

SECTION 01 57 20

CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Administrative and procedural requirements for the indoor air quality management and moisture control during construction operations.
 - 1. Control of emissions during construction.
 - 2. Moisture control during construction and protection of moisture sensitive materials.
 - 3. Procedures for testing baseline IAQ. Baseline IAQ requirements specify maximum indoor pollutant concentrations for acceptance of the facility.

1.2 DEFINITIONS

- A. Sustainable Definitions: ASTM E2114 Standard Terminology for Sustainability Relative to the Performance of Buildings.
- B. Adequate Ventilation: Ventilation, including air circulation and air changes, required for curing materials, dissipate humidity, control moisture to guard against damage to moisture sensitive materials and prevent accumulation of dust fumes, vapors, or gases.
- C. Chemicals of Concern: Chemicals listed as carcinogens, reproductive toxicants, and chemicals with established Chronic Reference Exposure Levels (REL):
 - 1. Carcinogens: Chemicals listed as probable or known human carcinogens in listed in:
 - a. California Environmental Protection Agency, Air Resources Board (ARB), list of Toxic Air Contaminants (California Air Toxics).
 - b. California Environmental Protection Agency, Office of Environmental Health Hazard Assessment (OEHHA), Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65).
 - 2. Reproductive Toxicants: Chemicals known to cause reproductive toxicity including birth defects or other reproductive harm:
 - a. California Environmental Protection Agency, Office of Environmental Health Hazard Assessment (OEHHA), Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65).
 - b. Assessment (OEHHA), Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65).
 - 3. Chemicals with Established Chronic Reference Exposure Levels (REL):
 - a. Chronic RELs have been developed for hazardous airborne substances. A chronic REL is an airborne concentration level that would pose no significant health risk to individuals indefinitely exposed to that level. RELs are based solely on health considerations and are developed from the best available data in the scientific literature.

- b. Table 1 under Indoor Air Emissions Tests, Special Requirements for Adhesives.
- D. Formaldehyde: Naturally occurring VOC, found in small amounts in animals and plants; carcinogenic and irritant to humans when present in high concentrations. (Levels above 0.1ppm).
 - 1. Urea Formaldehyde: Combination of urea and formaldehyde, used in glue, and readily decomposes at room temperature.
 - 2. Phenolformaldehyde: Type of formaldehyde that off gasses only at high temperature; used for exterior products and suitable for interior applications.
- E. Hazardous Materials: Material regulated as hazardous material in accordance with 49 CFR 173, requiring Material Safety Data Sheet (MSDS) in accordance with 29 CFR 1910.1200, or which during end use, treatment, handling, storage, transportation, or disposal meets or has components which meet or have the potential to meet the definition of a Hazardous Waste in accordance with 40 CFR 261. Hazardous material includes hazardous chemicals.
 - 1. Hazardous materials include but are not limited to pesticides, biocides, and carcinogens listed by the Environmental Protection Agency (EPA) and International Agency for Research on Cancer (IARC) and recognized authorities.
- F. Indoor Air Quality (IAQ): Composition and characteristics of air in an enclosed space affecting occupants of space and Project materials. The indoor air quality refers to relative quality of air in a building with respect to contaminants and hazards and is determined by levels of indoor air pollution and characteristics of air, including those that impact thermal comfort such as air temperature, relative humidity, and air speed.
- G. Interior Final Finishes: Materials and products exposed at interior, occupied spaces including flooring, wallcovering, finish carpentry, and ceilings.
- H. MERV: Minimum Efficiency Reporting Value: Arrestance rating of filter at three MERV Rating Explanation particle sizes of 0.3 microns to 10 microns at a determined face velocity.
- I. Packaged Dry Products: Materials and products installed in dry form and delivered in manufacturer's packaging; including carpets, resilient flooring, ceiling tiles, and insulation.
- J. Wet Products: Materials and products installed in wet form, including paints, sealants, adhesives, and special coatings.

1.3 ACTION SUBMITTALS

- A. IAQ (IAQ) Management Plan: Minimum 10 days prior to the commencement of the work, prepare and submit an IAQ Management Plan indicating method for complying with construction indoor air quality management during construction and prior to occupancy:
 - 1. Procedures for control of emissions during construction.
 - 2. Procedures for moisture control and establishing a level of relative humidity in interior spaces prior to the installation of moisture sensitive materials.

