

CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT PLAN



**SOUTHERN CONNECTICUT STATE UNIVERSITY
NEW ACADEMIC LABORATORY
STATE PROJECT NO. BI-RS-283**

**485 Fitch Street
New Haven, Connecticut**

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OVERVIEW

The intent of this Plan is to:

- (1) Minimize exposure of construction workers to air pollutants;
- (2) Prevent air pollutants from collecting in building systems and on building materials; and
- (3) Prevent air pollutants caused by construction from migrating into occupied spaces.

For the purposes of this Plan, air pollutants are defined as:

- Particulates;
- Volatile organic compounds;
- Formaldehyde;
- Combustion emissions;
- Airborne bacteria and micro-organisms; and
- Airborne inorganic compounds, such as ozone (from electrical motors), metal fumes (from smoldering and welding), and ammonia and chlorine (from cleaning products).

The Plan addresses all measures required by the U.S. Green Building Council's LEED Rating System (Version 2.2) Credits EQ-3.1 and EQ-3.2 (Construction Indoor Air Quality Management Plan).



PROJECT ORGANIZATION

PERSONNEL AND RESPONSIBILITIES

The following personnel will have primary responsibility for executing and monitoring the Construction IAQ Management Plan. Responsibilities are defined as the following:

Construction Manager

- Overall responsibility for the execution of the plan.
- Resolve disputes related to Plan execution and coordination.
- Appoint the IAQ Representative. The Representative shall be the Project Manager.

IAQ Representative

- Inform all construction personnel of the Construction IAQ Management Plan's goals and procedures. Provide opportunities for discussion and feedback to ensure that all construction personnel thoroughly understand the intent and detailed procedures of the Plan.
- Regularly inspect jobsite to supervise and ensure Plan compliance.
- Discuss ongoing measures to carry out the Plan at project coordination meetings and/or meetings organized to address Construction IAQ Management. Minutes shall be kept at these meetings for the Owner's records and for Plan documentation.
- Ensure that criteria for warnings and corrective actions due to poor or failed compliance with the Plan are clearly understood by all affected parties.
- Notify the Field Superintendent if, in the Representative's opinion, the procedures and measures required to implement the Plan are not being adhered to.
- Generate and/or compile all Plan documentation.

Subcontractors

- Carry out requirements of the Plan under the direction of the Representative.
- Discuss measures to carry out the Plan at all meetings with the Construction Manager and with any other subcontractors performing work affected by the Plan.
- Sequence work and use work methods that conform to the Plan requirements.
- Assume financial responsibility for costs resulting from poor or failed compliance with the Plan.



PLAN DOCUMENTATION

Primary copies of the documentation will be filed at the project site, with a copy stored at the office of the Construction Manager. Upon occupancy of the building (or earlier, if requested), the Owner will be provided with the following documentation package:

- The approved Construction IAQ Management Plan.
- Minutes of all meetings in which Construction IAQ issues were discussed.
- Deficiency reports showing corrective action taken and dates of both deficiency and corrective action.
- Copies of work orders and a work order log.
- Schedule of temporary use of building mechanical equipment.
- Schedule of filter change-outs showing location, time, and filter type, until acceptance of equipment by Owner.
- Cut sheets for all filtration media used.
- Copies of duct testing and cleaning reports (if performed).
- Job progress photographs: at least (20) clear progress photographs evenly divided among different occasions. Photographs will show implementation of various measures required by the Plan, and will be labeled to indicate the measure being shown. Photographs will have integral date stamps, and will be submitted in chronological order.

REFERENCED STANDARDS

SMACNA IAQ Guidelines for Occupied Buildings under Construction, 1995, Sheet Metal and Air Conditioning National Contractors Association (SMACNA). The overall intent and some detailed recommendation found in these Guidelines is the basis for the Plan, although the Guidelines are intended for use in occupied buildings.

ANSI/ASHRAE 52.2-1999; Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size. These define the testing to establish the MERV rating of filters.

