

This is a guidance document with sample specification language intended to be inserted into project specifications on this subject as appropriate to the agency's environmental goals. Certain provisions, where indicated, are required for U.S. federal agency projects. Sample specification language is numbered to clearly distinguish it from advisory or discussion material. Each sample is preceded by identification of the typical location in a specification section where it would appear using the SectionFormat™ of the Construction Specifications Institute; the six digit section number cited is per CSI Masterformat™ 2004 and the five digit section number cited parenthetically is per CSI Masterformat™ 1995.

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SECTION 01 57 19.11 (SECTION 01352) – INDOOR AIR QUALITY (IAQ) MANAGEMENT

SPECIFIER NOTE:

This section includes requirements for IAQ management during construction. Coordinate with requirements of other sections; verify that products and installation methods specified in other sections are environmentally appropriate. Edit to suit location and project.

For more information on IAQ, refer to the U.S. EPA Green Indoor Environments Program

<http://www.epa.gov/iaq/greenbuilding/index.html>

Also, refer to the [American Lung Association](#), a voluntary health organization that provides information on health aspects of indoor air quality topics.

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Special requirements for Indoor Air Quality (IAQ) management during construction operations.
 - a. Control of emissions during construction.
 - b. Moisture control during construction.
 - 2. Procedures for testing baseline IAQ. Baseline IAQ requirements specify maximum indoor pollutant concentrations for acceptance of the facility.
- B. Related Sections:
 - 1. 01 30 00 (01300)- Administrative Requirements: Environmental Manager and Contractor training requirements.
 - 2. 01 40 00 (01400) – Quality Requirements: Meetings and project coordination.
 - 3. 01 78 53 01780 – Sustainable Design Close-Out Documentation: Cleaning and final submittals.
 - 4. 01 91 00 (01810) - Commissioning
 - 5. 10 81 50 (10295) – Integrated Pest Management (IPM).

1.2 DEFINITIONS

- A. Definitions pertaining to sustainable development: As defined in ASTM E2114.
- B. Adequate ventilation: Ventilation, including air circulation and air changes, required to cure materials, dissipate humidity, and prevent accumulation of particulates, dust, fumes, vapors, or gases.
- C. Hazardous Materials: Any material that is regulated as a hazardous material in accordance with 49 CFR 173, requires a 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. Throughout this specification, hazardous material includes hazardous chemicals.

1. Hazardous materials include: pesticides, biocides, and carcinogens as listed by recognized authorities, such as the Environmental Protection Agency (EPA) and the International Agency for Research on Cancer (IARC).
- D. Indoor Air Quality (IAQ): The composition and characteristics of the air in an enclosed space that affect the occupants of that space. The indoor air quality of a space refers to the relative quality of air in a building with respect to contaminants and hazards and is determined by the level of indoor air pollution and other characteristics of the air, including those that impact thermal comfort such as air temperature, relative humidity and air speed.
- E. Interior final finishes: Materials and products that will be exposed at interior, occupied spaces; including flooring, wallcovering, finish carpentry, and ceilings.
- F. Packaged dry products: Materials and products that are installed in dry form and are delivered to the site in manufacturer's packaging; including carpets, resilient flooring, ceiling tiles, and insulation.
- G. Wet products: Materials and products installed in wet form, including paints, sealants, adhesives, special coatings, and other materials which require curing.

1.3 QUALITY ASSURANCE

- A. Inspection and Testing Lab Qualifications: Minimum of 5 years experience in performing the types of testing specified herein.
- B. Coordinate with Section 01 74 13 (01740) – Progress Cleaning.
- C. Coordinate with Section 10 81 50 (10295) – Integrated Pest Management (IPM).

1.4 PRECONSTRUCTION MEETING

- A. After award of Contract and prior to the commencement of the Work, schedule and conduct meeting with Owner and Architect to discuss the proposed IAQ Management Plan and to develop mutual understanding relative to details of environmental protection.

1.5 SUBMITTALS

SPECIFIER NOTE:

EO 13423 directs Federal agencies to “provide reports on agency implementation of this order to the Chairman of the Council [on Environmental Quality] on such schedule and in such format as the Chairman of the Council may require; and ... provide information and assistance to the Director of the Office of Management and Budget, the Chairman of the Council, and the Federal Environmental Executive.”