3. Identify schedule for application of interior finishes.
 4. Procedures for moisture control during construction.
 5. Identify porous materials and absorptive materials.
 6. Identify schedule for inspection of stored and installed absorptive materials.
 7. Revise and resubmit Plan as required by Owner. Approval of Contractor's Plan will not relieve the Contractor of responsibility for compliance with applicable environmental regulations.
- B. Product Data: Submit technical product data for filtration media used during construction and during operation. Include Minimum Efficiency Reporting Value (MERV).
1. Submit air pressure difference maps for each mode of operation of HVAC.
 2. Submit Material Safety Data Sheets (MSDS) for the following:
 - a. Adhesives, including but not limited to those used for wood products, resilient flooring, carpeting, wallcovering, construction glues, other.
 - b. Floor and wall patching/leveling materials.
 - c. Sealants.
 - d. Insulating materials.
 - e. Firestopping materials and sealants.
 - f. Carpet.
 - g. Field paints and coatings.
 - h. Clear finish for wood surfaces.
 - i. Fabric wallcoverings.
 - j. Lubricants.
 - k. Cleaning products.
 - l. Materials or products specified in individual specification sections.
- C. Inspection and Test Reports: Submit the following:
1. Moisture control inspections.
 2. Relative humidity testing prior to the installation of moisture sensitive materials.
 3. Moisture content testing.
 4. Moisture penetration testing.
 5. Microbial Growth testing.
 6. Baseline Indoor Air Quality test report.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements:
1. Environmental Protection Agency: Environmental Specification Section 01445 Testing for Indoor Air Quality, Baseline IAQ, and Materials.
 2. American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE): Comply with requirements applicable to air quality control.
 - a. ASHRAE 52.2 Method of Testing General Ventilation Air Cleaning Devices for Removal Efficiency by Particle Size.
 - b. ASHRAE 55 Thermal Environmental Conditions for Human Occupancy.

- c. ASHRAE 62.1 Ventilation for Acceptable Indoor Air Quality.
 - d. ASHRAE 129 Measuring Air Change Effectiveness.
 - e. ASHRAE/IESNA 90.1: Energy Standard for Buildings Except Low Rise Residential.
3. SMACNA IAQ Guidelines for Occupied Buildings under Construction.
 4. Carpet and Rug Institute's Green Label Plus.
- B. Testing Agency Qualifications: Minimum of 5 years documented experience in performing indoor air quality testing.
- C. Preconstruction Conference: Conduct conference to review methods and procedures related to environmental quality procedures and responsibilities. Review Construction Environmental Program with staff and subcontractors.

1.5 COORDINATION

- A. On-Site Application: Where VOC emitting products are applied onsite, apply prior to installation of porous and fibrous materials. When not practical, protect porous materials with polyethylene vapor barriers.

1.6 FIELD CONDITIONS

- A. Temporary Construction Ventilation: Maintain sufficient temporary ventilation in areas where materials emitting high VOCs are used. Continuously ventilate area during installation until emissions have dissipated after installation.
1. Allow odors and elevated concentrations of VOCs to dissipate. Where no specific period is stated, ventilate a minimum of 72 hours after installation.
 2. Ventilate areas directly to outside; ventilation to other enclosed areas is not permitted.
 3. During dust producing activities (e.g. drywall installation and finishing), turn off ventilation system and protect openings from dust infiltration in the supply and return HVAC.
 4. Preconditioning: Allow products which have odors or significant VOC emissions to off gas in a dry, well ventilated space until VOC emissions have dissipated and no odor remains.
 - a. Condition products and materials without containers and packaging off site to maximize off gassing.
 5. Confirm odors are mitigated prior to installation of porous materials that may absorb odors, such as drywall, ceiling and other finishes.
- B. Moisture Control and Protection: Coordinate and comply with Section 01 50 00 for moisture control and protection, Moisture Control and Protection Plan and maximum relative humidity prior to, during and after the installation of moisture sensitive materials.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Develop and utilize an indoor air quality (IAQ) management plan to limit indoor contamination during construction activities until Date of Substantial Completion. Coordinate with environmental quality management plan.
1. Identify potential construction related outdoor and indoor contaminants.
 2. Identify possible means of contaminant spread.
 3. Identify reasonable control options for containing contaminants.
- B. Environmental Procedures: Minimize environmental impacts of construction activities and operations. Manage environmental quality through use of recycled materials, energy efficient equipment and fixtures, waste handling procedures, and limiting contaminants and emitted irritants. Refer to individual technical specifications sections for specific materials and products.
- C. Indoor Environmental Quality: Comply with ASHRAE 62.1 to reduce indoor environmental quality issues resulting from contaminants during and after construction until Date of Substantial Completion.
1. Identify methods for controlling air contaminants, such as odors and irritants generated during the work based on SMACNA IAQ Guidelines for Occupied Buildings under Construction.
 2. Avoid use of materials high in pollutants, such as volatile organic compounds (VOCs) or toxins. In addition to VOC limitations for low emitting materials adhesive, sealants, and paint products, utilize materials and products complying with the following VOC content limitations:
 - a. Field Paint and Coatings, including but not limited to:
 - 1) Aromatic Compounds: Maximum 1.0 percent by weight total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
 - 2) Dry Fog Coatings: 400 grams/liter.
 - 3) Floor Coating: 50 grams/liter.
 - 4) Industrial Maintenance Coatings: 100 grams/liter.
 - 5) Traffic Coating: 150 grams/liter.
 - 6) Waterproofing Concrete and Masonry Sealer: 100 grams/liter.
 - b. Wood Preservative: 350 grams/liter (below or above ground).
 - c. Carpet and Rug Institute's Green Label Plus: 50 grams/liter.
 3. Avoid entrainment of pollutants into ventilation air path.
 4. Sufficiently ventilate enclosed areas.
 5. Protect organic matter and materials against mold, insect infestation, or absorption of odors.
 6. Sequence construction activities to prevent absorption of contaminants by building materials.

