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SMACNA’s IAQ for Occupied Buildings Under Construction

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SMACNA’s IAQ for Occupied Buildings Under Construction

- Received ANSI Accreditation
- Overview of Contents in Terms of Where to “Look” To Evaluate Project Requirements
- Limitations
  - Occupied buildings with construction activity—new or existing
  - Odors, dust, other containments of concern
  - Does not address worker safety—OSHA
  - Not about lead paint or asbestos abatement
2- Air Pollutants Associated with Construction

- Sources of Airborne Contaminants
- How Contaminants Move Through Buildings
- How Airborne Contaminants Impact Building Occupants
- Placing Contaminant Exposures in Perspective
- Hazard Assessment

Sources of Airborne Contaminants

- It is as simple as looking at what materials will be demolished/constructed and what tools will be used.
- Then, deciding along what paths the generated contaminants can move through the building.
- Is it more cost-effective to contain or clean contaminants?
How Contaminants Move Through Buildings

- Primarily, via the air!
  - That is one of the reasons SMACNA developed this guideline
- HVAC is the prime mover of air and, in turn if appropriate measures are not taken, the prime mover of contaminants.
- Pressure gradients
- Some movement via foot “tracking”

How Airborne Contaminants Impact Building Occupants

- Typically Eyes, Nose, and Throat!
  - Also dermal, ie fiberglass
- Generally brief exposure
  - acute effects not long term
- It comes down to two issues:
  - what building materials are being demolished, constructed, or disturbed
  - with what type of machinery or equipment
Placing Contaminant Exposures in Perspective

- Air is never pollutant free
- Expect contaminants
  - VOCs
  - Dust
  - Ultrafines and semi-volatiles
  - Bioaerosols (Fungi and bacteria, endo/myco toxins)
- OSHA sets exposure limits to the workers, not occupants indirectly exposed to contaminants

Placing Contaminant Exposures in Perspective

- Air quality assessment can be based on:
  - Types of dust/odor/other contaminants
  - Presence of hazardous pollutants
    » Consult MSDS
  - Determination of times/locations occupants are likely to be exposed
  - Amount and duration of exposure
Hazard Assessment

- Need not predict specific concentration values
- Can show relative magnitude

Example renovation project
- Initial removal of asbestos-containing material in the mechanical room could present exposure hazard unless properly contained
- Offices near active worksites may experience dust/odor – no health effects
- Odors from enamel painting of CEO office doors may affect nearby occupants for up to two days
Hazard Assessment

- Previous example suggests that control methods are needed, they can be prioritized and selected to efficiently ensure a safe environment for occupants.

3- CONTROL MEASURES REFERENCED BY LEED*

- HVAC Protection
- Source Control
- Pathway Interruption
- Housekeeping
- Scheduling
- Occupant Relocation

*Virtually identical to previous edition
HVAC Protection

- DO NOT USE PERMANENT HVAC FOR CONSTRUCTION SITE CONDITIONING!
- Block all HVAC air intake openings within construction areas
- LEED requires MERV 13 filters when the HVAC system is used during construction (filter bypass—around the edges—is a major issue with contaminants, must be sealed/taped)

What is MERV?

- Minimum Efficiency Reporting Value
  - Test aerosol Polydisperse KCl
  - 6 dust loading curves 0, 25, 50, 75, 100, 125% airflow
  - Note minimum efficiency for each loading
  - Generate composite minimum efficiency curve
  - 3 efficiency ranges 0.3-1.0, 1.0-3.0, 3.0-10 µ
    - MERV 1-8 use 3.0-10 µ
    - MERV 9-12 use 1.0-3.0 and 3.0-10 µ
    - MERV 13-16 use 0.3-1.0, 1.0-3.0, 3.0-10 µ
(a) Resistance of clean device vs. airflow.

(b) PSE after incremental dust loading.
Figure C-3  Sample air cleaner performance report summary. Page 3.
Source Control

- Product Substitution
  - Low VOC paints/adhesives
  - Plaster instead of sheet rock
- Modify Equipment or Operation
  - Paint removal, heat stripping v. chemical paint remover v. sanding
- Modify Work Practices
  - Vacuum-assisted sheet rock sanders and concrete saws
- Local Exhaust with Portable Fans & Flex Pipe
- Space Cleaning
  - Consider HEPA or central vacuums exhausting ODs
- Cover and Seal >> reduce evaporation of VOCs

Pathway Interruption

- Barriers
  - Plastic sheeting and duct tape, simplest
  - Constructed plywood barriers, costliest
- Pressurization
  - Generally, positive pressure in occupied spaces
  - Negative pressure in construction areas
Housekeeping

- Suppress dust with wetting agents or sweeping compounds
- Increase frequency based on visible inspections (eyes)
- Use more efficient methods—wet mops, HEPA vacuums, central vacuum with outside exhaust

Scheduling

- Can extremely odorous or dust generating activities be done on weekend or at night with HVAC off?
- What is extremely odorous?
  - Tar kettles
  - Flooring adhesives
  - Urethane floor coatings
- See examples in Chapter 12
Occupant Relocations

- Try to maintain buffer zone between construction and occupied spaces
- Consider relocating workers who complain of effects to more isolated locations
- Consider temporary facilities
  - Like portable school rooms (trailers)

4- HVAC

- HVAC: A Critical Factor in Construction
- Contaminant Control
- HVAC Protection
- HVAC Scheduling
- Equipment Cleaning
- Establishing Pressurization
HVAC Critical Factor

- Most important system for IAQ
  - Before and after construction

- Proper HVAC management offers the best method to prevent or remedy most IAQ issues

HVAC Protection

- Protect entire system from collecting dust, odors, or other contaminants
  - Use temporary heating/cooling
  - Disconnect portions of duct in construction area
  - Replace all ceiling tile (plenum)
  - Return side most critical
HVAC Protection

Return Side
- Negative Pressure
- Shut down system if possible
- Seal openings with plastic (6 mil)
- Use temporary filters (MERV 6 or better)
- Damper off returns in construction area

HVAC Scheduling
- Most problems occur because of early start-up
- Equipment not designed to operate in a construction environment
- Shut down system if possible
- Temporarily adjust fan schedule post construction to reduce odors
Equipment Cleaning

- Requirements should be clearly specified in contract, both cleaning and covering
- Evaluate existing HVAC system
  - look at outlets
- Be aware that closing off ducts in one area may increase velocity in other ducts and dislodge existing dirt/debris
- Decision>>clean before or after completion of work?

