ASSP 2020

Curious and Curiouser

Remarkable IAQ Case Studies

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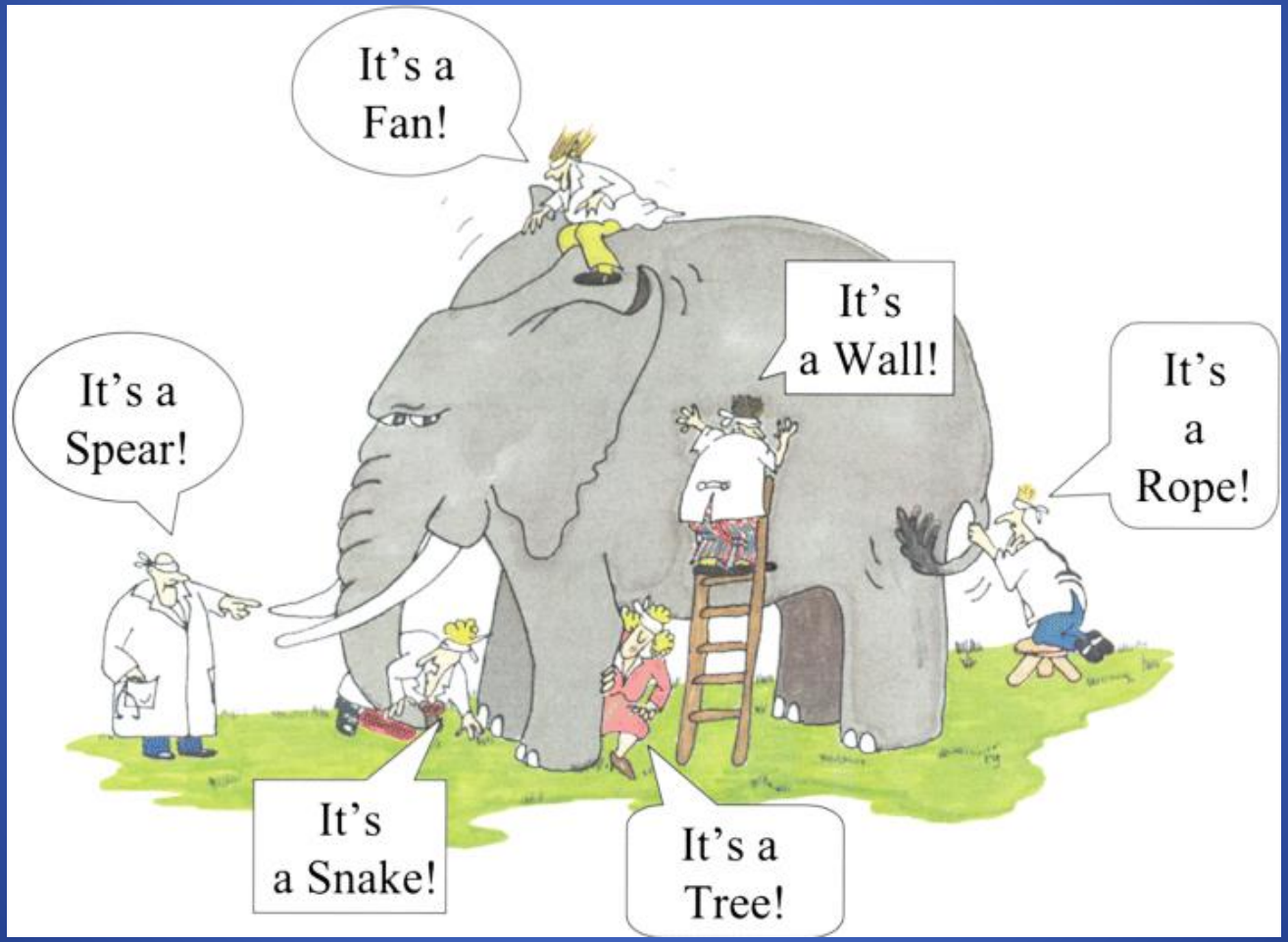
Presentation does not purport to represent current employer’s positions nor business

“One person can make a difference, and everyone should try.”