General Specifications for the Cleaning of HVAC Systems, National Air Duct Cleaning Association, 1997, www.nadca.com (202-737-2926).



CONTROL MEASURES

HVAC EQUIPMENT AND DUCTWORK

HVAC equipment and ductwork will be protected from dust and other pollutants via the following procedures:

Sealing Ductwork and Air Handling Equipment

- All ductwork and air handling equipment will arrive on site and be stored in a sealed and/or protected condition.
- Openings into installed ductwork and air-handling equipment not in active use will be sealed using taped plastic, taped cardboard, or other reasonably air-tight coverings. Sealing will occur prior to, or immediately upon installation of the ductwork or equipment. Regular walk-throughs will be conducted by the IAQ Representative to check for damaged or displaced coverings. Repair or replacement of damaged or displaced coverings will occur immediately upon discovery, at the direction of the IAQ Representative.
- Should ductwork or equipment be improperly sealed or become visibly contaminated during storage or installation, the installing subcontractor will be required to clean any such material prior to turnover to Owner.
- Construction work that generates air pollution will be avoided where ductwork or air-handling equipment is being installed. If visible air pollutants are present in a space where ductwork is to be installed, spot cleaning or other measures will be used to prevent ductwork or equipment contamination.

Use of Mechanical Systems during Construction

The use of mechanical systems during construction will be subject to the following control and protection measures:

- Exhaust and makeup air supply systems: when a system is operated during construction, its filters will be replaced upon completion.
- Central air systems will be subject to these provisions when operated during construction:
 - The central AHU will be protected with a temporary filter having a minimum rating of MERV 8 per ASHRAE 52.2-1999.
 - Distribution elements needing filters, including all return air ductwork, will be protected with temporary filters having a minimum rating of MERV 8 per ASHRAE 52.2-1999 unless otherwise noted below.
 - If used for prolonged periods, filters will be periodically inspected and replaced if dirty.



- All components of the distribution on the return side will be protected, including but not limited to:
 - The portion of the air handler upstream of the central fan;
 - Return vents, ducts and shafts;
 - VAV box intakes; and
 - Transfer ducts.
- Components of the distribution system on the supply side will typically not need protection except:
 - If portions of the supply system become contaminated, coarse filters will be applied to completely cover supply outlets, to prevent the distribution of particulates into building spaces.

Filter Replacement and Tracking

- MERV 8 filters used for ductwork protection will be replaced on an as-needed basis, as determined by the IAQ Representative.
- Upon completion, the MERV 8 filters used for ductwork protection will be discarded. New filters will be installed at all air handlers.
- A cut sheet for each type of temporary filter used will be filed and included in the final submittal.
- A schedule of filter replacements (showing location, time, and filter type) will be recorded and included in the final Plan documentation.

Duct Cleaning

Duct cleaning will be considered a last resort measure in the event of a failure of other measures. If duct cleaning is needed:

- The work will be done by experienced professionals skilled in the task, using specialized equipment and following the requirements of the *General Specifications for the Cleaning of HVAC Systems* referenced above.
- If it is found that duct liner, ductwork, or equipment is too contaminated to be cleaned successfully, it will be replaced at no cost to the Owner.
- If construction is still underway at the completion of cleaning, all openings required to be sealed per this Plan will be resealed as soon as possible after cleaning.
- A log recording all duct cleaning that takes place during construction will be created, filed, and included in the final submittal.



- The party creating the pollution will bear the cost of cleaning, if the polluting work was done in violation of the Plan and if the party was properly informed before the violation per the provisions of this Plan.

