of clean or occupied areas				
Outside air used to exhaust contaminated air directly to outside during installation of VOC emitting materials				
<b>CONSTRUCTION HOUSEKEEPING</b>				
HVAC equipment cleaned regularly to remove contaminants prior to occupancy				
Coils, filters, fans, ductwork kept clean during installation; cleaned prior to occupancy				
Dust suppressed and minimized; effective dust collection methods used				
Water not allowed to accumulate; porous materials protected				
Interior surfaces thoroughly cleaned prior to replacing HVAC filters and balancing and testing HVAC system				
<b>SCHEDULING</b>				
High pollutant activities scheduled prior to installation of absorbent materials				

END OF SECTION 01 81 13B