— John F. Kennedy

Same Paging for Collaborative Success



IAQ Frequent Problems

- 30 percent of new or remodeled commercial buildings
- High rates of health and comfort complaints from occupants

LEED Building Rating System

- Leadership in Energy and Environmental Design
  - Global certification
  - Resource efficient
  - Occupant health and comfort
  - Marketing advantage
- Professional credentialing

Indoor Air Pollution Causes

- Indoor or outdoor sources
- Poorly designed, maintained, or operated building or ventilation systems
- Unanticipated uses of the building

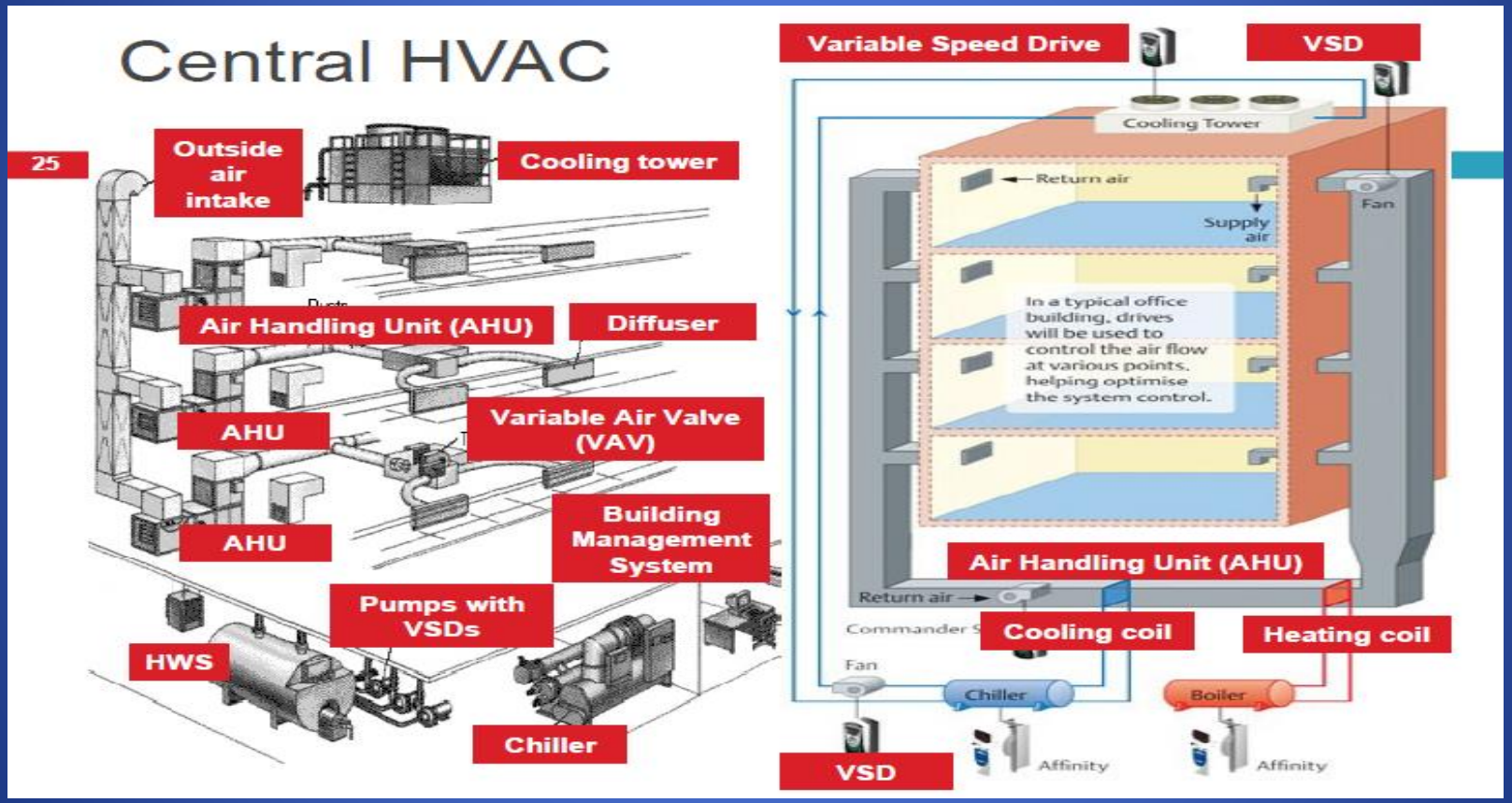
Common “Sick Building” Symptoms

- Headache
- Fatigue
- Mucous membrane irritation or dryness
- Allergy symptoms
- Nausea