SOURCE CONTROL

This Plan is predicated on the use of low-emission interior products which comply with the following VOC limit standards:

- Adhesives, Sealants, and Sealant Primers: California's South Coast Air Quality Management District (SCAQMD) Rule #1168 (effective July 1, 2005 and rule amendment date of January 7, 2005). [LEED Credit EQ-4.1]
- Architectural paints, coatings, and primers applied to interior walls and ceilings: Green Seal Standard GS-11, Paints, First Edition, May 20, 1993. [LEED Credit EQ-4.2]
- Anti-corrosive and Anti-rust paints applied to interior ferrous metal substrates: Green Seal Standard GC-03, Anti-Corrosive Paints, Second Edition, January 7, 1997. [LEED Credit EQ-4.2]
- Clear wood finishes, floor coverings, stains, sealers, and shellacs applied to interior elements: California's South Coast Air Quality Management District (SCAQMD) Rule 1113, Architectural Coatings, rules in effect January 1, 2004. [LEED Credit EQ-4.2]
- Carpet, carpet cushion, and carpet adhesives: Carpet and Rug Institute's (CRI) Green Label Plus program. [LEED Credit EQ-4.3]
- Composite wood, agrifiber products, and laminating adhesives: Urea formaldehyde-free [LEED Credit EQ-4.3]

Modifying Equipment Operation

To reduce air pollution during construction:

- Electric equipment will be used instead of gasoline-powered equipment whenever practical.
- Bottled gas will be used in place of diesel fuel whenever practical.
- Exhaust from gasoline or diesel vehicles will be kept away from air intake pathways.
- Fuel-burning equipment will be cycled off during extended periods between uses.

Changing Work Practices

All construction workers will use work practices that reduce the generation and distribution of indoor air pollutants. The Representative will conduct orientation sessions with affected construction workers and supervisors. In these sessions, the Representative will review goals covering all aspects of the Plan, including HVAC protection, source control, pathway interruption, used of low-VOC products, housekeeping, and flush-out.



Local Temporary Exhaust

Where available, operable vents and windows will be opened to ventilate the building during application of interior finishes when weather conditions are suitable. Spaces with fixed glazing or no windows will be ventilated by localized temporary exhaust, as described below, or by using building mechanical systems (described above).

- Any local regulations concerning the discharge of particulates will be adhered to.
- Local temporary exhaust will be accomplished using fans, duct extensions, and filters.
- Local temporary exhaust will not discharge near air intakes or other openings that lead into the building.
- When necessary to control odors, special filtration media such as potassium permanganate or activated charcoal will be used.
- Building louvers may be temporarily removed, or the installation of fixed windows delayed for the placement of exhaust ductwork.

Covering or Sealing Sources of Pollution

The following rules apply to materials that emit air pollutants or odors:

- Containers containing wet materials will be covered whenever they are not in active use.
- Waste materials will be covered or sealed and regularly removed from the building.
- Absorptive materials or materials with an odor will be covered while moved through the building.
- Whenever possible, material containers will be disposed of with the covers on.
- Enclosed tankers will be used for built-up roofing instead of open kettles.
- Materials that require a surface coating to control pollutants or odors will be coated promptly.

PATHWAY INTERRUPTION

Measures will be implemented to close or cover pathways between spaces through which pollutants could travel.

Controlling Pollution at Entrances

Measures will be taken to prevent pollutants from being tracked into interior spaces by workers or equipment. These will include temporarily walk-off mats and floor protection.

Protection of Stored Materials

Measures will be taken to minimize dust accumulation on material surfaces and the absorption of other pollutants by absorbent materials. The measures will include the following:

- Materials will be handled and stored according to the manufacturer's recommendations.



- Unwrapped absorbent materials will be shrink-wrapped if necessary.
- Highly absorbent materials like duct liner, acoustic tile, carpeting, or insulation will be stored indoors in the original packaging, or covered and sealed.
- Moderately porous materials like gypsum board will be stored indoors, wrapped or away from dust and materials prone to off-gas VOC's.
- Framing lumber will be stored indoors whenever possible. If stored outdoors, the lumber will be (1) covered with a water proof covering, (2) stored off the ground, and (3) located away from standing water.
- Dense material like glass, metal framing, ductwork and equipment will be covered and kept dry.
- If condensation forms on cold material, care will be taken not to expose it to dust or other particles. If exposed to pollution, housekeeping measures will be used promptly to clean the material before installation.