7. Limit use of building ventilation system during construction activities. Utilize filtration media with a Minimum Efficiency Reporting Value (MERV) of 8 at each return air grille complying with ASHRAE 52.2.
 - a. Cover diffusers, registers, grilles, and open ducts during construction to prevent dust and odors from entering ventilation system.
 - b. Replace filtration media prior to Date of Substantial Completion with media having minimum MERV 13 in accordance with ASHRAE 52.2.

- D. VOC Content Limitations Requirements: Utilize materials and products complying with VOC content and emissions limitations for low emitting materials. Refer to the Contract Documents as a whole and the individual specification sections governing these requirements. Nothing in this Section shall remove the responsibility from the Contractor to Coordinate all Work and comply with the Contract Documents.
 1. Adhesives and Sealants: Product Data for adhesives and sealants used on the interior of the building indicating VOC content of each product used. Utilize sealants complying with specified VOC limits.
 - a. For field applications inside the weatherproofing system, 90 percent of adhesives and sealants shall comply with the requirements of the California Department of Public Health's Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers.
 2. Field Paints and Coatings: For paints and coatings used on the exterior and interior of the building indicating chemical composition and VOC content of each product used. Indicate VOC content in g/L. Utilize architectural interior paints and coatings that do not exceed the VOC content and emissions limits.
 - a. For field applications that are inside the weatherproofing system, 90 percent of paints and coatings shall comply with the requirements of the California Department of Public Health Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers.
 3. Carpet:
 - a. Carpet Systems: Technical product data for interior carpet systems complying with testing and product requirements of the Carpet and Rug Institute's Green Label Plus Program.
 - b. Carpet Adhesive: VOC limit of 50 g/L.
 4. Composite Wood and Agrifiber Products:
 - a. Composite wood, agrifiber products, and adhesives shall be made using ultralow emitting formaldehyde resins as defined in the California Air Resources Board Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products or made with no added formaldehyde.
 - b. Laminating adhesives used to fabricate on site and shop applied composite wood and agrifiber assemblies containing no added urea formaldehyde resins.
 - c. Composite wood and agrifiber products are defined as: particleboard, medium density fiberboard (MDF), plywood, wheatboard, strawboard, panel substrates, and door cores.

- E. Restricted Components for Paint and Coatings: EPA prohibited components in the formulation of paints and coatings.
- F. Relative Humidity and Moisture Control: Comply with the requirements of Section 01 50 00 and the following:
 - 1. Provide Adequate Ventilation: Provide ventilation during construction, including air circulation and air changes, sufficient to cure materials, dissipate humidity, and prevent accumulation of fumes, vapors, or gases that are detrimental to materials or result in odors being absorbed by Project materials.
 - 2. Indoor Air Quality (IAQ): Maintain the composition and characteristics of air in enclosed spaces affecting Project materials including but not limited to finish materials and products exposed at interior enclosed spaces.
 - 3. Establish and maintain a maximum relative humidity at the building interior of 60 percent.

2.2 MATERIALS

- A. Select materials that generate least amount of pollution during mining, manufacturing, transport, installation, use, and disposal.
 - 1. Avoid materials that emit greenhouse gases.
 - 2. Avoid materials that require energy intensive extraction, manufacturing, processing, transport, installation, maintenance, or removal.
 - 3. Avoid materials that contain ozone depleting chemicals (e.g. CFCs or HCFCs) and that emit potentially harmful volatile organic compounds (VOCs).
 - 4. Employ construction practices that minimize dust production and combustion byproducts.
 - 5. Avoid materials that leach harmful chemicals into ground water; do not allow potentially harmful chemicals to enter sewers or storm drains.
 - 6. Minimize noise generation during construction; screen mechanical equipment to block noise.
 - 7. Select materials that can be reused or recycled and materials with significant percentage of recycled content; conform with or exceed specific project recycled content percentages for individual materials; avoid materials difficult to recycle.
- B. Mold and Mildew: Materials that have evidence of growth of molds or of mildew are not acceptable, including both stored and installed materials. Immediately remove from site and dispose of properly.
- C. Moisture Stains: Materials that have evidence of moisture damage, including stains, are not acceptable, including both stored and installed materials. Immediately remove from site and dispose of properly.
- D. Ducts: Seal ducts during construction to prevent accumulation of construction dust and construction debris inside ducts.

- E. Volatile Organic Compounds (VOCs): Materials and chemical having VOC content and emissions including total VOCs (TVOC), specific individual VOCs, formaldehyde and other aldehydes for materials or chemical of concern.
- F. Air Infiltration Media: Minimum Efficiency Reporting Value (MERV) as determined by ASHRAE 52.2:
 - 1. MERV 8 for filtration media used at each return air grill, if used during construction.
 - 2. MERV 13 for filtration media installed at the end of construction and prior to occupancy.
- G. Cleaning Materials: Low toxic and low emitting spot removers and cleaning agents for surfaces, equipment, and workers' personal use. Use HEPA filter equipped vacuum cleaners for the final cleaning.

