# PART 1 - GENERAL

## 1.1 SUMMARY

A. Indoor air quality procedures include:
   1. Credit EQc3.1: Construction procedures to promote healthy indoor air quality during and after construction, which meets the SMACNA IAQ Guidelines for Occupied Buildings under Construction 2nd Edition, 2007, ANSI/SMACNA 008-2008 (Chapter 3).
   2. Credit EQc3.2: Construction procedures to promote healthy indoor air quality after construction and before occupancy.
   3. Prepare plan to comply with the requirements for LEED EQc3.1 and EQc3.2 as specified in Division 01 Section “Sustainable Design Requirements” and in this Section.

B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Division 01 Section “Sustainable Design Requirements” as applicable.
   2. Divisions 03-10, 31 and 32 Sections for “LEED Submittal Requirements” and “LEED Material Requirements.”

## 1.2 IAQ MANAGEMENT SUMMARY

A. Indoor air quality procedures include:
   1. Credit EQc3.1: Construction procedures to promote healthy indoor air quality during and after construction, which meets the SMACNA IAQ Guidelines for Occupied Buildings under Construction 2nd Edition, 2007, ANSI/SMACNA 008-2008 (Chapter 3).
   2. Credit EQc3.2: Construction procedures to promote healthy indoor air quality after construction and before occupancy.
   3. Prepare plan to comply with the requirements for LEED EQc3.1 and EQc3.2 as specified in Division 01 Section “Sustainable Design Requirements” and in this Section.

## 1.3 PROJECT GOALS

A. Develop and implement an IAQ Management Plan, which meets the SMACNA IAQ Guidelines for Occupied Buildings under Construction, 2nd Edition, 2007, ANSI/SMACNA 008-2008 (Chapter 3).

## 1.4 REFERENCES

A. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; 1999.

B. SMACNA (OCC) - IAQ Guideline for Occupied Buildings under Construction; 2nd Edition, 2007, ANSI/SMACNA 008-2008 (Chapter 3).

C. EPA Compendium of Methods for the Determination of Air Pollutants in Indoor Air.

## 1.5 SUBMITTALS

A. Indoor Air Quality Management Plan.

1. Credit EQc3.1 IAQ Management Plan during Construction: An IAQ plan based upon SMACNA IAQ Guidelines. The plan describes in detail measures specific to this project to be taken during construction to promote adequate indoor air quality upon completion.
   a. HVAC Protection: Seal and protect ductwork and HVAC equipment from dust and water damage.
   b. Source Control: Identify sources of VOCs and appropriate measures to mitigate their impacts.
   c. Pathway Interruption: Manipulate air paths to reduce contaminants of finished spaces.
   d. Housekeeping: Describe cleaning and dust control procedures.
   e. Scheduling.
   f. Quality Assurance and IAQ Monitoring: Describe steps to ensure compliance by General Contractor and subcontractors.
   g. 18 Photographs - six photographs of the 5 SMACNA approaches taken on three different occasions during construction. Identify SMACNA approach featured in each with dates and captions.
2. Credit EQc3.2 IAQ Management Plan before Occupancy: An IAQ plan based upon ASHRAE Standard 62.1-2004. The plan describes in detail measures specific to this project to be taken before occupancy to promote adequate indoor air quality upon completion.
   a. Narrative describing the Project's specific flush-out procedures and proposed schedule for flush out.

   Or,

   b. IAQ Testing plan and schedule to verify that all required contaminants are accounted for and reported in the correct unit of measure.

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.

1.6 CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT PLAN

A. Develop a Draft Indoor Air Quality (IAQ) Management Plan for the construction and pre-occupancy phases of the building as follows:
   1. During construction meet or exceed the minimum requirements of the Sheet Metal and Air Conditioning National Contractors Association SMACNA IAQ Guidelines for Occupied Buildings under Construction 2nd Edition, 2007, ANSI/SMACNA 008-2008 (Chapter 3).
   2. Protect stored on-site or installed absorptive materials from moisture damage.