Protection of Materials During and After Installation

- No materials intended for dry installation will be installed wet.
- No materials will be stored in rooms containing air-handling equipment, other than materials intended for use there.
- The Representative will determine appropriate measures to prevent water damage to materials not intended to be wet during construction, including temporary water barriers and/or water stops.
- Subcontractors are required to notify the Representative of any condition in which a material may be moisture damaged. The Representative will inspect the material and determine if it needs to be replaced.
- Subcontractors who apply finishes without notifying the Representative of underlying water damage will be financially responsible for the cost of removing and replacing all affected materials, and of related work, including investigating for mold spores.

Preventing Contamination of Completed Areas from Work under Construction

When work is completed in an area, the area will be protected from pollutants generated in other parts of the building still under construction. One or more of the following methods of pathway interruption will be used:

Erecting barriers between completed areas and areas still under construction

Where present, doors and windows will be closed and locked between completed portions of the building and portions of the building still under construction. The closures will be further sealed with tape, plastic sheeting and/or sealant, if necessary.



Where there is no constructed barrier between the two portions of the building, a temporary barrier will be erected to close in the smaller of the two spaces. The edge of the temporary barrier will be taped continuously to ensure a tight seal, or even caulked. The temporary barrier will be erected to withstand pressure differentials between the two spaces. Shafts and stairways that open on to both completed areas and areas still under construction will have air lock vestibules at their entries to the floor to prevent the passage of dust and other contaminants by the stack effect.

De-pressurizing the Work Area

After sealing the finished area off from the work area with a barrier, the work area will be de-pressurized using temporary exhaust measures described elsewhere, in order to contain dust and particulates within the active construction zone.

HOUSEKEEPING

The following housekeeping measures will be employed as part of the Plan:

- A regular housekeeping schedule will be instituted. Cleaning measures and frequency will be selected according to the pollutants generated in a space.
- Where applicable, dust will be suppressed by the use of low-odor wetting agents and sweeping compounds.
- Low-odor cleaning agents will be used.
- Spills of water or solvent will be cleaned up immediately.
- Attention will be given to cleaning hidden or hard-to-reach surfaces, such as wall cavities, tops of door, ledges, and behind water closets. All cavities and concealed spaces will be thoroughly cleaned of dirt and debris prior to close-up.

SEQUENCING FINISH APPLICATIONS

- The installation and application of finishes will be scheduled to prevent porous materials from acting as “sinks” for the storage and subsequent release of contaminants emitted from wet-applied finishes and other high off-gassing materials.

PROCEDURES

The following sequencing procedures will be coordinated by the Representative:

- Carpet and carpet tiles will be removed from their packaging 24 to 72 hours prior to their installation and stored in ventilated areas away from acoustical ceiling tiles (and away from spaces where ceiling tiles have been installed). Only low-VOC adhesives will be used for carpet installation.
- Caulks, sealants, and joint fillers will be applied prior to installing carpets or acoustical ceiling tiles.
- Painting of interior walls, soffits, doors, frames, etc. (with the exception of touch-up work) will occur prior to installing carpets or acoustical ceiling tiles.



- Painted areas will be allowed a minimum 48 hour drying period before carpets or acoustical ceiling tiles are installed. Only low-VOC paints and primers will be used.
- Where feasible, a primer coat of paint will be applied to gypsum wallboard prior to the application of caulks, sealants, and joint fillers.
- Custom architectural millwork items will be finished off site, except for touch-up, and delivered to the site after a minimum 48-hour curing period.
- Fabric-covered systems furniture panels and upholstered furniture will be installed after all other finish work is complete, and after flush-out is complete.