Refer to <http://www.wbdg.org/sustainableEO>

Additionally, under the Sustainable Building requirements per Guiding Principle #2 Optimize Energy Performance, EO 13423 directs Federal agencies to “Enter data and lessons learned from sustainable buildings into the High Performance Buildings Database. <http://femp.buildinggreen.com/>

Executive Order 13514; *Federal Leadership in Environmental, Energy, and Economic Performance*; was signed on October 5, 2009. <http://www.ofee.gov/execorders.asp> It expands upon the environmental performance requirements of EO 13423.

http://www1.eere.energy.gov/femp/regulations/printable_versions/EO13423.html

EO 13514 sets numerous Federal requirements in several areas, including:

- Federal agency heads must designate a senior management official to serve as Senior Sustainability Officer accountable for agency conformance, reporting to the Chair of the Council on Environmental Quality (CEQ) and the Director of the Office of Management and Budget (OMB). The Senior

Sustainability Officer shall prepare targets for agency-wide reductions in 2020 for greenhouse gas (GHG) emissions and shall prepare and submit a multi-year Strategic Sustainability Performance Plan.

- Agency efforts and outcomes in implementing EO 13514 must be transparent and disclosed on publicly available Federal Web sites.
- OMB must prepare scorecards providing periodic evaluation of Federal agency performance. Scorecard results must be published on a publicly available Web site.

Documentation of environmental procedures can assist in required Agency reports.

- A. Indoor Air Quality (IAQ) Management Plan: Not less than 10 days before the Pre-construction meeting, prepare and submit an IAQ Management Plan including, but not limited to, the following:
1. Procedures for control of emissions during construction.
 - a. Identify schedule for application of interior finishes.
 2. Procedures for moisture control during construction.
 - a. Identify porous materials and absorptive materials.
 - b. Identify schedule for inspection of stored and installed absorptive materials.
 3. Revise and resubmit Plan as required by Owner.
 - a. Approval of Contractor's Plan will not relieve the Contractor of responsibility for compliance with applicable environmental regulations.
- B. Product Data:
1. Submit product data for filtration media used during construction and during operation. Include Minimum Efficiency Reporting Value (MERV).

SPECIFIER NOTE:

In general, air pressure mapping is used to determine whether air is moving through a building in a manner that contributes to condensation problems or not. Unplanned airflow will cause problems if:

- Air is moving from the warm side of the exterior wall, ceiling, or basement to the cool side or
- Cold air is blowing from an air conditioning diffuser into a space with high humidity.

2. Submit air pressure difference maps for each mode of operation of HVAC.

SPECIFIER NOTE:

GSA requires submittal of MSDS upon request for the following products prior to their installation or use: adhesives, caulking, sealants, insulating materials, fireproofing/firestopping, paint, carpet, floor and wall patching/leveling materials, lubricants, clear finish for wood surfaces, and cleaning products. Refer to December 13, 2002 Memorandum for all Real Property Leasing Activities for additional information.

3. Material Safety Data Sheets: Submit MSDSs for inclusion in Operation and Maintenance Manual for the following products. Coordinate with Section 01 78 23 (01830).
 - a. Adhesives.
 - b. Floor and wall patching/leveling materials.
 - c. Caulking and sealants.
 - d. Insulating materials.
 - e. Fireproofing and firestopping.
 - f. Carpet.
 - g. Paint.
 - h. Clear finish for wood surfaces.
 - i. Lubricants.
 - j. Cleaning products.
- C. Inspection and Test Reports:
1. Moisture control inspections.
 2. Moisture content testing.
 3. Moisture penetration testing.
 4. Microbial Growth testing.

PART 2 PRODUCTS

PART 3 EXECUTION

3.1 IAQ MANAGEMENT - EMISSIONS CONTROL

SPECIFIER NOTE:

Under the Sustainable Building requirements per Guiding Principle #4 Enhance Indoor Environmental Quality, EO13423 directs Federal agencies to follow "Sheet Metal and Air Conditioning Contractor's National Association Indoor Air Quality Guidelines for Occupied Buildings under Construction, 1995" and, after "construction and prior to occupancy, conduct a minimum 72-hour flush-out with maximum outdoor air consistent with achieving relative humidity no greater than 60 percent."

USGBC-LEED™ v3 includes credit for an IAQ Management Plan for construction and pre-occupancy consistent with SMACNA IAQ Guidelines, including the elements herein.

GSA recommends that new construction provide IAQ management during construction that includes compliance with ASHRAE Standard 62, proper sequencing of finish materials, and a pre-occupancy flush out of the building. Refer to December 13, 2002 Memorandum for all Real Property Leasing Activities for additional information.