PART 3 - EXECUTION

3.1 IMPLEMENTATION

- A. Implement, monitor, and enforce IAQ Management Plan during construction activities until date of Final Completion.
 - 1. Control dust particles, aerosols, and gaseous byproducts from construction activities, processing, and preparation of materials.
 - 2. Perform particulate control as work proceeds and whenever particulate nuisance or hazard occurs
 - 3. Potential sources of emissions include the following:
 - a. Environmental Tobacco Smoke: Lighted cigarettes, cigars, pipes.
 - b. Combustion Contaminants: Furnaces, generators, gas or kerosene space heaters, tobacco products, outdoor air, vehicles.
 - c. Biological Contaminants: Wet or damp materials, cooling towers, humidifiers, cooling coils or drain pans, damp duct insulation or filters, condensation, reentrained sanitary exhausts, bird droppings, cockroaches or rodents, dust mites on upholstered furniture or carpeting, body odors.
 - d. Volatile Organic Compounds (VOC): Paints, stains, varnishes, solvents, pesticides, adhesives, wood preservatives, waxes, polishes, cleansers, lubricants, sealants, dyes, air fresheners, fuels, plastics, copy machines, printers, tobacco products, perfumes, dry cleaned clothing.
 - e. Formaldehyde: Particle board, plywood, cabinetry, insulation, furniture, fabrics.
 - f. Soil Gases (Radon, Sewer Gas, VOC, Methane): Soil and rock (radon), sewer drain leak, dry drain traps, leaking underground storage tanks, land fill
 - g. Pesticides: Termiticides, insecticides, rodenticides, fungicides, disinfectants, herbicides.
 - h. Particles and Fibers: Printing, paper handling, smoking and other combustion, outdoor sources, deterioration of materials, construction/renovation, vacuuming, insulation.

- B. Implement, monitor, and enforce the Moisture Control and Protection Plan required by Section 01 50 00 during construction activities until date of Final Completion.
 - 1. Provide temporary moisture control required to achieve and maintain maximum humidity levels as specified throughout construction and prior to the installation of moisture sensitive materials.
- C. Housekeeping and Pest Management Procedures: During construction, maintain project and building products and systems to prevent contamination of building spaces.
 - 1. Designate area for food storage and consumption. Food and drink is not permitted inside building footprint. Immediately dispose of food or food residues after meals or breaks.
 - 2. Upon enclosure of building and installation of finishes, minimize entry of dirt with walk off grilles or mats at entrances. Clean entry grilles or mats daily.
 - 3. Sweep using dust reducing wax based sweeping compounds.
 - 4. Keep materials clean and stored neatly on dunnage or pallets required by manufacturer.
 - 5. Inspect and clean coils, fans, and air handler chambers including return air chambers prior to start up, final testing, commissioning, and air testing.

3.2 IAQ MANAGEMENT - EMISSIONS CONTROL

- A. During construction operations, follow the recommendations in SMACNA IAQ Guidelines for Occupied Buildings under Construction.
- B. HVAC Protection:
 - 1. Seal return registers during construction operations.
 - 2. Provide temporary exhaust during construction operations
 - 3. To the greatest extent possible, isolate and/or shut down the return side of the HVAC system during construction. When ventilation system must be operational during construction activities, provide temporary filters.
- C. Source Control: Control odors for construction activities, processing, and preparation of materials, for potentially noxious materials, identified and employ control measures complying with SMACNA guidelines.
 - 1. Smoking or tobacco materials are not permitted in building.
 - 2. Use of gasoline or fuel fired equipment are not permitted inside enclosed building.
 - 3. Keep wet processes within enclosed building to minimum.
 - 4. Protect chase and wallboard materials from water. Remove and replace damaged materials.
 - 5. Use low emission materials and chemicals.
 - 6. Perform cleaning involving chemicals outside building to the extent possible.
 - 7. Unroll or uncrate carpet materials and air in well ventilated warehouse for a minimum of minimum 3 days prior to installation.
 - 8. Air modular furniture in well ventilated warehouse for minimum 7 days prior to entry into building.