Potentially More Serious Illnesses

- COVID19/viral/bacterial infection
- Legionnaire's Disease
  - Pontiac Fever
- Dermatitis or rash/fiberglass
- Carbon monoxide poisoning
- Asbestos
- Formaldehyde

Building HVAC



Slide Share: 2012, HVAC Energy Efficiency in Commercial Buildings, Alan Richardson

Building HVAC
#1 Building Operational Expense

Part of Solution

- Adequate fresh make up air
- Odor and contaminants control
- Temperature maintenance

Part of Problem

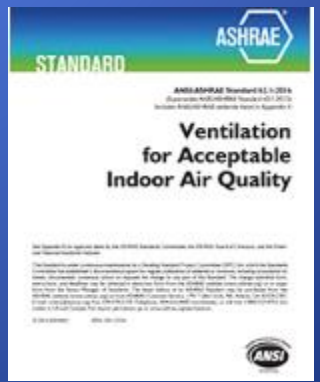
- Restricted make up air
- Poor temperature control
- Over/under humidification
- Spread contaminants
  - Mold and bacteria
  - VOCs, particulate and carbon monoxide
- Inadequate design
- Maintenance

Ventilation

Air Turnover and Make Up Air Adequacy

- Heating/cooling fresh make up air $$$$
- Fresh air intake restricted during hot and cold weather
- Increasing CO2 results in classic ambiguous sick building syndrome complaints
- HVAC on/off time matters

Organization	Carbon Dioxide (ppm)
US and CA OSHA Industrial	5000 ppm
ASHRAE 62.1 - 2016	700 above outside air (odor)
NIOSH Industrial REL	5000
NIOSH IAQ	Sensitive population 800
ACGIH industrial	5000



Ambient CO2 Levels Increasing

Climate Change: Atmospheric Carbon Dioxide

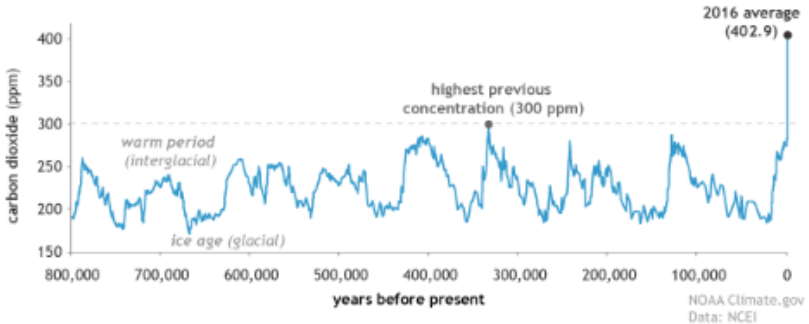
Author: Rebecca Lindsey

October 17, 2017

Print

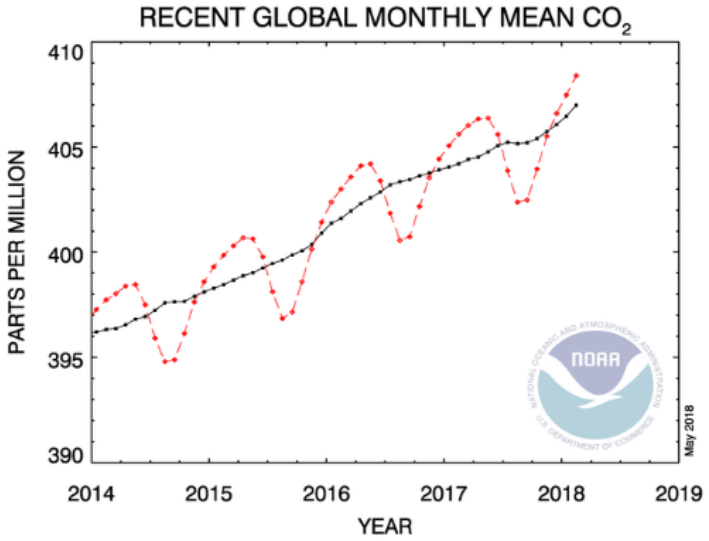
The global average atmospheric carbon dioxide in 2016 was 402.9 parts per million (*ppm* for short), with a range of uncertainty of plus or minus 0.1 ppm. Carbon dioxide levels today are higher than at any point in at least the past 800,000 years.

