



IMAGINE THE POSSIBILITIES...
SEIZE THE POTENTIAL

26th Annual NANT Symposium

February 11,2009

*Indoor Air Quality, Gnat, Drain Fly and
and Mold Issues - Oh My !*

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Learning Objectives

- Defining Indoor Air Quality (IAQ)
- Exploring IAQ problems
- Investigating your Clinic
- Repairing the problems
- Mold Remediation
- Gnat and Drain Fly Discussion



What is Indoor Air Quality?

- Quality of air inside buildings as a function of:
 - Comfort parameters (temperature, relative humidity, CO₂)
 - Concentrations of potential contaminants
- IAQ affects occupant comfort, performance and health
- ANSI/ASHRAE Standard 62-2001
 - Defines ***acceptable indoor air quality*** as air in which there are no known contaminants at harmful concentrations as determined by cognizant authorities and with which a substantial majority (80% or more) of the people exposed do not express dissatisfaction

IAQ Contaminant Types & Sources

Type/Class

Examples

Potential Sources

Chemical Compounds

- Alcohols - Isopropanol
- Aldehydes - Formaldehyde
- Aliphatics – Cyclohexane
- Aromatic- Benzene
- Halogenated Cmpds – TCE

Particle board, plywood, cabinetry, carpeting, upholstery, plastics, paints, stains, dyes, varnishes, adhesives, sealants, waxes, cleaning products, fuels, copy machines, printers, soil gas

Combustion Products

- Carbon monoxide/dioxide
- Nitrogen oxides
- Sulfur oxides
- Polyaromatic Hydrocarbons
- Tobacco smoke

Furnaces, generators, gas or kerosene heaters, vehicle exhaust, loading docks, tobacco smoke, outdoor air

IAQ Contaminant Types & Sources

Type/Class	Examples	Potential Sources
Respirable Particulates and Fibers	<ul style="list-style-type: none">•Asbestos•Fiberglass•Organic and inorganic dusts•Tobacco smoke	Deterioration of building materials, construction and renovation, insulation, printing, paper handling, vacuuming, smoking, outdoor sources
Inorganic Gases	<ul style="list-style-type: none">•Radon	Soil, rock and groundwater (radon), sewer drain leaks, dry drain traps, landfills
Pesticides	<ul style="list-style-type: none">•Pyrethrum•Chlordane	Application of termiticides, insecticides, rodenticides, fungicides, herbicides

IAQ Contaminant Types & Sources

Type/Class

Examples

Potential Sources

Biologics & Bioaerosols

- Fungi (mold)
- Bacteria
- Viruses
- Animal dander/droppings
- Arthropods

Wet or damp materials, HVAC systems, cooling towers, humidifiers, cooling coils or drain pans, damp insulation or filters, condensation, water incursion, bird droppings, dustmites

Comfort Parameters

- Temperature
- Relative Humidity
- Carbon Dioxide

HVAC systems underperforming; maintenance and operation issues

Who Defines Acceptable IAQ Standards?



■ Comfort Parameters (ASHRAE)



- CO₂ = 300 - 1,000 ppm
- Temp.°F = 68 - 76°F winter, 72 - 79°F summer
- RH% = 40 - 60%

■ Target Chemicals

- EPA, OSHA, NIOSH etc. have established levels and guidelines for specific chemicals (ex. asbestos, CO, formaldehyde)



Who Defines Acceptable IAQ Standards?

■ Fungi (mold)

- Currently no accepted government or professional consensus standards for permissible exposure levels for mold spores or mycotoxins.
- Comparison of indoor to outdoor background is the standard,
- Species identified indoors and outdoors should be similar,
- Concentrations indoors should be 70% or less than those measured outdoors.

Causes of IAQ Complaints - Statistical Breakout

Cause (%)

Common Problems

HVAC (35%)

Comfort parameters not met. Entrainment of contaminated outside air, intake locations, venting/exhaust problems, poor maintenance

Biologic (Mold) (35%)

Moisture management, HVAC maintenance and operation, building envelope and roof leakage, inadequate response to water impact events

Chemical Contaminants (15%)

Building material emissions, inadequate ventilation, poor ventilation of specialty areas, improper chemical storage conditions

Physical (3%)

Lighting, ergonomics, aesthetics

No Explanation (12%)

Mold Health Issues

- **Allergenic molds:**

All molds are regarded as allergenic and can cause irritations to the respiratory tract.

Health effects can be minor or serious for immune compromised individuals or individuals with respiratory disorders such as asthma.

- **Toxigenic molds:**

Certain molds such as *Stachybotrys* and types of *Aspergillus* and *Penicillium* can produce mycotoxins. Various types of mycotoxins can suppress the immune system and some are known carcinogens.