9. Remove trash daily to the appropriate recycle container.
 10. Treat mold growth according to the procedures recommended by the EPA.
 11. Clean inside of walls at base track to remove excess materials and dirt with vacuum prior to enclosing wall.
 12. HEPA vacuum concrete floors before installation of floor covering materials.
 13. Do not enclose, hide, or paint over mold or chemical contamination.
- D. Temporary Ventilation: Provide an ACH (air changes per hour) of 1.5 or more and as follows:
1. Provide minimum 48 hours preventilation of packaged dry products prior to installation. Remove from packaging and ventilate in a secure, dry, well ventilated space free from strong contaminant sources and residues. Provide a temperature range of 60 degrees F minimum to 90 degrees F maximum continuously during the ventilation period. Do not ventilate within limits of Work unless otherwise approved by Architect.
 2. Provide adequate ventilation during and after installation of interior wet products and interior final finishes.
 3. Provide filtration media with Minimum Efficiency Reporting Value (MERV) of 8 as determined by ASHRAE 52.2 during construction. Coordinate with work of mechanical specifications.
 - a. Replace filters during construction as necessary to protect equipment and indoor air quality.
- E. Hydrocarbons and Carbon Monoxide Emissions from Equipment: Control emissions to comply with federal, state, and local allowable limits. For potentially noxious materials, identified and employ control measures complying with SMACNA guidelines.
- F. Monitoring Indoor Air Quality: Monitor air areas affected by construction activities.
- G. HVAC System: To extent possible, isolate or shut down return side of HVAC system during construction activities.
1. HVAC System Protection: When ventilation system is operational, provide temporary, replaceable filters and seal return air openings.
 - a. Comply with recommendations of SMACNA IAQ Guideline for Occupied Buildings under Construction.
 - b. Keep air handling equipment, ducts, and accessories clean during transportation, storage and assembly.
 - c. Wrap lined, spiraled, and assembled ducts and protect from dirt and water during transportation and storage.
 - d. Keep insulation and lined ducts dry. Remove and replace insulation that becomes wet.
 - e. Keep fiberglass duct board in air handlers and bases dry and clean. Coat exposed fiberglass subject to erosion with sealer to prevent entry of raw fiberglass into air stream.
 - f. Do not permit water to stand on mechanical equipment.
 - g. Cover and seal open ends of installed duct and equipment to prevent the entry of dirt.

- h. Wrap zone boxes and seal from dirt and water before installation. Seal openings in installed zone boxes until permanently connected to ductwork.
 - i. Cover dampers and attenuators into open chases and ducts to reduce dirt entry.
 - j. Do not start air handlers without MERV 8 filtration at each return grille. Upon system activation, install sheet media on return openings and filters in zone box plenum openings.
 - 1) Monitor and change media filters as necessary to prevent the entry of dirt into the system.
 - 2) Remove temporary media after building flush out and before occupancy.
 - k. Do not permit use of return air system during gypsum board installation, sanding, or painting operations.
 - l. Keep building under a positive pressure to the extent possible.
 - m. Keep chase dampers closed until the system is activated.
 - n. Complete the initial mechanical checklists at system startup.
 - o. Replace final filters with new MERV 13 filters before flush out or occupancy.
2. HVAC System Flush Out: Prior to Substantial Completion with interior finishes installed, perform building flush out by supplying total air volume of 14,000 cu.ft. (4 300 000 L) of outdoor air per sq.ft. of floor area while maintaining an internal temperature of at least 60 degrees F (16 degrees C.) and relative humidity no higher than 60 percent. After flush out, replace filtration media with new MERV 13 media, except for filters solely processing outside air.
- a. Flush out may not begin until the following are complete:
 - 1) All work including punchlist.
 - 2) Final cleaning.
 - 3) Final test and balance, and HVAC controls must be functioning.
 - 4) Commissioning may occur during flush out provided it does not introduce additional contaminants.
 - b. Return ventilation system to normal operation following flush out period to minimize energy consumption.
 - c. Install new filters following flush out period.
 - d. Bake out or super heating of spaces to accelerate the release of gaseous emissions is not permitted.
 - e. In lieu of flush out, Contractor may elect to conduct baseline indoor air quality testing after construction ends and prior to occupancy.
3. Inspect ductwork for refuse, contaminants, moisture, and foreign contamination prior to commissioning by Owner. Notify Owner of satisfactory inspection prior to beginning of commissioning.
4. HVAC System Cleaning: Clean coils, media filters, and fans before performing testing and balancing procedures and before conducting air quality tests or flush out.
- H. Pathway Interruption: Isolate areas of work necessary to prevent contamination of clean or occupied spaces. Provide pressure differentials or physical barriers to protect clean or occupied spaces.

1. Humidity Conditions: During rain or high humidity conditions, cool air supply from coils to 55 degrees F or stop air handler stopped to prevent moist air entry into building. Do not permit exhaust fans to draw moist air into building.
 2. Cover return air dampers and openings with filter media during construction operations.
- I. Scheduling: Schedule construction operations involving wet and odorous materials and products prior to packaged dry products or odor absorbent materials and products to reduce absorption of VOCs by porous materials.
1. To the extent possible, group contaminating operations.
 2. Replace materials and products directly exposed to moisture through precipitation, plumbing leaks, or condensation from the HVAC system that are susceptible to microbial contamination.

