The Role of IAQ in Tenant Satisfaction, Sustainability, Productivity and Profitability

Newman Consulting Group, LLC
Consultants for Energy Efficient and Sustainable Buildings

WHY CONSIDER IAQ OR IEQ

2004 BOMA/ULI* OFFICE TENANT SURVEY REPORT

WHAT OFFICE TENANTS WANT

COMFORT 95%
INDOOR AIR QUALITY 94%

*Building Owners and Management Association/Urban Land Institute

Outline

• What’s It All About?
• What Can I Do About It?
• Legal Liability
• What’s It Cost?
• What’s It Save?
• How Do I Do It?
• Additional Information
  - Websites

Poor IAQ Can Have Many Origins – Some Indoor, Some Outdoor

350 Building IAQ Study by NIOSH – Problem Buildings

• 50% Ventilation Problems
• 28% Specific Indoor Contaminant
• 11% Specific Outdoor Contaminant
• 11% ???

Solving IAQ Problems in Commercial Office Buildings Is Not Always Easy
IAQ Problem: Winter Humidity – As Low As 15% In Many Buildings!

Optimum Relative Humidity for Health

Potential IAQ Problems - VOCs

Potential IAQ Problem - VOCs

Potential IAQ Problem – Food Areas

Potential IAQ Problem – Pest Control
Potential IAQ Problem - Renovation

IAQ Problems

- Mold Or Mildew Growth Due To Condensation
- Interior Surfaces Of Walls Near Thermal Bridges
- Carpeting On Cold Floors
- Locations Where Humidity Promotes Condensation

IAQ Problems - Mold and Mildew

IAQ Problems – HVAC Systems

- HVAC System - A Source Of Biological Contaminants
- Surface Contamination By Molds Or Bacteria
- Drain Pans
- Interior Duct Work
- Air Filters And Filter Media
- Improper Damper Operation

Microbial Soup in a Drain Pan

Fungi & Bacteria bio-aerosolize into the air stream and are transported down the ductwork by the air handling systems into the breathing zone of the building occupants

Dried-Up “Goop” (Scientific Term) – From Drain Pan in Air Handling Unit
What to Watch Out For

• Standing Water in Drain Pan – How Does It Happen?
  – Condensate drain higher than bottom of drain pan (common in older air handling systems)
  – Flat drain pan (common in older systems – newer drain pans are pitched toward the drain and the drain is at the bottom of the pan)
  – Plugged condensate drain

Poorly Maintained Dampers

Poor IAQ – Supply Air

Poor IAQ – No Exhaust Capability

Filtration

• Yesterday – to protect coils from dirt
• Today – to protect equipment & personnel
• ASHRAE Rating System 52.2 - 1999: MERV Ratings (Minimum Efficiency Reporting Value)

  Capture efficiency on 3-10 micron particles:
  MERV 6  ≡ 35-50%  MERV 8  ≡ > 70%
  MERV 11 ≡ > 85%   MERV 13 ≡ > 90%
  MERV 15 ≡ > 90%   MERV 16 ≡ > 95%

New & Improved Systems - Not your father’s filters...

IAQ Problems – HVAC Filters
Filter Maintenance - Poor

Filter Maintenance – Poor Goes To Worse - This Is What Happens

These Are Permanent, Cleanable Filters

Improper Filter Installation or Replacement

Potential IAQ Problems: Outdoor – Air Intake Above Condensing Units
Potential IAQ Problems: Outdoor/Indoor – Parking Garage Under Building

Potential IAQ Problem: Outdoor – Makeup Air Unit to Hospital O.R.

Ventilation Standard for Acceptable Air Quality in Buildings – ANSI/ASHRAE Std. 62

Purpose: "To specify minimum ventilation rates and other measures intended to provide IAQ that is acceptable to human occupants and that minimizes adverse health effects".

Other Relevant Standards – 55 (Thermal Environment) & 90.1 (Energy)

Other Environmental Stressors Leading to Poor IEQ (Indoor Environmental Quality)

• Lighting - Glare
• Noise – Too Much or Not Enough
• Vibration
• Ergonomic Stress
• Psychosocial Factors

USGBC LEED® Guidelines (1)

• All these ASHRAE Standards are referenced in the LEED Guidelines for New Construction (LEED-BD&C), Existing Buildings (LEED-EBOM) and Commercial Interiors (LEED-CI)
• LEED-EBOM Guideline includes numerous ideas and references on ventilation air, energy and good O & M techniques.
**USGBC LEED® Guidelines (2)**

- LEED-CI Guidelines (Commercial Interiors)
  - Specifically for tenants who have no control over the building envelope or the HVAC system
  - Especially good for remodeling or retrofit projects
  - Green maintenance, purchasing, etc.

