

# Managing IAQ During Construction in Occupied Buildings

Ed Light, CIH  
Building Dynamics, LLC  
Ashton, Maryland  
[ELight@building-dynamics.com](mailto:ELight@building-dynamics.com)

Presented to Federal Interagency Committee on IAQ  
June 6, 2012

# *How not to do it-* *Renovation of Federal Technical Center*



- **Change offices to daycare**
- **Concrete cutting not isolated**
- **Dust and fumes into adjacent offices**
- **Occupant illness**
- **Facility evacuation**

# <sup>3</sup> Potential for IAQ hazards greatest during:

**Occupied building renovation**



**Occupancy of new building with ongoing construction**

<sup>4</sup> Issue not recognized until occupant complain,  
resulting in:

**Loss of Productivity/Disruption**



**Project Delays/Cost Increase**

# <sup>5</sup> IAQ Issues during construction avoided by:



- **Planning**
- **Control Measures**
- **Monitoring**
- **Communication**
- **Contingency plans**

# <sup>6</sup> Sources: Demolition



# Sources: Combustion



# 8 Sources: VOC's





# 9 Sources: Dust



# 10 Sources: Moisture



# 11 Sources: Utility Disruption



# 12 Contaminant Pathways



# <sup>14</sup> IAQ Plan: Objectives

1. No visible dust or detectable odor related to construction in occupied space
2. Public exposure to construction dust and odors in areas outside the building is minimized
3. HVAC equipment is protected from construction dust
4. Acceptable conditions are confirmed prior to occupancy of new areas
5. Occupants are kept informed about the construction process and any concerns are resolved

# 15 IAQ Controls: Barriers



# <sup>16</sup> Other Common IAQ Controls

1. Existing HVAC positively pressurizes occupied space
2. Other potential contaminant pathways (including tracking on shoes) identified and controlled
3. No occupants allowed in construction areas
4. Work area surfaces cleaned daily
5. Moisture and mold growth controlled
6. New HVAC protected from construction dust, using appropriate filtration if operated during construction
7. Low-emitting products, equipment and procedures used
8. Prior to occupancy, complies with HVAC and IAQ requirements

# <sup>17</sup>Additional IAQ Controls

- *Use of area-wide or local exhausts in work area*
- *Protection of outdoor air intakes*
- *Relocation of equipment emissions*
- *Restriction of high-emitting operations to after-hours*



# <sup>18</sup> IAQ Plan: Monitoring

**Detectable Odor**



**Settled Dust**



**Controls Verification**



# <sup>19</sup> IAQ Monitoring

- \* **Measurement of specific contaminants not feasible**
- \* **Construction and facility personnel continuously observe site conditions and investigate occupant concerns**
- \* **IAQ Coordinator periodically evaluates**

# 20 Occupant Communication



# <sup>21</sup>Pre-Occupancy Conditions

**At Substantial Completion, IAQ Coordinator conducts an inspection to determine whether:**

- **Surfaces are free of visible dust**
- **New material odors are minor and diminishing**
- **Occupied areas are isolated from ongoing construction**

# <sup>22</sup>Other Pre-Occupancy Requirements

- HVAC is functional and in the process of being commissioned
- Any deficiencies noted will be included in a punch list (all items to be resolved prior to acceptance)
- Applicable LEED documentation complete

# <sup>23</sup> Role: General Contractor

- **Designate IAQ Coordinator**
- **Erect and maintain sealed barriers of moisture-resistant drywall between work areas and occupied space; identify/seal any penetrations**
- **Protect, operate and maintain HVAC equipment consistent with IAQ Plan**
- **Adjust operations, as needed, to prevent migration of dust and odor into occupied space**
- **Regularly inspect work areas to verify that IAQ control measures are being effectively implemented**
- **Respond immediately to any IAQ concerns**
- **Train supervisory personnel in relevant provisions of the IAQ Plan.**

# <sup>24</sup> Role: Facility Management

- Regularly check occupied space for visible dust or detectable odor
- Update tenants and their employees on site conditions and IAQ controls
- Immediately report any occupant concerns to IAQ Coordinator immediately

# <sup>25</sup> Role: IAQ Coordinator

- Conduct walkthrough of work areas and adjacent occupied space
- Discuss changes or new issues regarding construction activities with site personnel
- Investigate occupant IAQ complaints and recommend response measures
- Recommend HVAC operating procedures to facilitate control of air contaminants
- Present IAQ update at project meetings
- Provide information to occupants
- Identify potential IAQ issues at the start of each new construction phase and update IAQ Plan, as needed
- At Substantial Completion, perform a general walkthrough of all potentially impacted areas and prepare a punch list for IAQ-related issues.
- Verify the resolution of IAQ punch list items.



# <sup>26</sup> ANSI Guideline: SMACNA 008-2008

- **Guidance**
- **Optional Controls**
- **HVAC Protection**
- **Pre-Planning**
- **Site Management**
- **Monitoring**
- **Occupancy Criteria**
- **Communication**

# <sup>27</sup> LEED IEQ Credit 3.1

- **Include Construction IAQ Management Plan**
- **Generally not site-specific or comprehensive**
- **Often not fully implemented**

# <sup>29</sup> Case Study: Main Interior Building Renovation

Phased construction with adjacent area occupied-

- Asbestos
- Replace building systems
- Modify spaces
- Re-finish

# Construction IAQ Plan

- **Implement practices in SMACNA Manual**
- **Construct barrier between work & occupied**
- **Portable air scrubbers**
- **Periodic occupant meetings**

# Occupant Complaints

- **Odor**
- **Dust**
- **Asthma/Allergy Aggravation**
- **Eye Irritation**
- **Lack of Information**

# NIOSH Investigation

- In response to 5 years of complaints
- Reviewed plans
- Interviewed construction & facility personnel and occupants
- Inspection
- Smoke tubing
- No sampling

# Findings: Contaminant Pathways

- Gaps under walls and around doors
- Holes in walls
- Wall seals failing
- Elevator shafts
- Stairwells
- Air moved from work area to occupied space (smoke tubes)

# Findings: HVAC Deficiencies

- Continued supplying air to work area to help control building temperature, pressurizing it positive to occupied space
- Plastic seals on return vents in work area failed, circulating contaminants to occupied space



# NIOSH Recommendations: Isolation

- **Maintain work area under negative pressure**
- **Seal all barrier openings**
- **Regularly inspect/maintain isolation**
- **Protect HVAC systems**

# Recommendations: Project Management

- **Fully implement SMACNA Guidelines**
- **Designate qualified individuals to oversee IAQ**
- **Regularly check site isolation and work practice compliance**
- **Improve communication with occupants**

# Conclusions

- **An effective IAQ Management Program during occupied building construction protects occupants and promotes timely project completion**
- **Costs are minimal where cost-effective controls are selected and work is done by existing personnel**

# Recommendations

- IAQ controls should be integrated into the construction planning process from the beginning
- Implementation should be monitored continuously and controls modified, as needed
- Occupants should be kept fully informed and involved in the process.



**QUESTIONS?**