B. The SMACNA IAQ Guidelines for Occupied Buildings under Construction provides an overview of air pollution associated with construction, control measures, construction process management, quality control, communicating with occupants, and case studies. These guidelines can be accessed at www.smacna.org. Chapter 3 of the SMACNA Guidelines recommends Control Measures in five areas: HVAC protection, source control, pathway interruption, housekeeping, and scheduling. Review the applicability of each Control Measure and include those that apply in the Draft IAQ Management Plan.
   1. HVAC Protection: Shut down the return side of the HVAC system whenever possible during heavy construction. If the system must remain operational during construction include the following strategies that apply:
      a. Fit all return air grilles with temporary filters with a Minimum Efficiency Reporting Value (MERV) of 8.

b. Isolate the return side of the HVAC system from the surrounding environment as much as possible (e.g., place all tiles for the ceiling plenum, repair all ducts and air handler leaks).
c. Damper off the return system in the heaviest work areas and seal the return system openings with plastic.
d. Upgrade the filter efficiency where major loading is expected to affect operating HVAC system.
e. Clean permanent return air ductwork per National Air Duct Cleaning Association standards upon completion of all construction and finish installation work.
f. Replace all filtration media prior to occupancy.

2. Control: Propose the substitution of non-toxic formulations of materials that are generally the responsibility of the contractor such as caulks, sealants, and cleaning products.
3. Pathway Interruption: Prevent contamination of clean spaces. Include the following strategies that apply:
   a. Use 100% outside air ventilation (when outside temperatures are between 55 degrees F and 85 degrees F and humidity is between 30% and 60%) with air exhausted directly to the outside during installation of finishes and other VOC emitting materials.
   b. Erect some type of barrier between work areas or between the inside and outside of the building to prevent unwanted airflow from dirty to clean areas.
4. Housekeeping: Reduce construction contamination in the building prior to occupancy through HVAC and regular space cleaning activities.
   a. Store building materials in a weather tight, clean area prior to unpacking for installation.
   b. Check for possible damage to building materials from high humidity.
   c. Clean all coils, air filters, and fans before testing and balancing procedures are performed.
5. Scheduling: Specify construction sequencing to reduce absorption of VOC's by materials that act as sinks or contaminant sources. Complete application of wet and odor-emitting materials such as paints, sealants, and coatings before installing sink materials such as ceiling tiles, carpets, insulation, gypsum products, and fabric-covered furnishings are installed.
   a. Protect stored on-site or installed absorptive materials from exposure to moisture through precipitation, plumbing leaks, or condensation from the HVAC system to prevent microbial contamination.

C. Draft IAQ Management Plan Review Meeting: Once the Owner and Architect have reviewed the Draft IAQ Management Plan and prior to construction at the site, schedule and conduct a meeting to review the Draft IAQ Management Plan and discuss procedures, schedules and specific requirements for IAQ during the construction and pre-construction phases of the building. Discuss coordination and interface between the Contractor and other construction activities. Identify and resolve problems with compliance to the requirements. Record minutes of the meeting; identify all conclusions reached and matters requiring further resolution.
   1. Attendees: The Contractor and related Contractor personnel associated with the work of this section, including personnel to be in charge of the IAQ management program, Architect, Owner and such additional personnel as the Architect or Owner deem appropriate.

D. Final IAQ Management Plan: Make any revisions to the Draft IAQ Management Plan agreed upon during the meeting identified in item (C) above and incorporate resolutions

agreed to be made subsequent to the meeting. Submit the revised plan to the Owner and Architect for approval within 10 calendar days of the meeting.

PART 2 - PRODUCTS

A. Credit EQc4: See Division 1 Section “Sustainable Design Requirements” for specific VOC limits.

B. Air Filters: MERV of 8, minimum, when tested in accordance with ASHRAE 52.2-1999.

PART 3 - EXECUTION

PART 4 - EXECUTION

4.1 CREDIT EQC3.1 IAQ MANAGEMENT PLAN DURING CONSTRUCTION

A. Refer SMACNA IAQ Guideline for Occupied Buildings under Construction for avoiding unnecessary contamination due to construction procedures.

B. 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 moisture-impermeable packaging.
   3. Provide sufficient ventilation for drying within reasonable time frame.

C. Begin construction ventilation when building is substantially enclosed.

D. Building HVAC system and supply air ductwork may be used for ventilation during construction:
   1. Operate HVAC system with 100 percent outside air and with 1.5 air changes per hour, minimum.
   2. Ensure that air filters are correctly installed prior to starting use; replace filters when they lose efficiency.
   3. Do not use return air ductwork for ventilation unless absolutely necessary.
   4. Where return air ducts must be used for ventilation, install MERV 8 filters at return inlets, sealed to ducts; replace filters when they lose efficiency.

E. Do not store construction materials or waste in mechanical or electrical rooms.

F. Prior to using 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 topsides 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 air plenums of air handling units.
   6. Remove air intake filters only after cleaning is complete.

G. Do not perform dust or dirt- producing work after starting use of return air ducts without intake filters on return air ducts.