Repercussions of poor IAQ

- Worker's comp claims
- Disability claims
- Personal injury claims
- Clinic closures

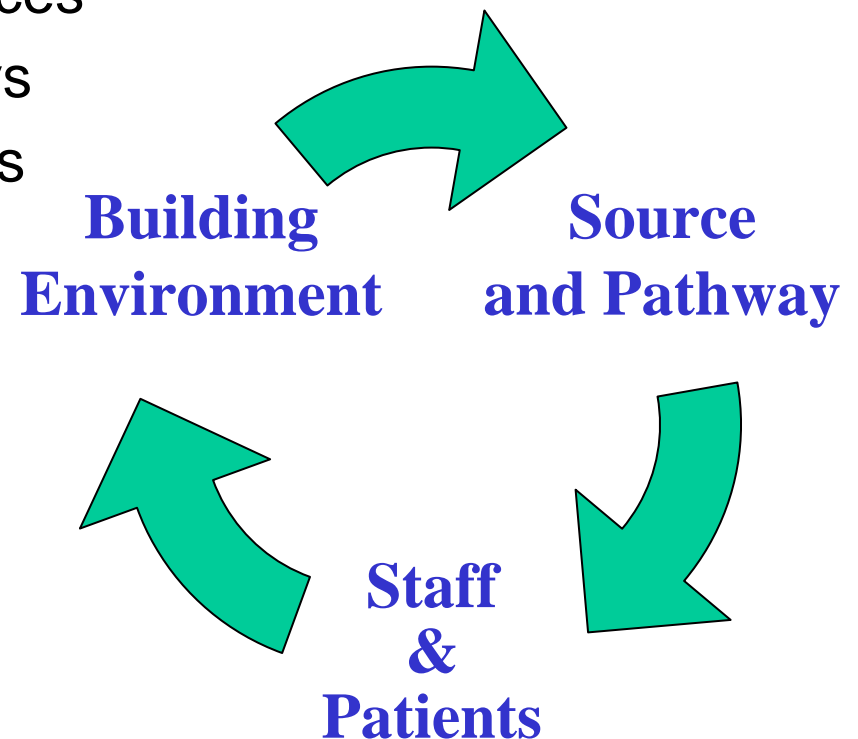
Some Common False Mold “Myths”

- **If I can't see the mold, it doesn't exist...**
 - Mold often grows on both sides of building materials. Often the mold growth is on the unexposed side in the wall cavity.
- **All molds are toxic...**
 - All molds are allergens and have the potential to adversely affect human health, but not all molds produce mycotoxins.
- **Mold can be “sprayed” away...**
 - Antimicrobial agents can be useful in remediation of non-porous materials, but the moisture source has to be cured to stop the mold.



IAQ and Building Dynamics

- **IAQ depends on a complex of interrelated factors;**
 - HVAC System
 - Building Envelope
 - Contaminant Sources
 - Migration Pathways
 - Building Occupants



Investigating IAQ Problems

■ HVAC Issues

- Location of outdoor air intakes
- Dirty air intake dampers – dirt, bird droppings, etc.
- Contaminants stored in air handling room
- Contaminants present in air plenums
- Air filters – poorly fitted, excessive build-up, improper efficiency
- Standing water in drain pans
- Dirty coils provide food for microbial growth
- Un-insulated ducts or piping cause condensation

HVAC System Problems



- Outdoor air is intended to introduce fresh air into occupied spaces -
Complaints of odors and nausea led to discovery of bathroom vents located at fresh air intakes

Roofing System Problems

- Evidence of high moisture in occupied spaces led to these rooftop discoveries



Improper drainage can result in severe water damage



Unintended rooftop pool and garden

Water Damage Sources



- **Roof Leaks**
- **Pipe Failures**
- **Spills**
- **Condensation**
- **Building Envelope Problems**
 - Soil in contact with building
 - Leaking irrigation
 - Drainage problems

Investigating Clinic Conditions



Inspect the Building Facade



Missing mortar provides points of water entry

Secure the building envelope from the elements



Mold resulted from poor window sealant

Inspect Roof and Drains



Broken condensate lines, clogged roof drains and downspout resulted in water leaks onto the ceiling of the Treatment Room



Inspect Plenum Above Ceilings



Condensation from un-insulated pipe and duct and broken water lines can lead to stains and mold on ceilings



Look for Hidden Conditions



Pipe leaks,
moisture, clogged
drains and hidden
mold are not
always obvious



Moisture Detection

Delmhorst® BD-2100 Moisture Meter

This versatile moisture meter features three scales -- for moisture measurement of wood (6% to 40%), a gypsum scale for measurement of sheetrock (0.2% to 50%), and a 0 to 100 reference scale for measurement of other non-wood materials. Results are shown on a digital display, and up to 100 accumulated readings can be averaged. A set-point alerts you when a pre-selected moisture content is reached.