EPA's Indoor Air Quality Building Education and Assessment guidance (I-BEAM) is designed to be comprehensive state-of-the-art guidance for managing IAQ in commercial buildings. I-BEAM provides educational information as well information for planning and budgeting IAQ activities, for calculating and recording IAQ expenses, for estimating the impact of IAQ on revenues and productivity, and for developing reports and documentation. Refer to <http://www.epa.gov/iaq/largebldgs/i-beam/index.html>

- 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.

SPECIFIER NOTE:

Under the Sustainable Building requirements per Guiding Principle #4 Enhance Indoor Environmental Quality, EO13423 directs Federal agencies to use "materials and products with low pollutant emissions, including adhesives, sealants, paints, carpet systems, and furnishings."

Potential sources of emissions include the following:

<u>Indoor Pollutant or Pollutant Class</u>	<u>Potential Sources</u>
Environmental Tobacco Smoke Combustion Contaminants	Lighted cigarettes, cigars, pipes Furnaces, generators, gas or kerosene space heaters, tobacco products, outdoor air, vehicles.
Biological Contaminants	Wet or damp materials, cooling towers, humidifiers, cooling coils or drain pans, damp duct insulation or filters, condensation, re-entrained sanitary exhausts, bird droppings, cockroaches or rodents, dustmites on upholstered furniture or carpeting, body odors.
Volatile Organic Compounds (VOCs)	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.

Formaldehyde	Particle board, plywood, cabinetry, insulation, furniture, fabrics.
Soil gases (radon, sewer gas, VOCs, methane)	Soil and rock (radon), sewer drain leak, dry drain traps, leaking underground storage tanks, land fill
Pesticides	Termiticides, insecticides, rodenticides, fungicides, disinfectants, herbicides.
Particles and Fibers	Printing, paper handling, smoking and other combustion, outdoor sources, deterioration of materials, construction/renovation, vacuuming, insulation.

- C. Source Control: Provide low and zero VOC materials as specified.
- D. Pathway Interruption: Isolate areas of work as necessary to prevent contamination of clean or occupied spaces. Provide pressure differentials and/or physical barriers to protect clean or occupied spaces.
- E. Housekeeping: During construction, maintain project and building products and systems to prevent contamination of building spaces.

SPECIFIER NOTE:

Materials/products that generally require temporary ventilation for offgassing include: adhesives, wood preservatives, composite wood products, plastics, waterproofing, insulation, fireproofing, sealants/caulking, acoustical ceilings, resilient flooring, carpet, painting, sealers/coatings, wall coverings, manufactured casework, and furniture.

- F. Temporary Ventilation: Provide an ACH (air changes per hour) of **[1.5] [xxxx]** or more and as follows:
 1. Provide minimum 48 hour pre-ventilation 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 degree 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 a Minimum Efficiency Reporting Value (MERV) of 8 as determined by ASHRAE 52.2 during construction **[and during Owner occupancy]**. Coordinate with work of Division 23 (15), Heating Ventilating and Air Conditioning (HVAC).
- G. Scheduling: Schedule construction operations involving wet products prior to packaged dry products to the greatest extent possible.
- H. Flush-Out: After construction ends, prior to occupancy and with all interior finishes installed, perform a building flush-out by supplying a total air volume of 14,000 cu.ft. of outdoor air per sq.ft. of floor area while maintaining an internal temperature of at least 60 degrees F and relative humidity no higher than 60%.

3.2 IAQ MANAGEMENT - MOISTURE CONTROL

SPECIFIER NOTE:

Under the Sustainable Building requirements per Guiding Principle #4 Enhance Indoor Environmental Quality, EO13423 directs Federal agencies to develop and implement “a moisture control strategy for controlling moisture flows and condensation to prevent building damage and mold contamination.”

Moisture sensitive materials that get wet during construction may grow mold, corrode, or deteriorate. Many of these materials can tolerate brief wetting but must be dried thoroughly prior to installation. For guidance in reducing potential moisture problems, refer to:

- ASTM E241 Standard Guide for Limiting Water-Induced Damage to Buildings;

- Indoor Air Quality and Mold Prevention of the Building Envelope
<http://www.wbdg.org/design/envelope.php>
- Mold and Moisture Dynamics <http://www.wbdg.org/resources/moisturedynamics.php>

Also, refer to MOIST. MOIST, developed by the National Institute of Standards and Technology (NIST), is a user-friendly, personal computer program that predicts the one-dimensional transfer of heat and moisture. MOIST helps the user to define a wall, cathedral ceiling, or low-slope roof construction and investigate the effects of various parameters on the moisture accumulation within layers of the construction. It can conduct computer runs for different U.S. and Canadian cities, thereby investigating the effect of climate on moisture accumulation. It allows the user to vary the building materials and their relative placement and predicts the resulting moisture accumulation within each as a function of time for the selected climate. It can be used to generate guidelines and practices for controlling moisture. Refer to <http://www.bfrl.nist.gov/863/moist.html>