H. HVAC Protection:
1. Seal off all louvers and air intake/discharge points to prevent construction dust and debris from entering.
2. Seal off all ductwork openings and air outlets with plastic sheeting to protect the duct system from dust and debris. Do not re-open until the end of activities that produce dust or pollution, such as drywall sanding, concrete cutting, masonry work, wood sawing, and so forth.
3. If, off all ductwork openings and air outlets with plastic sheeting to protect the duct system from dust and debris. Do not re-open until the end of activities that produce dust or pollution, such as drywall sanding, concrete cutting, masonry work, wood sawing, and so forth.
4. Under permanent supply ductwork, unless and until the level of construction in the relevant area involves final finishes and trim and the construction has reached a point of complete building dry-in with no sanding and is free from dust, debris, and contaminants.
5. Store permanent supply ductwork, unless and until the level of construction in the relevant area involves final finishes and trim and the construction has reached a point of complete building dry-in with no sanding and is free from dust, debris, and contaminants.
6. Seal all HVAC inlets and outlets. Use of the HVAC system shall be avoided during construction until drywall construction is complete. Temporary ventilation may be installed to remove contaminants. All air inlets and outlets shall be sealed securely with tape during construction. These include outside air inlets, grilles, diffusers, supply ducts, return ducts, ceiling plenums, VAV (variable-air volume) plenum intakes, exhaust ducts and window ventilator or air conditioning units. Openings shall be sealed with plastic film and tape that can be removed cleanly.
7. Seal HVAC components during installation. For ducting runs that require several days to install, sections shall be sealed off as they are completed. Seals shall be removed prior to continuing the ducting run. Other components of the HVAC system shall be subjected to the same requirements to protect them from contamination.
8. Use temporary filtration media. If the HVAC system is to be used while construction work is being done, temporary filtration media shall be installed on all intakes. Such filtration media shall have a minimum filtration efficiency (Minimum Efficiency Reporting Value-MERV per ASHRAE 52.2) of 8 or higher.
9. Inspect filters regularly. When the HVAC system is being used during construction and temporary filters are installed, filters shall be inspected weekly and replaced as needed.
10. Avoid contaminated air entry into enclosed parts of the building. When outdoor construction activities generate dust, combustion emissions, or other contaminants, operable windows and outside air supplies to enclosed portions of the building shall be closed.

I. Source Control:
1. Limit construction traffic and motor idling in the vicinity of air intake louvers when the HVAC systems are activated. Restrict motor vehicles to the loading dock area, well removed from air intakes and operable windows, preventing emissions from being drawn into the building.
2. Use electric or natural gas alternatives for gasoline and diesel equipment where possible and practical.
3. Cycle equipment off when not being used or needed.

4. Avoid the use of materials and products with high VOC and/or particulate levels. Use products and installation methods with low VOCs such as paints, sealers, sealants, filler materials, insulation, adhesives, caulking and cleaners. Comply with the requirements in other specification Sections.
5. Keep containers of wet products closed as much as possible. Cover and seal waste materials, which can release odor or dust.
6. Protect all materials, especially absorbent materials such as insulated ductwork, against moisture during delivery to and storage at the job site. Store materials inside the structure in a dry and clean environment pending installation. Building materials shall be kept dry to avoid the introduction of moisture into the building interior.
7. Avoid the use of moisture-damaged materials. Any porous materials that have been wetted shall be dried thoroughly before installation. Any porous materials that have been damaged remained wet longer than 48 hours, or show signs of visible mold shall be discarded.
8. Ensure that the construction process will not result in moisture intrusion.
9. Avoid tracking pollutants into work areas. Once the framing and mechanical system installation starts, access to the building interior shall be controlled to minimize the tracking in of contaminants. Material deliveries and construction waste removal shall be routed via the most direct route to the building exterior of the building rather than through the space.
10. Provide rough track-off grates or matting at the entryway to remove moisture and containments from entering the building.
11. Prevent the ingress of rodents and pests.
12. Prohibit smoking inside the building and designate outdoor smoking areas to prevent environmental tobacco smoke trespass.

J. Pathway Interruption:
1. Use dust curtains or temporary enclosures to prevent dust from migrating to other areas when applicable. During construction, isolate areas of work to prevent contamination of clean or occupied areas.
2. Keep pollutant sources as far away as possible from ductwork and areas occupied by workers when feasible.
3. Isolate work areas and/or create pressure differentials to prevent the migration of contaminants.
4. Use portable fan systems to exhaust contaminated air directly to the outside of the building, and discharge the air in a means to prevent it from re-entering.