BUILDING FLUSH-OUT

The following procedures address the requirements of LEED Credit EQ-3.2: Construction IAQ Management Plan – Before Occupancy. The [Representative] and [Commissioning Agent] will be responsible for coordinating and documenting the flush-out operation.

FLUSH-OUT

- [After completing and cleaning the building, all mechanical systems that supply outside air will supply a total air volume of [_____ cubic feet] of outdoor air per square foot of floor area while maintaining an internal temperature of at least 60 degrees Fahrenheit and a relative humidity no higher than 60%.

-OR-

- After completing and cleaning sections of the building to be occupied prior to the flush-out, all mechanical systems that supply outside air to the completed section will supply a minimum of 3,500 cubic feet of outdoor air per square foot of the floor area space. The occupied space will be ventilated at [a minimum rate of 0.30 cfm/sq.ft. of outside air or the design minimum outside air rate determined in EQ Prerequisite 1, whichever is greater.]
- Ventilation of the occupied spaces will begin [a minimum of 3 hours] prior to occupancy and continue for the duration of occupancy. Flush-out will continue until a total of [14,000 cu.ft./sq.ft.] of outside air has been delivered to the space.]
- Filters at central air handling units (AHU's) that are operated during flush-out:
 - Prior to use, each AHU will be equipped with filters having a minimum rating of MERV 8 per ASHRAE 52.2-1999 (AHU's that have been operated during construction will already be so equipped per the above section "Use of Mechanical Systems during Construction").
 - After flush-out, filters in those AHU's that supplied and exhausted 100% outside air will be inspected. If a significant accumulation of particulates has occurred, these filters will be replaced.
- When a completed section of the building is flushed out while construction continues elsewhere, it will be effectively separated from on-going construction-generated pollution in accordance with the requirements of "Pathway Interruption," above.



- Care will be taken to prevent pollution generated by construction dust, particulates or volatile chemicals from entering outside air intakes during flush-out.

[LEED only requires a building flush-out or air quality testing. It is the responsibility of the representative, commissioning agent, or other responsible party to determine which compliance path to take in order to fulfill the credit requirements of EQ-3.2: Construction IAQ Management Plan – Before Occupancy]

AIR QUALITY TESTING

The following procedures address the requirements of LEED Credit EQ-3.2: Construction IAQ Management Plan – Before Occupancy. The [Representative] will be responsible for coordinating and documenting the baseline IAQ testing after construction ends and prior to occupancy.

- After completing and cleaning the building, perform baseline IAQ testing prior to occupancy using testing protocols consistent with the United States Environmental Protection Agency Compendium of Methods for the Determination of Air Pollutants in Indoor Air. Testing will be performed by a licensed, independent third-party firm.
- All testing will be conducted prior to occupancy, during normal occupied hours, with the building ventilation system operating on a normal schedule with an outside air flow rate of [minimum outside air flow rate] for the occupied mode for the duration of the air testing.
- All interior finishes will be installed prior to air testing.
- Sampling locations will be designated for each portion of the building served by a separate ventilation system; at a minimum of one sampling point per 25,000 square feet or contiguous floor area, and including areas with the least ventilation and greatest presumed source strength.
- Air samples will be collected from [between 4 feet and 6 feet] from the floor to represent the breathing zone of occupants over a 4-hour period.
- Testing will be performed and documented noting that the maximum contaminant concentrations listed below are not exceed. If the maximum contaminant concentrations are exceeded, additional flush-out with outside air will be performed at each sampling point where concentration limits are exceed. Retesting will be performed to document concentration levels have been met.
 - o Formaldehyde 50 parts per billion
 - o Particulates (PM10) 50 micrograms per cubic meter
 - o Total Volatile Organic Compounds (TVOCs) 500 micrograms per cubic meter
 - o 4-Phenylcyclohexene (4-PCH) 6.5 micrograms per cubic meter
 - o Carbon Monoxide (CO) 9 parts per million and no greater than 2 parts per million above outdoor levels