CO_2 during ice ages and warm periods for the past 800,000 years



Recent Global CO_2

February 2018: 408.39 ppm
February 2017: 405.61 ppm
Last updated: May 6, 2018



NOAA

Basic Building IAQ Evaluation

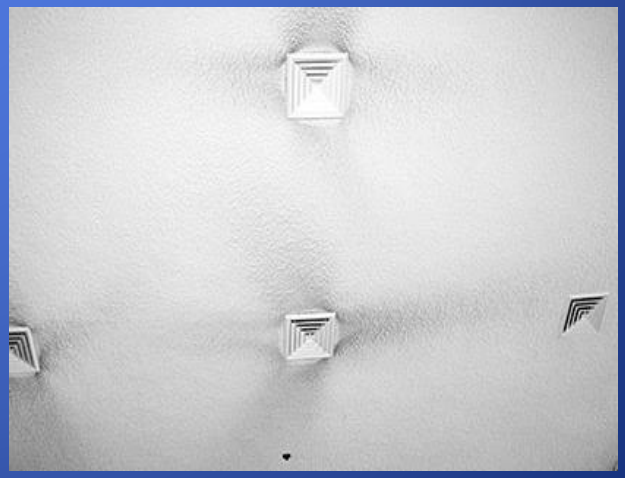
- Average day and during working hours
- Interviews of complainants and others
  - Health and comfort
    - Pre-existing condition
    - New symptoms
    - How many complainants?
      - Commonalities
- Building tour includes roof too!
- Overall air quality plus any identified contaminants
- Location
  - Entire premises vs. Areas
  - Inside vs. outside
- Symptom time frame
  - Ongoing vs. new
  - Event or day or time of day related

Common IAQ Equipment

- Carbon dioxide
- Carbon monoxide
- Temperature and RH
- Moisture meter
- Mold/bacteria sampling equipment
- Air samplers for VOCs or dust
- Calibration, condition, chain of custody

Common Complaints

- Temperature and Humidity
  - ASHRAE 55 range
    - 68.5°F to 75°F in the winter
    - 75°F to 80.5°F in the summer.
  - Perimeter vs. interior
  - RH 30-60%
  - Air dryer in winter/colder months
    - Humidification pros and cons
- Dust around supply vents



Overhangs

- Overhanging spaces colder
- Monitor employee supply vent adjustment
  - Particularly during or after renovations

Renovations with Heavy VOCs

- Large mfg. location
- Friday night floor stripping and recoating
- No weekend ventilation
- Monday morning emergency response

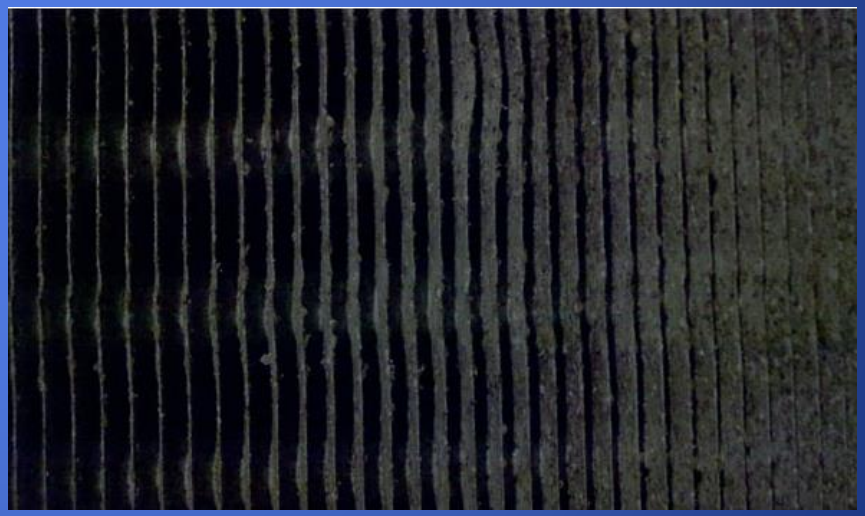
Pressure Differentials

- Garages
  - Carbon monoxide
    - Positive pressure
    - CO monitoring fan activation
- Building drains
- Pipe and utility chases