K. Housekeeping:
1. Minimize accumulation of dust and other contaminants. Construction practices shall be used that minimize the production of dust and other contaminants from construction activities. Use integral dust-collection systems on drywall sanders, cutoff saws, and routers. Confine dust-generation activities to areas where cleanup can be carried out easily and contaminants will not be tracked to other areas.
2. Suppress Dirt Wetting agents or sweeping compounds shall be used to deep dust from becoming airborne.
3. Clean up dust. Wet clothes, damp mops, wet scrubbers, and vacuum cleaners with high-efficiency particulate (HEPA) filters shall be used to clean up dust generated by construction activities.
4. Cleaning frequency shall be increased when dust accumulation is noted. Institute cleaning activities of building areas on a daily basis, and of HVAC equipment as required.
5. Keep all coils, air filters, dampers, fans, and ductwork clean during installation, and clean them as required prior to performing the testing, adjusting and balancing of the systems.

6. Clean up spills. All spills and excess applications of solvent-containing products should be cleaned up using approved methods as soon as practicable. Water spills shall be mopped up promptly.
7. Keep work area dry. Avoid accumulations of water inside the building, and promptly remove any that may occur. Especially protect porous materials such as insulation and ceiling tiles from exposure to moisture.
8. The entire area shall be kept as dry as practicable by promptly regarding any leaks that allow rainwater entry and mopping up any water accumulation. Use dehumidification if necessary for prompt drying of wetted spaces. Unvented combustion (e.g., propane of diesel “salamander” space heaters) shall not be used.
9. Seal containers containing volatile liquids. Containers of fuel, paints, finishes, and solvents shall be kept tightly sealed and preferably stored outside of the building when not in use.

L. Scheduling:
1. Comply with the scheduling requirements of Article, "Sequence of Finish Installation" of this Section.
2. To avoid potential contamination of porous or absorbent materials such as ceiling tiles, install furnishings after interior finishes (drywall, paint, and floor finishing) have cured.
3. Phased Completion: Implement IAQ control measures in each tenant area until construction in that area is complete. Do not allow contaminants from an area under construction to enter the HVAC ductwork systems or to migrate to completed areas.
4. Filters: Install new MERV 8 filters at the central fan system, immediately prior to the first phase of building occupancy. Install new MERV 8 filters at fan systems serving limited areas immediately prior to occupancy for each respective area.

M. Ventilation
1. Provide adequate ventilation during curing period. To aid in curing of interior finishes and other products used during construction and to remove pollutants after drywall installation is complete, provide adequate ventilation with 100% outside air, and proper filtration. In humid periods or when very high-moisture materials are present, supplementary dehumidification may be required during this curing period.

N. Take periodic photos of the 5 SMACNA measures listed above (HVAC Protection, Source Control, Scheduling, Pathway Interruption and Housekeeping) during the course of construction to document implementation.

4.2 CREDIT EQC3.2 IAQ MANAGEMENT PLAN BEFORE OCCUPANCY

A. Perform either Building Flush out (A) or Air Quality Testing (B).

B. After construction ends, prior to occupancy and with all interior finishes installed, perform a building flush-out by supplying a total volume of 14000 cu. ft. of outdoor air per sq. ft. of floor area while maintaining an internal temperature of at least 60 degrees F and a relative humidity no higher than 60 percent. Indicate operating procedure for each HVAC system and piece of equipment and the operating duration required for flush out.

If occupancy is desired prior to flush-out completion, the space may be occupied following delivery of a minimum of 3500 cu. ft. of outdoor air per sq. ft. of floor area to the space.
1. Once a space is occupied, it shall be ventilated at a minimum rate of 0.30 cfm per sq. ft. of outside air or the design minimum outside air rate determined in EQ Prerequisite 1, whichever is greater.

2. During each day of the flush-out period, ventilation shall begin a minimum of three hours prior to occupancy and continue during occupancy.
3. These conditions shall be maintained until a total of 14000 cu. ft./sq. ft. of outside air has been delivered to the space.