- A. Housekeeping:
1. Keep materials dry. Protect stored on-site and installed absorptive materials from moisture damage.
 2. Verify that installed materials and products are dry prior to sealing and weatherproofing the building envelope.
 3. Install interior absorptive materials only after building envelope is sealed and weatherproofed.
- B. Inspections: Document and report results of inspections; state whether or not inspections indicate satisfactory conditions.
1. Examine materials for dampness as they arrive. If acceptable to Architect/Owner, dry damp materials completely prior to installation; otherwise, reject materials that arrive damp.
 2. Examine materials for mold as they arrive and reject materials that arrive contaminated with mold.
 3. Inspect stored and installed absorptive materials regularly for dampness and mold growth. Inspect **[weekly,] [after each rain event,] [xxxx]**.
 - a. Where stored on-site or installed absorptive materials become wet, notify **[Architect] [Owner]**. Inspect for damage. If acceptable to Architect/Owner, dry completely prior to closing in assemblies; otherwise, remove and replace with new materials.
 3. Basement: 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.
 4. Site drainage: Verify that final grades of site work and landscaping drain surface water and ground water away from the building.
 5. Weather-proofing: Inspect moisture control materials as they are being installed. Include the following:
 - a. Air barrier: Verify air barrier is installed without punctures and/or other damage. Verify air barrier is sealed completely.
 - 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: In accordance with ASTM D7186 Standard Practice for Quality Assurance Observation of Roof Construction and Repair
 6. Plumbing: Verify satisfactory pressure test of pipes and drains is performed before closing in and insulating lines.
 7. HVAC: Inspect HVAC system as specified in Section 01 91 00 (01810) – Commissioning.

[And, inspect HVAC to verify:

 1. **condensate pans are sloped and plumbed correctly;**
 2. **access panels are installed to allow for inspection and cleaning of coils and ductwork downstream of coils;**

3. **ductwork and return plenums are air sealed;**
4. **duct insulation is installed and sealed; and**
5. **chilled water line and refrigerant line insulation are installed and sealed.]**

C. Schedule:

1. Schedule work such that absorptive materials, including but not limited to porous insulations, paper-faced gypsum board, ceiling tile, and finish flooring, are not installed until they can be protected from rain and construction-related water.
2. Weather-proof as quickly as possible. Schedule installation of moisture-control materials, including but not limited to air barriers, flashing, exterior sealants and roofing, at the earliest possible time.

SPECIFIER NOTE:

Moisture in building materials can be measured with direct reading instruments or by sealing a vessel over the surface and measuring the equilibrium relative humidity. Moisture surveys of buildings typically start with a qualitative sweep with a pinless type meter to determine patterns of moisture intrusion followed by a more precise measurement with a pin type meter. Equilibrium relative humidity measurements are typically performed on concrete to determine if it is dry enough to receive finishes.

- D. Testing for Moisture Content: Test moisture content of porous materials and absorptive materials to ensure that they are dry before sealing them 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 as specified in Division 09 (9).] [Moisture test as per one or more of the following; unless otherwise indicated, acceptable upper limits for concrete are < 4% top inch; < 85% headspace RH; < 3 lbs/1000ft²/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 as per ASTM D4444 - Standard Test Methods for Use and Calibration of Hand-Held Moisture Meters; unless otherwise indicated acceptable upper limits for wood products are < 20% at center of piece; < 15% at surface.
 3. Gypsum Board, Gypsum Plaster, Insulation, and other absorptive materials: Moisture test with a Pinless Moisture Meter to assess patterns of moisture, if any.
- E. Testing for Moisture Penetration:
1. Windows: Test as per 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] [xxxx]**.
 2. Horizontal Waterproofing (not roofing): Test as per ASTM D5957 Standard Guide for Flood Testing Horizontal Waterproofing Installations; acceptable upper limits are **[no leakage for 15 minutes] [xxxx]**.
 3. Masonry: Test as per ASTM C1601 Standard Test Method for Field Determination of Water Penetration of Masonry Wall Surfaces; acceptable upper limits are **[no leakage for 15 minutes] [xxxx]**.
 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; acceptable upper limits are **[xxxx]**.

- b. Water Leakage: Review as per 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.
 - d. **[xxxx]**

END OF SECTION