Change of Season

Heat Register Dust

Dirty Sox Smell Cooling Coils



Fiberglass Insulation

- Spray on building members above the suspended ceiling
  - Renovations shake fibers loose
  - Loose ducts blow fibers
  - Skin rash
- Duct lining

Vapors and Dust

New Partitions Off Gassing

Building Renovations

Industrial Building HVAC Failure

- Hot July Day
- HVAC Failure
- 350 Employees walked out
- Press “Fake News”

Furniture and Carpet

- Fire retardants-contact

- Mid 1990's
  - Carpet and mastics VOCs
  - 4 PC byproduct of backing polymerization
- LEED emission limits
- Most flooring and adhesive manufacturers now pursue both Green Label Plus, Greenguard, and FloorScore certifications
- Extra ventilation after installation

Outside Sources

- NO idling at the loading dock.
  - Signage and enforcement
- Positive pressurization in receiving area
- No outdoor air intakes in vicinity

Rooftops

- Sanitary, cooking, and other building exhausts should be away from the outdoor air intake.
- Roof repair
  - Hours consideration
  - HVAC management
  - Employee concerns

Confined Spaces
Low Oxygen or Contaminants

- Steam pipe tunnels
- Water valve pits
- Ground vaults
- Repair pits
- Boilers

Neighborhood

Silica Dust From Adjacency

VOCs Intrusion from Neighboring Paint Manufacturer

Carbon Monoxide Combustion Process

- Product of combustion
  - Heating
    - Air
    - Water
  - Cooking
  - Vehicles

Organization	Carbon Monoxide Limit (ppm)
US OSHA	50
CA OSHA	25
ACGIH	25
ASHRAE	9
NIOSH REL	35

Carbon Monoxide
High Rise Office

New York State CO Detection Law

- Restaurants and commercial spaces
  - Legal seafood 2014 incident
    - Leaky flue
- Mid 2016 compliance
- Detection hard wired – new
- Battery acceptable for existing

Restaurant Hot Water Heater

Laboratories - Urine Allergy

- 10-45% of laboratory animal workers report allergy symptoms
  - Urine; nanograms/m3
  - Severe condition for small %
- Controls
  - Substitution
    - In vitro vs. live animals
    - Female rats vs. males
  - Enclosure /caging and ventilation upgrades
  - Personal protective equipment and clothing
  - Administrative controls
    - Access and handling
    - Medical monitoring and allergy testing

Mold

- Result of water and moisture intrusion
  - Floods (Stachybotrus)
  - Leaks
    - Windows
    - Sub grade spaces
    - Landscape automatic watering
  - Humidity
    - Building envelope problems
    - Poor HVAC controls
    - Excessive humidification
- Allergic reactions and asthma
- Dry water-damaged areas and items within 24-48 hours to prevent mold growth
- Air monitoring compares results to outside air and other building areas

Mold Remediation

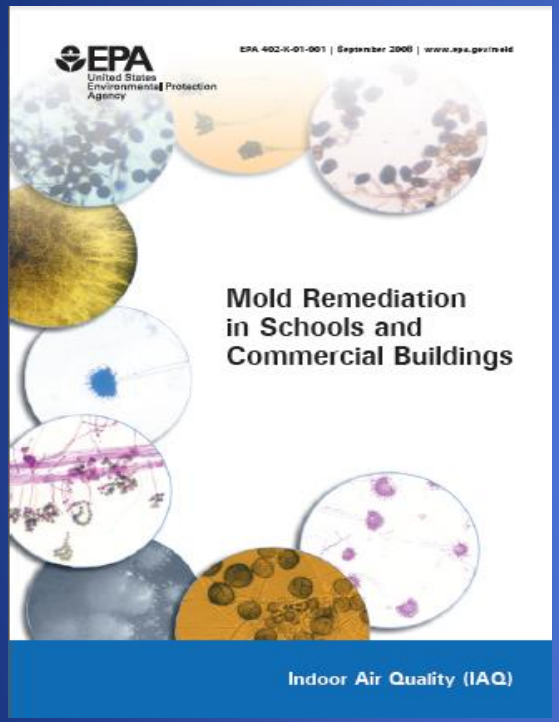


Table 2: Guidelines for Remediating Building Materials with Mold Growth Caused by Clean Water*