Establishing Pressurization

- Easy to say, difficult to maintain
- Factors working against the best plan:
  - Wind
  - HVAC Economizer Operation – disable?
  - Exhaust Fans >> Bathrooms, kitchen, etc.
  - Taller buildings (starts at three stories)
    » Stack Effect & Piston Effect of Elevators
6- MANAGING THE CONSTRUCTION PROCESS

- Project Organization
  - Specify who is responsible for what—use specifications to achieve expectations
  - In LEED projects the LEED-AP should “map” out in advance which credits are being sought and specify who is responsible for what.

5 MANAGING THE CONSTRUCTION PROCESS

- IAQ Management Plan
  - Assignment of responsibilities
  - Written plan
  - Budget
  - Contingency plan for sensitive individuals
  - Contingency plan for unexpected contamination
  - Project monitoring and documentation
MANAGING THE CONSTRUCTION PROCESS

- Selecting IAQ controls
  1. Identify sources of dust, odors, other contaminants
  2. Locate occupied areas potentially affected
  3. Identify construction activities likely to produce DETECTABLE odors and dust
  4. Classify potential IAQ problems by relative risk
  5. Identify available control options
  6. Select specific control measures

Relative Risk
- Class 1: Nuisance, no health issues except for hyper-sensitive.
- Class 2: Moderate but temporary health issues (moldy material)
- Class 3: Potentially Hazardous, cause severe acute or chronic illness. (asbestos, roof tar)
6- PRE-RENOVATION BUILDING EVALUATION

- Objectives
  - Get more info about the building
  - ASHRAE HVAC assessment
  - CDC Risk assessment

PRE-RENOVATION BUILDING EVALUATION

- Building history
  - past IAQ concerns
- HVAC System
  - TAB reports
  - Inspection
  - Pre existing contaminants
  - Fix issues before proceeding
PRE-RENOVATION BUILDING EVALUATION

- Sources and Pathways
  - What is expected worst-case
  - What areas might be affected
  - When are worst case conditions expected
  - Are there preexisting IAQ issues
    » Might later be attributed to construction

7- Containment

- Other Guidelines (Healthcare)
  - ASHRAE “HVAC DESIGN MANUAL FOR HOSPITALS AND CLINICS”
    » Rigid fire rated walls, negative pressure, entry vestibules
  - AIA “Guidelines for…Hospital and Healthcare Facilities”
  - CDC “Guidelines for Environmental Infection Control”
**Containment**

- **Basic Containment**
  - Move contents from room or cover with plastic
  - Create critical barriers (6 mil)
    » Doors, other openings
  - Plastic drop cloth at work site
  - Shut down/Block all HVAC openings
  - Wipe down all affected surfaces until visibly clean

- **Intermediate Containment**
  - Move contents from room
  - Plastic containment around work area
    » Overlapping flaps for entry
  - Seal interior surfaces like cabinets, carpets
  - Shut down/block HVAC openings
  - Use HEPA air scrubber in work zone
  - Clean affected areas with HEPA vac then wipe with sanitizer (10% bleach solution)
Containment

- Advanced Containment
  - Work area sealed with solid barrier (wood) from floor to permanent ceiling
  - All penetrations identified and sealed and checked with smoke tube
  - Emergency Exit doors installed as required
    » Self closing and sealed (weather stripping)

- Advanced Containment
  - Negative pressure with make up air
  - Vestibule to change clothes, tools, etc
  - Periodic inspections with smoke tubes
    » Check barrier integrity and negative pressure
  - Maintain containment until demo/construction is complete and cleaning is at a level deemed acceptable under written project requirements
8- MOISTURE AND MOLD CONTROL

- General Characteristics of Mold
  - Water is required! Use eyes, look for water
- Moisture Problems Associated with Construction – Wet concrete & “open” buildings are biggest water concerns
- Prevent Mold Growth
  - Most cost effective strategy
    » See EPA Schools & Commercial Bldgs
    » NYC Dept. of Health
- Mold Cleanup Issues/Procedures

9- QUALITY CONTROL

- Standards – Ultimately set by occupants
- Surveillance Criteria – Eyes and Nose
- Enforcing Specified Work Practices
- Re-occupancy Criteria
- Project Documentation – IAQ Management Plan establishes accountability
10- COMMUNICATING WITH OCCUPANTS

- Occupant Education
  - What, when and who

- Complaint Response

*The most important activity?*

11- TROUBLESHOOTING

- Typical Complaint Scenarios
  - Timing, location reason (dust or odor)

- Investigation Protocol
  - Dust and water check physical barriers

- Developing Conclusions
  - Timing of event may be key, consider the weather (wind and direction) that was acting on building at the time.
Concluding Sections & Appendices

- Examples
- References
- Resources
- Planning Checklist
- Inspection Checklist
- Model Specifications
- Early Start-up of Permanently HVAC systs.
- Duct Cleanliness Standards

Questions?

See
www.smacna.org