3.3 IAQ MANAGEMENT - MOISTURE CONTROL

- A. Housekeeping:
1. Keep materials dry. Protect stored on site and installed absorptive materials from moisture damage.
 2. Verify installed materials and products are dry prior to sealing and weatherproofing the building envelope.
 3. Install interior absorptive materials after building envelope is sealed and weatherproofed.
- B. Inspections: Document and report results of inspections; state regardless if inspections indicate satisfactory conditions.
1. Examine materials for dampness upon arrival. When acceptable to Architect and Owner, dry damp materials completely prior to installation; otherwise, reject materials that arrive damp.
 2. Examine materials for mold upon arrival; and reject materials contaminated with mold.
 3. Inspect stored and installed absorptive materials regularly for dampness and mold growth. Inspect periodically and after each rain event.
 - a. When stored on site or installed absorptive materials become wet, notify Architect and inspect for damage. If acceptable to Architect and Owner, dry completely prior to closing in assemblies; otherwise, remove and replace with new materials.
 4. Below Grade: Monitor basement and crawlspace humidity and dehumidify when relative humidity is greater than 85 percent for more than 2 weeks or at the first sign of mold growth.
 5. Site Drainage: Verify final grades of site work and landscaping drain surface water and ground water away from the building.
 6. Weatherproofing: Inspect moisture control materials during installation. Include the following:
 - a. Air Barrier: Verify air barrier is installed without punctures and/or other damage. Verify air barrier is completely sealed.

- b. Flashing: Verify correct shingling of the flashing for roof, walls, windows, doors, and other penetrations.
 - c. Insulation Layer: Verify insulation is installed without voids.
 - d. Roofing: Coordinate inspections with Section 07 54 00 Polyvinyl Chloride (PVC) Roofing and as otherwise required by the Contract Documents.
 7. Plumbing: Verify pressure test of pipes and drains is performed prior to closing in and insulating lines.
 8. HVAC: Inspect HVAC system in accordance with mechanical specifications to verify:
 - a. Condensate pans are sloped and plumbed correctly.
 - b. Access panels are installed to allow for inspection and cleaning of coils and ductwork downstream of coils.
 - c. Ductwork and return plenums are air sealed.
 - d. Duct insulation is installed and sealed.
 - e. Chilled water line and refrigerant line insulation are installed and sealed.
- C. Schedule:
 1. Schedule work to endure absorptive materials, including but not limited to porous insulations, paper faced gypsum board, ceiling tile, and finish flooring, are not installed until building is enclosed and materials can be protected from rain and construction related water.
 2. Schedule installation of moisture control materials, including but not limited to air barriers, flashing, exterior sealants and roofing, to reduce exposure of the elements.
- D. Testing for Moisture Content: Test moisture content of porous materials and absorptive materials to ensure materials are dry before sealing into an assembly. Document and report results of testing. Where tests are not satisfactory, dry materials and retest. If satisfactory results cannot be obtained with retest, remove and replace with new materials.
 1. Concrete: Moisture test prior to finish flooring application. Moisture test in accordance with one or more of the following; unless otherwise indicated, acceptable upper limits for concrete are less than 4 percent top inch; less than 85 percent headspace RH; less than 3 lbs/1000 sq. ft./day:
 - a. ASTM D4263 Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
 - b. ASTM F1869 Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
 - c. ASTM F2170 Test Method for Determining Relative Humidity in Concrete Floor Slabs Using In Situ Probes.
 2. Wood: Moisture test in accordance with ASTM D4444 Standard Test Methods for Use and Calibration of Hand Held Moisture Meters; unless otherwise indicated acceptable upper limits for wood products are less than 20 percent at center of piece and less than 15 percent at surface.
 3. Gypsum Board, Plaster, Insulation, and Absorptive materials: Moisture test with a Pinless Moisture Meter to assess patterns of moisture, if any.

- E. Testing for Moisture Penetration:
1. Windows: Test in accordance with ASTM E1105 Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform or Cyclic Static Air Pressure Difference; unless otherwise indicated, acceptable upper limits are no leakage for 15 minutes.
 2. Horizontal Waterproofing (other than roofing): Test in accordance with ASTM D5957 Standard Guide for Flood Testing Horizontal Waterproofing Installations; acceptable upper limits are no leakage for 15 minutes.
 3. Masonry: Test in accordance with ASTM C1601 Standard Test Method for Field Determination of Water Penetration of Masonry Wall Surfaces; acceptable upper limits are no leakage for 15 minutes.
 4. Exterior Walls:
 - a. Air Tightness of the Enclosure Test: ASTM E779 Standard Test Method for Determining Air Leakage Rate by Fan Pressurization or ASTM E1827 Standard Test Methods for Determining Air tightness of Buildings Using an Orifice Blower Door. Refer to cladding specification sections for acceptable upper limits of leakage.
 - b. Water Leakage: Review in accordance with ASTM E2128 Standard Guide for Evaluating Water Leakage of Building Walls.
- F. Testing for Support of Microbial Growth: Test and report in accordance with ASTM D6329 Standard Guide for Developing Methodology for Evaluating the Ability of Indoor Materials to Support Microbial Growth Using Static Environmental Chambers. Indicate susceptibility of product or material to colonization and amplification of microorganisms. Identify microorganisms and conditions of testing.
1. Normal Conditions: Perform testing at 35 degrees Centigrade and 50 percent relative humidity.
 2. Extreme Conditions: Perform worst case scenarios screening tests by providing an atmosphere where environmental conditions may be favorable for microbial growth.
 3. Perform testing for the following:
 - a. Fireproofing material on appropriate substrate.
 - b. Ceiling tile.
 - c. Wallcovering.