C. Conduct baseline IAQ testing, after construction ends and prior to occupancy, using testing protocols consistent with the US EPA's "Compendium of Methods for the Determination of Air Pollutants in Indoor Air" and as additionally detailed in the LEED™ BD&C Reference Guide.
1. Demonstrate that the contaminants concentrated levels listed below are not exceeded:
   a. Formaldehyde 50 parts per billion
   b. Particulates (PM 10) 50 micrograms per cubic meter
   c. Total VOCs 500 micrograms per cubic meter
   d. 4-Phenylcyclohexene 6.5 micrograms per cubic meter
   e. Carbon Monoxide 9 parts per million and no greater than 2 parts per million above outdoor levels.
2. All measurements shall be conducted prior to occupancy, but during normal occupied hours and with the building ventilation system starting at the normal daily starts time and operated at the minimum outside airflow rate for the occupied mode throughout the duration of the air testing.
3. The building shall have all interior finishes installed, including but not limited to millwork doors, paint, carpet and acoustic tiles. Non-fixed furnishings such as workstations and partitions are required to be in place for the testing.
4. The number of sampling locations will vary depending upon the size of the building and number of ventilation systems. For each portion of the building served by a separate ventilation system, the number of sampling points shall not be less than one per 25,000 sq.ft. Or for each contiguous floor area, whichever is larger, and include areas with the least ventilation and greatest presumed source strength.
5. Air samples shall be collected between 4 feet and 7 feet from the floor to represent the breathing zone of occupants and over a minimum 4 hour period.

## 4.3 SEQUENCE OF FINISH INSTALLATION

A. Sequence of Finish Installation: Project schedule shall address construction scheduling/sequencing requirements and procedures necessary to optimize Indoor Air Quality (IAQ) levels for the completed Project.
1. Scheduling Contractor's Project Schedule for finish applications should allow for: Dissipation of high emissions from finishes that off-gas perceptible quantities of deleterious material during curing Separation of off-gassing effects from the installation of adsorptive materials that would act as a "sink" for storage and subsequent release of these unwanted substances into building spaces and mechanical systems after project occupancy.
2. When Contractor's "Project Schedule" requires less than optimal sequencing of finish installation, related to IAQ, provide supplemental filtered "fresh air" ventilation of work areas during construction and restrict / control the use of permanent building mechanical systems prior to Owner acceptance of building to prevent contamination of systems by construction wastes and other deleterious substances.

B. Finish Types:
1. Type 1: Materials and finishes which have a potential for short-term levels of off-gassing from chemicals inherent in their manufacturing process, or which are applied in a form requiring vehicles or carriers for spreading which release a high

level of particulate matter in the process of installation and/or curing. Type 1 Finishes include, but are not limited to the following:

a. Adhesives, sealants, and glazing compounds, specifically those with petrochemical vehicles or carriers.
b. Wood preservatives, finishes, and paint.
c. Control and/or expansion joint fillers.
d. All hard finishes requiring adhesive installation.
e. Gypsum board and associated finish processes.
f. Sealants and associated filler materials.

2. Type 2: Finishes: "Fuzzy" materials and finishes which are woven, fibrous, or porous in nature and tend to adsorb chemicals off-gassed by Type 1 finishes or may be adversely affected by particulates. These materials become "sinks" for deleterious substances, which may be released much later, or collectors of contaminants that may promote subsequent bacterial growth. Type 2 Finishes include, but are not limited to the following:
   a. Carpet and padding.
   b. Fabric wallcovering.
   c. Insulation exposed to the airstream.
   d. Acoustic ceiling materials.
   e. Fabric covered acoustic wall panels.
   f. Upholstered furnishings.
   g. Materials that can be categorized as both Type 1 and Type 2 materials shall be considered to be Type 1 materials.

C. Optimal Order of Installation: Apply all Type 1 interior finishes throughout the entire controlled air zone of each enclosed building or building segment and allow such finishes to completely cure according to intervals and times stated in respective finish manufacturer's printed instructions before commencing installation of any Type 2 materials in the same area.
   1. Do not store any Type 2 materials in areas where installation or curing of Type 1 materials is in progress.

D. Materials Test Data – Required for Substitutes Only:
   1. All manufacturers/producers of materials listed below that are proposed for substitution on this Project are required to provide test data for their materials which show permanent, in-place Indoor Air Quality performance in accordance with requirements of this Specification.
   2. Material Safety Data Sheets: Review all MSDS's of materials to be submitted for testing as well as MSDS's for other products where specifically requested in this Project Manual and identify those classified as "Prohibited Materials".
   3. Prohibited Materials: Any building materials or products that emit pollutants included on the International Agency for Research on Cancer (IARD) "List of Chemical Carcinogens", the "Carcinogen List" of the National Toxicology Program, and the "Reproductive Toxin List" of the "Catalog of Teratogenic Agents" must have approval in writing from the Owner’s Representative before that building material or product may be used on this Project. Carcinogens: Use of materials emitting carcinogens will not be permitted unless a suitable substitute is not available. Do not proceed with procurement of any carcinogen emitting product or material without prior review and written approval of the Owner’s Representative.