Look for Hidden Conditions



An ideal cabinet interior and two deteriorated views showing acid damage and mold growth



Examples of Other Cabinet Issues



These salt deposits are often mistaken for mold, they are not a harmful contaminant but do indicate pipe leaks which can promote mold growth



Examples of Other Cabinet Issues



Fig. 1. Adult and larva fungus gnat

Moisture in cabinets and food sources in drains can promote populations of fungal gnats, very annoying to staff and patients and State Inspectors



Biology: Fungus gnats develop through complete metamorphosis: egg; larva; pupa; and adult. Development occurs in 2 to 4 weeks. Larvae feed primarily on fungi, decaying organic matter and plant roots, particularly in very moist environments. Larval and pupal stages can also, however, survive periods of drought. Fungus gnats normally follow a predictable cycle of population development: The first two generations are the largest, followed by a leveling off or decline in numbers.





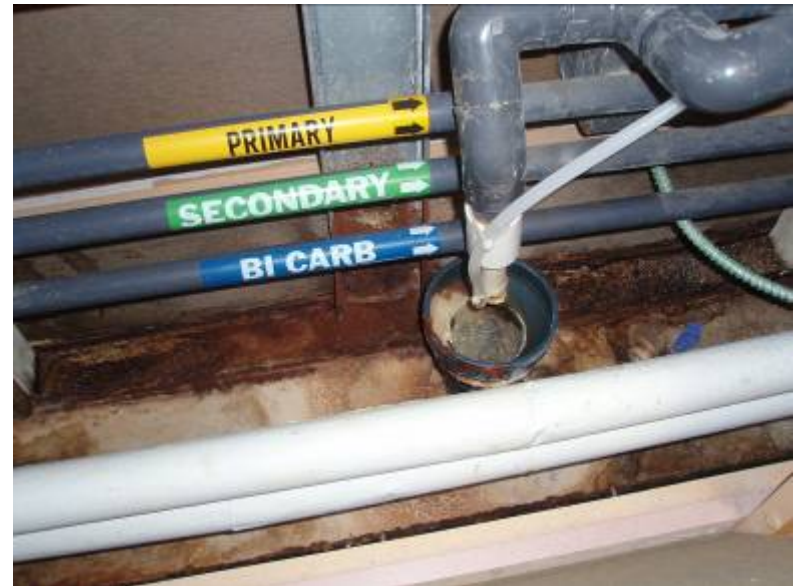
UC Statewide IPM Project
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Drain Treatment System



Automatic drain gel dispensing systems keep the drains clean, but wet conditions and food sources must be eliminated



Inspect the Entire Clinic



Sink cabinets can harbor mold, mechanical equipment rooms are often wet and neglected.



Water damage from adjacent Water Room

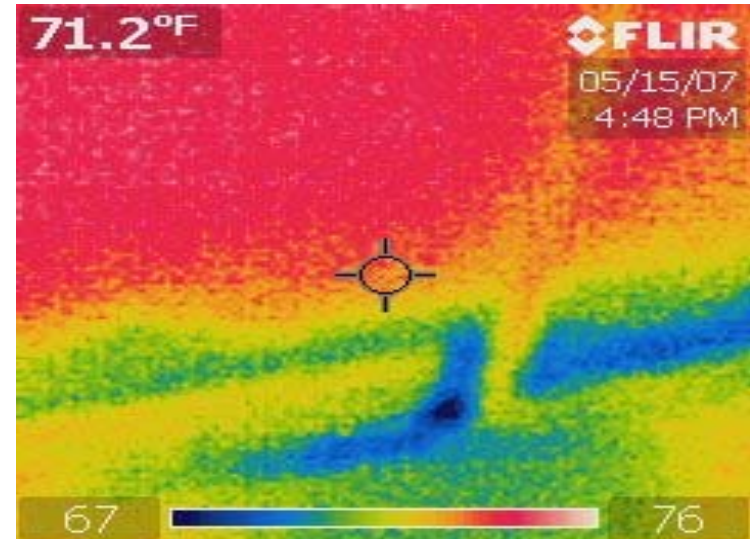
Preventative Maintenance is Important



Spills should be cleaned up quickly, otherwise damage can interrupt operations and be costly to repair.



Housekeeping Issues



Janitorial cleaning can create overly wet conditions that may result in hidden mold. Here damp sheetrock was revealed by inspecting with a Thermal Imaging camera.



Moisture Resistant Materials



Water resistant material instead of standard gypsum wallboard is recommended (e.g. U.S. Gypsum (FibreRoc[®] AquaTough[™])).