Material or Furnishing Affected	Cleanup Methods†	Personal Protective Equipment	Containment
SMALL – Total Surface Area Affected Less Than 10 square feet (ft²)			
Books and papers	3	Minimum N-95 respirator, gloves, and goggles	None required
Carpet and backing	1, 3		
Concrete or cinder block	1, 3		
Hard surface, porous flooring (Linoleum, ceramic tile, vinyl)	1, 2, 3		
Non-porous, hard surfaces (Plastics, metals)	1, 2, 3		
Upholstered furniture & drapes	1, 3		
Wallboard (Drywall and gypsum board)	3		
Wood surfaces	1, 2, 3		
MEDIUM – Total Surface Area Affected Between 10 and 100 (ft²)			
Books and papers	3	Limited or Full Use professional judgment, consider potential for remediator exposure and size of contaminated area	Limited Use professional judgment, consider potential for remediator/occupant exposure and size of contaminated area
Carpet and backing	1, 3, 4		
Concrete or cinder block	1, 3		
Hard surface, porous flooring (Linoleum, ceramic tile, vinyl)	1, 2, 3		
Non-porous, hard surfaces (Plastics, metals)	1, 2, 3		
Upholstered furniture & drapes	1, 3, 4		
Wallboard (Drywall and gypsum board)	3, 4		
Wood surfaces	1, 2, 3		
LARGE – Total Surface Area Affected Greater Than 100 (ft²) or Potential for Increased Occupant or Remediator Exposure During Remediation Estimated to be Significant			
Books and papers	3	Full Use professional judgment, consider potential for remediator exposure and size of contaminated area	Full Use professional judgment, consider potential for remediator/occupant exposure and size of contaminated area
Carpet and backing	1, 3, 4		
Concrete or cinder block	1, 3		
Hard surface, porous flooring (Linoleum, ceramic tile, vinyl)	1, 2, 3, 4		
Non-porous, hard surfaces (Plastics, metals)	1, 2, 3		
Upholstered furniture & drapes	1, 3, 4		
Wallboard (Drywall and gypsum board)	3, 4		
Wood surfaces	1, 2, 3, 4		

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CLEANUP METHODS

Method 1: Wet vacuum (in the case of porous materials, some mold spores/fragments will remain in the material but will not grow if the material is completely dried). Steam cleaning may be an alternative for carpets and some upholstered furniture.

Method 2: Damp-wipe surfaces with plain water or with water and detergent solution (except wood—use wood floor cleaner); scrub as needed.

Method 3: High-efficiency particulate air (HEPA) vacuum after the material has been thoroughly dried. Dispose of the contents of the HEPA vacuum in well-sealed plastic bags.

Method 4: Discard – remove water-damaged materials and seal in plastic bags while inside of containment, if present. Dispose of as normal waste. HEPA vacuum area after it is dried.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

Minimum: Gloves, N-95 respirator, goggles/eye protection
Limited: Gloves, N-95 respirator or half-face respirator with HEPA filter, disposable overalls, goggles/eye protection
Full: Gloves, disposable full body clothing, head gear, foot coverings, full-face respirator with HEPA filter