3.4 BASELINE INDOOR AIR QUALITY TESTING

- A. After construction ends and prior to occupancy, conduct a baseline indoor air quality testing procedure that randomly selects sampling points for every 25,000 sq. ft. (2323 sq. m), or for each contiguous floor area, whichever is larger, to measure the maximum concentration levels for the chemical contaminants below:
1. Carbon Dioxide (CO₂): Maximum concentration of 530 parts per million per ASHRAE 62.
 - a. This measurement is required if the building is regularly occupied during the testing. Measured differential between indoor and outdoor conditions is based on occupancy type as defined by ASHRAE 62. Maximum concentration differential in parts per million = 10,300/ventilation rate per

occupant, in cubic feet per minute, assuming an occupancy of 7 persons per 1000 sq. ft. of floor space.

2. Carbon Monoxide (CO): 9 parts per million not to exceed outdoor levels by 2 parts per million.
 3. Formaldehyde: 27 parts per billion per State of California IAQ Standard.
 4. Particulates (PM10): 50 micrograms per cubic meter.
 5. TVOC: 300 micrograms per cubic meter per State of California IAQ Standard.
 6. 4-Phenylcyclohexene (4-PCH): 6.5 micrograms per cubic meter per State of California IAQ Standard.
- B. Building Flush Out: Coordinate with Section 01 50 00 .For each building area where the maximum concentration limits are exceeded, conduct a partial building flush out, for a maximum of two weeks; retest the indoor air quality levels to indicate the requirements are achieved. Continue retesting until test demonstrate compliance.
1. Flush out building continuously (i.e., 24 hours per day, seven days a week) using 100 percent tempered outside air, or maximum amount of outside air while maintaining minimum 60 degrees F (15.6 degrees C), for at least 14 days. If interruptions of more than a few hours are required for testing and balancing purposes, extend flush out period accordingly.
 2. When required to perform touch up work, provide temporary construction ventilation during installation and extend building flush out by a minimum of four days after touch up installation with maximum tempered outside air for 24 hours per day.
 3. If construction schedule permits, extend flush out period beyond 14 days.
 4. Return ventilation system to normal operation following flush out period to minimize energy consumption.
 5. Install new filters following flush out period.
 6. "Bake-out" or "super-heating" of spaces to accelerate the release of gaseous emissions is not permitted.

3.5 SPECIFICATION REQUIREMENTS

- A. Refer to individual specification sections for details.
1. Division 5 Metals: Maximize use of recycled metals.
 2. Division 6 Wood, Plastics, and Composites:
 - a. Utilize fiberboard that is urea formaldehyde free and does not exceed ANSI A208.1 emission standard of 0.20 ppm of formaldehyde.
 - b. Structural Fiberboard (OSB, MDF, and Particleboard): Utilize structural fiberboard that maximizes postconsumer waste material.
 - c. Plastic Laminate: Install plastic laminate with water based, urea formaldehyde free, low VOC (volatile organic compound) adhesive.
 - d. Millwork and Casework Adhesives: Provide water based, urea formaldehyde free, low VOC adhesives.
 - e. Transparent Wood Finish Systems: Utilize waterborne acrylic sealers and finish coats.

- f. Chromated Copper Arsenate (CCA): Use of CCA as a wood treating material is not permitted; use of ammonium copper quat (ACQ) is acceptable.
 - g. Cast Resin (Solid Surface) Countertops: Provide water based, zero or low VOC silicone sealant.
3. Division 7 Thermal and Moisture Protection:
- a. Waterproof Sealer: Utilize low VOC silane sealer.
 - b. Building Insulation:
 - 1) Insulation materials with no added formaldehyde (NAUF).
 - 2) Insulation materials manufactured using chlorofluorocarbons (CFCs) are prohibited.
 - 3) Extruded Polystyrene Insulation (XPS) manufactured with chlorofluorocarbon (CFC) blowing agent is prohibited.
 - 4) Utilize XPS with recycled content and manufactured with EPA approved blowing agents.
 - 5) Fiberglass Batt Insulation, Fiberglass Board Insulation, and Mineral Wool Insulation: Utilize batt and board insulation with recycled material.
 - 6) Mineral Wool Fire Safing Insulation: Utilize fire safing insulation having recycled material.
 - c. Sealants:
 - 1) Sealants: Use of sealants containing mercury, butyl rubber, neoprene, SBR (styrene butadiene rubber), or nitrile is prohibited.
 - 2) Silicone Sealants: Use silicone sealants having zero or low VOC content.
 - 3) Polyurethane Sealants: Use of polyurethane sealants containing mercury are prohibited. Use polyurethane sealants having low VOC content.
 - 4) Compressible Foam Joint Filler: Use of polyester polyurethane foam impregnated with neoprene rubber or acrylic ester styrene copolymer manufactured with CFC blowing agents is prohibited.
 - 5) Sealants formulated with aromatic solvents (organic solvent with a benzene ring in its molecular structure), fibrous talc, or asbestos, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium, or associated components are prohibited.
4. Division 8 Openings:
- a. Glass and Glazing:
 - 1) Sealants and Glazing Compounds: Utilize low VOC content.
 - 2) Sealants and glazing compounds formulated with aromatic solvents (organic solvent with a benzene ring in its molecular structure), fibrous talc, or asbestos, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium, or their components are prohibited.
5. Division 9 Finishes:
- a. Gypsum Drywall:
 - 1) Joint Compound: Utilize dustless joint compound having low VOC content.