Placement of new sheetrock should allow an approximate 1/2" gap at floor level to minimize water wicking in the event of water pooling or other water incursion.



Preventative Measures

Moisture Management

- **Moisture control is critical to acceptable IAQ**
 - HVAC design and Operations & Maintenance
 - Building envelope defects (roof, windows, etc.)
 - Water incursion events (floods, leaks)
- **Mold growth requires**
 - Spores – which are present everywhere
 - Food Source – building materials
 - Temperature – heat
 - Moisture – damp/wet materials or relative humidity greater than 60%
 - *Which can be controlled?*

Cures for Common Moisture Problems

■ HVAC Systems

- Proper sizing
- Sealing of roof-mount penetrations
- Proper pan drainage
- Location and accessibility for maintenance
- Proper ductwork insulation
- Air intake locations
- Proper Operations & Maintenance

■ Building Exteriors

- Proper installation of window trims and seals
- Do not use vinyl wallpaper on interior of outside walls

Cures for Common Moisture Problems

- **Water Incursion Events**
 - Immediate response
 - Complete drying of materials
 - Wall cavities
 - Clean and disinfect materials
 - Discard materials that can not be cleaned
 - Remedial actions when mold growth occurs



Mold growth on gypsum board from capillary action after flood

Dealing with IAQ Issues - Assess, quantify, fix



■ Visual Observations

- Complete building walk through
- Exterior inspections
- Identify obvious contaminant sources
- Look for water damage and mold growth
- Note musty or moldy odors
- Proactive efforts
 - Proper operations and maintenance
 - Proper response to water incursions
 - Periodic inspections may be performed as seasonal “checkup” for buildings



Mold Cleanup

Mold Remediation Fundamentals

- **Remediation scope depends on amount of mold**
 - <25 ft² can be done by trained tech. staff
 - >30 ft² may require professional contractor
- **Primary Goals**
 - Remove microbiological reservoirs
 - Protect adjacent environments and occupants
 - Protect remediation workers
- **When to Remediate**
 - After moisture problem has been corrected
 - With a clearly defined scope detailing the work, sequence and methods

Mold Remediation Methods

■ Work Area Isolation



- Containment and isolation of work area depending on size and scope
- EPA recommends isolation for areas >30 ft² of visible mold
- Ventilation of work area with HEPA filtering
- Occupants typically vacated from work area and adjacent spaces

■ Remediation Worker Protection



- Workers use respirators, eye protection, protective gloves and disposable coveralls
- Remediation workers should be properly trained on the cleanup methods and use of personal protection

■ Cleaning & Reuse of Materials

- Non-porous and semi-porous materials that are structurally sound can often be cleaned and reused
- Cleaning with biocides

Mold Remediation Methods



- **Material Removal & Disposal**
 - Porous materials (ex. Ceiling tiles, insulation, wallboard) with more than a small area of mold should be removed and discarded
 - Use of disinfectants and HEPA vacuums is highly recommended to remove viable and non-viable mold spores
 - Contaminated materials should be removed from building in sealed plastic bags to avoid contaminating other areas
 - No special disposal requirements
- **How Clean is Clean?**
 - Most common question is “Can we start the build back?”
 - Clearance inspection and testing performed to determine completion
- **Follow-up**
 - Control moisture (cause should have been corrected prior to remediation)
 - Periodic inspections



Summary

- Mold often results from exposure of building materials to water.
- Mold can result in damage and a variety of clinic issues.
- Quick response to water intrusion is key in avoiding mold growth and amplification, first 24-48 hours are critical.
- Mold removal and building restoration is expensive and time consuming
 - Be Proactive – perform baseline surveys and implement moisture control plan!

Useful Web Sites

- National Association of Mutual Insurance Companies
 - www.moldupdate.com
- US EPA IAQ & Mold Information/Publications
 - www.epa.gov/iaq
- EPA IAQ Building Education & Assessment Model (I-BEAM) Software
 - www.epa.gov/iaq/largebldgs/index.html
- US Green Building Council
 - www.usgbc.org
- NYC Guidelines on Mold Assessment & Remediation
 - www.ci.nyc.ny.us/html/doh/html/epi/moldrpt1.html

Other Suggestions for Addressing Gnats:

- Clear/evaluate all drains/P traps
- Consider videography to ensure all pipes and drains are clear and no accumulation of biofilm
- Drain Gel (as discussed already)
- Consider automated drain injection system
- Pour bleach periodically down pipes (Bleach will deactivate chemical within Drain Gel)
- Consider micromesh screen for all drain spouts/drain roof units
- Consider splash guards for drains
- Review refrigerator condensate drip pans
- Evaluate potential food sources in facility (food in breakroom, etc.)
- Keep all trash cans covered.

