CONTAINMENT

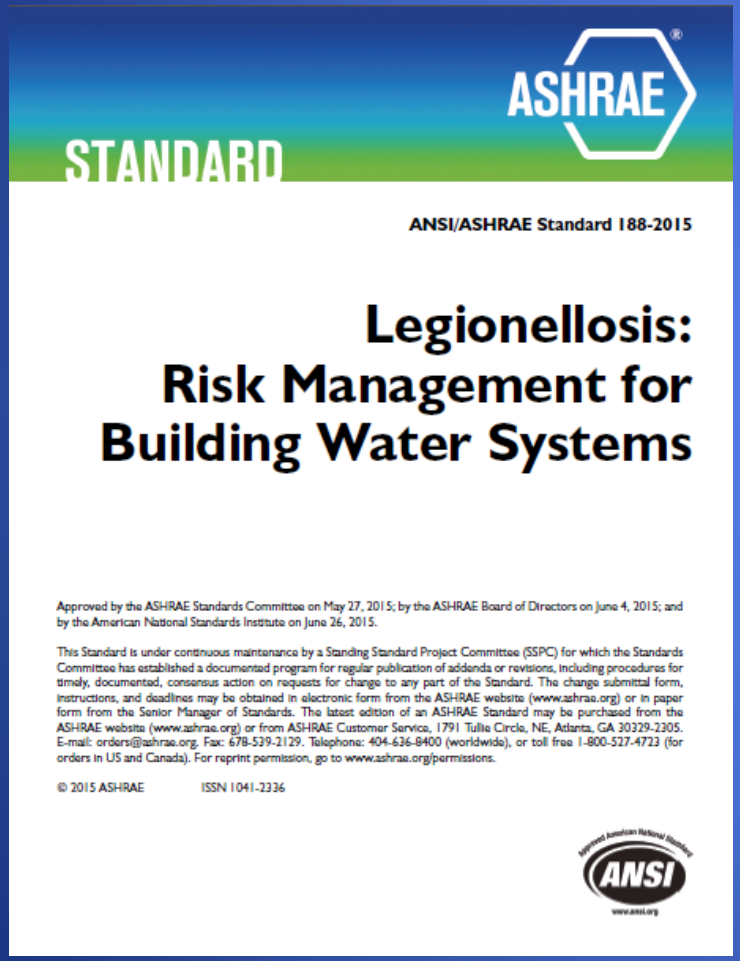
Limited: Use polyethylene sheeting ceiling to floor around affected area with a slit entry and covering flap; maintain area under negative pressure with HEPA-filtered fan unit. Block supply and return air vents within containment area.

Full: Use two layers of fire-retardant polyethylene sheeting with one airlock chamber. Maintain area under negative pressure with HEPA-filtered fan exhausted outside of building. Block supply and return air vents within containment area.

Brick Fluorescence

- Salts in the brick and mortar dissolve in rainwater that wicks through the brick
- Water evaporates and salts crystallize

Legionnaire's Disease and Pontiac Fever



ASHRAE

STANDARD

ANSI/ASHRAE Standard 188-2015

Legionellosis: Risk Management for Building Water Systems

Approved by the ASHRAE Standards Committee on May 27, 2015; by the ASHRAE Board of Directors on June 4, 2015; and by the American National Standards Institute on June 26, 2015.

This Standard is under continuous maintenance by a Standing Standard Project Committee (SSPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the Standard. The change submittal form, instructions, and deadlines may be obtained in electronic form from the ASHRAE website (www.ashrae.org) or in paper form from the Senior Manager of Standards. The latest edition of an ASHRAE Standard may be purchased from the ASHRAE website (www.ashrae.org) or from ASHRAE Customer Service, 1791 Tullie Circle, NE, Atlanta, GA 30329-2305. E-mail: orders@ashrae.org. Fax: 678-539-2129. Telephone: 404-636-8400 (worldwide), or toll free 1-800-527-4723 (for orders in US and Canada). For reprint permission, go to www.ashrae.org/permissions.

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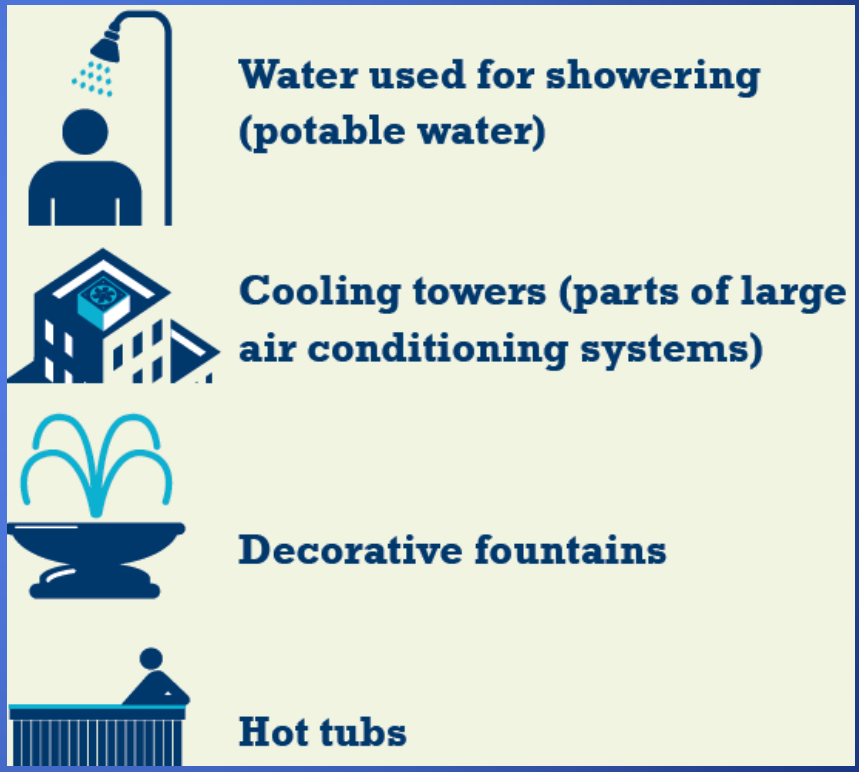