- 2) Multilayer Gypsum Board Applications: Screw attached gypsum board; laminated with adhesives is prohibited.
 - 3) Thoroughly clean and remove silica/gypsum dust upon completion of gypsum drywall installation, including, but not limited to, components in plenum spaces, including tops of pipes and sills, and insides and outsides of ducts.
 - 4) Joint Tape: Utilize paper joint tape; fiberglass tape is prohibited.
 - 5) Steel Studs, Runners, and Channels for Framing: Utilize components with recycled steel content.
- b. Acoustic Panel Ceilings:
- 1) Ceiling panels listed in the High Performance Products Database, compliance with CHPS criteria, or Greenguard Children and Schools.
 - 2) Utilize ceiling panels having recycled material and finished with water based low VOC paint.
- c. Resilient Flooring:
- 1) Resilient Floor Covering: One of the following:
 - a) Certified under Resilient Floor Covering Institute Floor Score Program.
 - b) CDPH for low VOC emissions limits and testing requirements.
 - c) Listed in the eCA-CHPS for high performance product database.
 - d) Certified under UL Greenguard Gold.
 - 2) Adhesives: Utilize adhesives having low VOC content.
- d. Carpet and Carpet Tile:
- 1) Carpet and Carpet Tile:
 - a) Allow carpet and carpet tile to off gas in a ventilated space or off site.
 - b) Provide carpet and carpet tile containing no PVC.
 - 2) Carpet Cushion: Installed in compliance with Carpet and Rug Institute Green Label program.
 - 3) Adhesive: Utilize low VOC manufacturer recommended carpet adhesive and install in accordance with manufacturer recommended frame or perimeter adhesive pattern method.
 - 4) Seam Sealer: Utilize carpet manufacturer recommended low VOC seam sealer or recommend heat welded seaming.
- e. Field Paint, Aerosols, and Polychromatic Finish Coating:
- 1) Use of water based paints formulated with aromatic hydrocarbons (organic solvent with a benzene ring in its molecular structure), formaldehyde, halogenated solvents, mercury or mercury compounds, or tinted with pigments of lead, cadmium, chromium VI and their oxides is prohibited.
 - 2) Provide water based paints having zero or low VOC content and flash point of 61 degrees C or greater.
 - 3) Where necessary to use solvent based paints, provide paints formulated for compliant VOC emissions; formulated without formaldehyde, halogenated solvents, mercury or mercury compounds, or tinted with pigments of lead, cadmium, chromium VI and their oxides; and not formulated with more than 10% aromatic hydrocarbons by weight.

- 4) Provide paints and coatings having zero or low VOC content and not formulated with aromatic hydrocarbons (organic solvent with a benzene ring in its molecular structure) formaldehyde, halogenated solvents, mercury or mercury compounds, or tinted with pigments of lead, cadmium, chromium VI and their oxides.
 - a) High performance water based acrylic coatings.
 - b) Pigmented acrylic sealers.
 - c) Catalyzed epoxy coatings.
 - d) High performance silicone grafted epoxy coatings.
6. Division 11 Equipment:
 - a. Refrigeration Units:
 - 1) Use of CFC refrigerant is prohibited.
 - 2) Provide refrigerant in compliance with EPA regulations and the Clean Air Act.
 - 3) Verify job site mechanic has received accredited training complying with EPA and the Clean Air Act as it applies to venting of EPA regulated refrigerant gases.
7. Division 22 Plumbing:
 - a. Basic Piping Materials and Methods: Utilize solder that does not contain lead.
 - b. Underground Utilities: Utilize solder that does not contain lead.
 - c. Pipes and Pipe Fittings: Utilize solder that does not contain lead.
 - d. Plumbing Fixtures: Utilize plumbing fixtures complying with water conservation requirements of the Energy Policy Act.
8. Division 23 Mechanical:
 - a. Basic Mechanical Materials and Methods: Use zero or low VOC sealants.
 - b. Mechanical Insulation: Utilize mechanical sound insulation materials within duct having impervious, nonporous coating that prevents dust from accumulating in insulating materials.
 - c. Metal Ductwork: Utilize zero or low VOC sealants.

END OF SECTION