Newman Consulting Group, LLC

Consultants for Energy-Efficient and Sustainable Buildings

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

- ASHRAE DL – MS Valley – 05/11/11

IAQ Is NOT A New Issue

2

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

3

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

4

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

5

350 Building IAQ Study by NIOSH – Problem Buildings

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

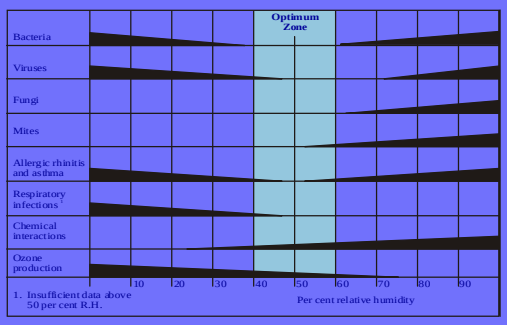
Solving IAQ Problems in Commercial Office Buildings Is Not Always Easy

6

IAQ Problem: Winter Humidity – As Low As 15% In Many Buildings!

7

Optimum Relative Humidity for Health



E.M. Sterling, Criteria for Human Exposure to Humidity in Occupied Buildings, 1985 ASHRAE

8

Potential IAQ Problems - VOCs

9

Potential IAQ Problem - VOCs

10

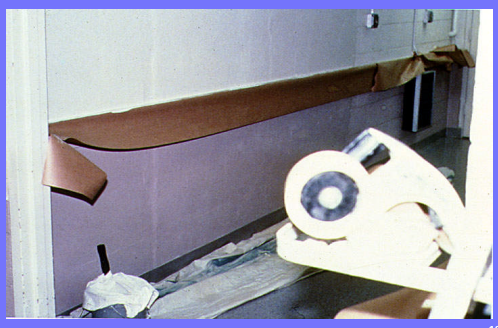
Potential IAQ Problem – Food Areas

11

Potential IAQ Problem – Pest Control

12

Potential IAQ Problem - Renovation



13

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

14

IAQ Problems – Mold and Mildew

15

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

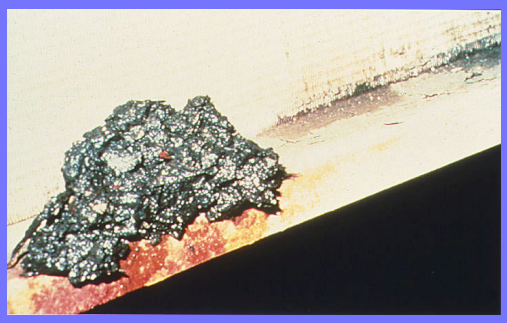
16

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

17

Dried-Up "Goop" (Scientific Term) – From Drain Pan in Air Handling Unit



18

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

19

Poorly Maintained Dampers

20

Poor IAQ – Supply Air

21

Poor IAQ – No Exhaust Capability

22

Filtration

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

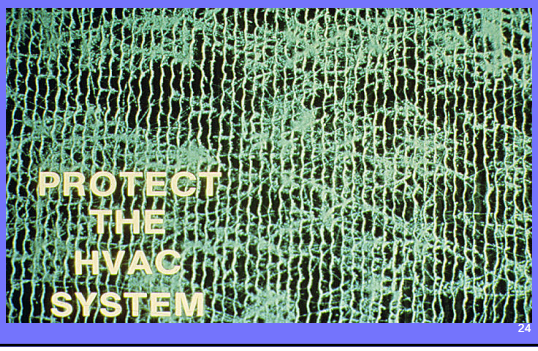
Capture efficiency on 3-10 micron particles:

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…*

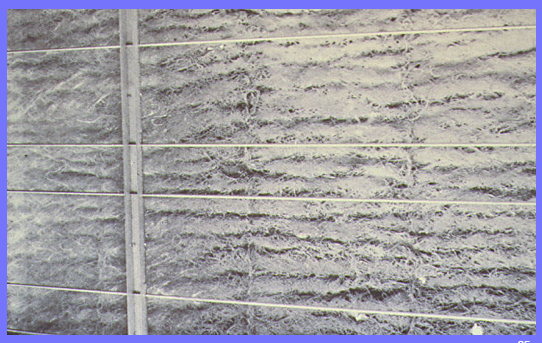
23

IAQ Problems – HVAC Filters



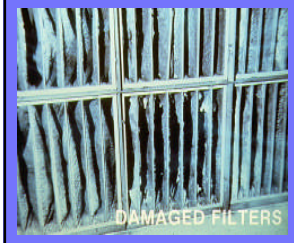
24

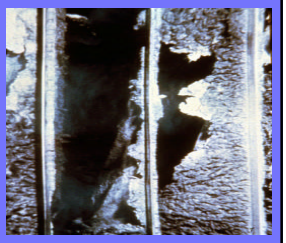
Filter Maintenance - Poor



25

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



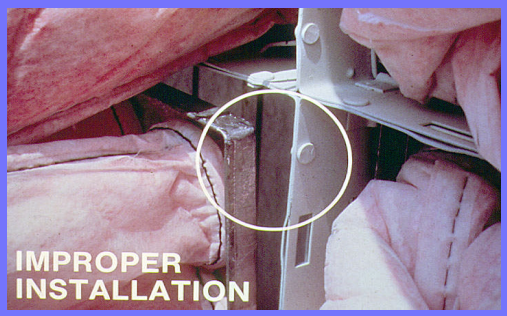


26

These Are Permanent, Cleanable Filters

27

Improper Filter Installation or Replacement



28

Potential IAQ Problems: Outdoor

29

Potential IAQ Problems: Outdoor – Air Intake Above Condensing Units

30

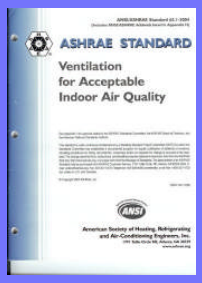
Potential IAQ Problems: Outdoor/Indoor– Parking Garage Under Building

31

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

32

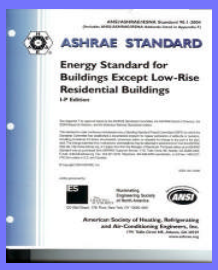
Ventilation Standard for Acceptable Air Quality in Buildings – ANSI/ASHRAE Std. 62



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".

33

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



34

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

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

35

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.

36

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.

37

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

38

Variances 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

39

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

40

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

41

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

42

Compliance with Standards & Regulations

NOTE:

Strictly Meeting Applicable Standards and Regulations May NOT Insure Protection!

Remember, Most Standards Are *Minimum* Standards

43

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!)

44

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

45

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

46

Cost of Personnel

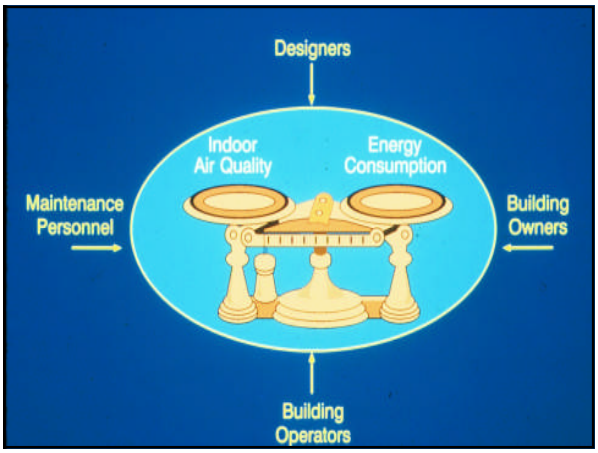
- Average Salary of Office Worker, including fringes = ~ $40,000/year (conservative)
- Assume 200 sq. ft. of floor area/worker = $200/sq. ft./year
- 2% Productivity Increase = $4.00/sq.ft./year (more than *either* energy or O & M cost)
- 3% Productivity Increase = $6.00/sq.ft./year (as much as or more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

47

Summary: Why Be Concerned About Good IAQ?

- Overall Health of Employees
- Reduced Absenteeism
- Increased Productivity
- Increased Profitability
- Minimized Litigation Risk
- ***Saves Money & Makes Money***

48



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.pecl.org (Portland Energy Conservation, Inc.)

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.camfilfarr.com

For Further Information

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EPA Energy Star® Partner, Rebuild Michigan® Partner,
Member – U.S. Green Building Council, ASHRAE, BOMA, IFMA, ESD

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

"Build Green – Everybody Profits!" - USGBC