**Ventilation for IAQ**

- Can have dramatic effect on health of occupant
- 15 cfm/person creates about 1 air change per hour in a typical office space — usually ample
- Improperly designed or maintained ventilation systems can cause too high or too low humidity levels, improper ventilation rates, poor air circulation, all leading to an uncomfortable thermal environment

**Variance in Outdoor Air Volume**

- Prior to 1973, 15 cfm/person was standard
- After oil embargo of 1973, 5 cfm became standard and buildings were designed and constructed to be tighter, i.e., lower infiltration of outside air
- By 1989, 15 cfm once again became standard because of IAQ problems created by lower air volumes and tighter buildings

**Defensive Strategies (1)**

- Avoid Potentially Offensive Building and Maintenance Materials
- Operate with Adequate Ventilation
- Operate Cooling & Heating Systems Conservatively Toward the Center of the Thermal Comfort Zone as Set Forth in ASHRAE Standard 55
- Fully Commission Mechanical Systems Prior to Occupancy
- Re-Commission Systems Every Year To Ensure Their Proper Operation

**Defensive Strategies (2)**

- Clean, Maintain and Operate Systems As Designed
- Periodically Check Your Building for Sensor Stress (Auditory, Visual, Olfactory) and for Conditions That Might Cause Psychological Stress. Ask Yourself, “Would I Want To Work/Live in That Area?”
- Periodically Check Occupants’ Satisfaction with Their Environment
- Document Everything
- Understand Your Liability Insurance Coverage and Operate Within Its Limits

**What To Do If IAQ Problem – Either Real or Perceived**

- Respond **Immediately!!**
  - If You Don’t, 1 Goes To 2, 2 Goes To 4, etc. Until You Have “Mass Psychogenic Illness”
  - Remember, “Perception Is Reality” To the Person with the Perception
- Identify Problem (if there is one)
- Make Necessary Corrections as Needed
Compliance with Standards & Regulations

NOTE:

Strictly Meeting Applicable Standards and Regulations May NOT Insure Protection!
Remember, Most Standards Are Minimum Standards

Legal Ramifications

• 1990 – No Jury Trials in IAQ Cases

• Today – Entire floors of attorneys salivating over potential IAQ cases (and some of them are very, very good – both the cases and the attorneys!)

Liability/Litigation

Who is Blamed for Poor IAQ?

• Building Owners
• Architects & Engineers
• Building Contractors & Suppliers
• Building Management, Maintenance Personnel
• Real Estate Brokers
• Landlords & Tenants
• Employers

Costs of Energy and O & M

• Energy = $1.50 - $2.50/sq.ft./year
• O & M = $1.40 - 3.50/sq.ft./year

-BOMA EER Report

Cost of Personnel

• Average Salary of Office Worker, including fringes = ~ $40,000/year (conservative)
• Assume 200 sq. ft. of floor area/worker = $200/sq. ft./year
• 2% Productivity Increase = $4.00/sq.ft./year (more than either energy or O & M cost)
• 3% Productivity Increase = $6.00/sq.ft./year (as much as or more than both energy and O & M costs)!

Summary: Why Be Concerned About Good IAQ?

• Overall Health of Employees
• Reduced Absenteeism
• Increased Productivity
• Increased Profitability
• Minimized Litigation Risk
• **Saves Money & Makes Money**
Additional References & Resources (2) — Filter Manufacturers (Partial List)

- StrionAir: www.strionair.com
- Purafil: www.purafil.com
- Circul-Aire: www.dectron.com
- American Air Filter: www.aafintl.com
- 3M: www.3M.com
- CRS: www.cosatron.com
- Camfil Farr: www.camfillen.com

Additional References & Resources (1)

- www.ashrae.org
- www.usgbc.org
- www.wgbc.org
- www.aia.org
- www.iesna.org
- www.epa.gov/iaq
- www.cdc.gov/niosh/topics/indoorenv
- www.sustainable.doe.gov
- www.peci.org (Portland Energy Conservation, Inc.)

For Further Information

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"We Do Not Inherit The Earth From Our Ancestors, We
Borrow It From Our Children" — Native American Proverb

"Build Green — Everybody Profits!" — USGBC

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