Water used for showering (potable water)

Cooling towers (parts of large air conditioning systems)

Decorative fountains

Hot tubs

Legionnaire's Disease

- In 1976, American Legion members who attended a Philadelphia convention, suffered from an unusual pneumonia. Outbreaks still occur today
  - 2015 Bronx outbreaks
- Cooling towers contain large amounts of water and are potential breeding grounds for *Legionella* bacteria if they are not properly disinfected and maintained.

NYC Cooling Tower Regulations

Cooling Tower Registration and Maintenance

Free Trainings

Property managers and building operators can attend free, two-hour trainings to learn how to comply with the City's cooling tower maintenance laws.

If you are interested in hosting a training session, email **CTAcademy@health.nyc.gov**, with the subject line "Hosting Request".

In response to the 2015 outbreak of **Legionnaires' Disease** that was attributed to cooling towers, the City requires all building owners to register, maintain, and test their cooling towers, fluid coolers, and evaporative condensers.

Registration and Annual Certification

Building owners and property managers are required to register cooling towers, fluid coolers and evaporative condensers with the City. If you own or manage cooling towers, fluid coolers, or evaporative condensers, you must register them through Cooling Tower Web Portal.

In addition to initial registration, building owners must file an Annual Certification each year attesting that all cooling equipment was inspected, tested, cleaned and disinfected in accordance with the **Maintenance Program and Plan (MPP)**. The certification must document any lapses in compliance with the MPP, as

Hot Tub Legionella

- CDC reports that poorly maintained hot tubs are the third most common water source implicated among Legionnaires' disease outbreaks
  - Improper filter maintenance
  - Deficient disinfection levels
  - Inadequate monitoring
  - Poor temperature control and ventilation.

Dieffenbachia (Dumb Cane)

- Receptionist complaint of mouth numbness and tingling
- Large dieffenbachia display nearby
  - Receptionist care
- Calcium oxalate crystals and sap cause inflammation

IAQ Management

- Adequate design
- Source control
- Ventilation improvements
- Air cleaners
- Maintenance
  - Checks and balances

EPA I- BEAM and Other Resources

Indoor Air Quality Building Education and Assessment Model

The Indoor Air Quality Building Education and Assessment Model (I-BEAM), released in 2002, is a guidance tool designed for use by building professionals and others interested in indoor air quality in commercial buildings.

What is I-BEAM? | How Does I-BEAM Work?

How Does I-BEAM Work?

There are three types of modules which incorporate what is I-BEAM.

1. **Visual Reference Modules**: The Visual Reference module contains pictures of IAQ problems and solutions. Learn about the IAQ issues contained in each picture by clicking on a "hot button" contained on the pictures. You may find explanations in text, or in other visual guides which show air movement flows, or pollutant flows as various elements in the building are changed.
2. **Text Modules and Links**: Text modules contain text material only, along with links to other parts of I-BEAM for more explanation and information. Click on one of the main menu topics, and a submenu of that topic appears, along with the main page for that subject. You can access the information in one of two ways. The text screen contains a detailed table of contents that will link you directly to the detailed subject matter identified. Or, you can scroll down the text screen for all the text material contained in that module.
3. **IAQ Budget and Accounts Module**: All of the modules on the CD-version in the IAQ Budget and Accounts module are interactive. *To use all the features in the Budgets and Accounts module you must have a copy installed, however,* ***this CD-ROM is no longer available****.*

QUESTIONS?