

Indoor Environmental Quality- Briefly

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Who is here and what are your concerns???

- What are your locations?
- What are the symptoms that employees are experiencing?
- What has been the history of the workplace?
- What has been the response to concerns?
- What has actually been changed in the building?

Lots of Questions, are there answers?

Sometimes it is difficult to find the people who know about the history of the building, building systems

Management and the union safety committee should be working together to get the answers and resolve issues

Step by step guides are available in the EPA document Tools for Schools Action Kit

Indoor Environmental Quality (IEQ)

- Health inside buildings is more than just the air- interiors are complex environments with many factors that impact the health of occupants

Health Impacts of the Indoor Environment

- People now spend up to 90% of their time indoors
- People may be inactive, working with chronic health conditions
- Workplace is more stressful
- What illnesses are *caused* by the indoor environment? Versus common conditions people get, lifestyle, genetics, etc.

Potential Health Problems in Buildings

- Chemicals in the air- these are usually in the form of molecules-VOC's, acids, etc.
- Particulates- dust, smokes, very fine particles
- Bioaerosols- either of the above, but usually particles that came from living organisms
- Environmental Factors- lighting, ventilation, heat, cold, radiation
- Social Factors- stress

Building Problems- CDC/NIOSH

- Most common- Sick Building Syndrome (SBS), no diagnosable problem, many general complaints- headache, tiredness, irritation, etc.
- Building Related Illness- (BRI)

There is a diagnosable illness connected to conditions in the building-Legionnaires disease, asbestosis are examples- not common

In general, 5 factors cause indoor environmental problems and concerns

1. Poor ventilation, due to inadequate fresh air from outside being pulled into building, not one specific pollutant, and poor filtration
2. Dirty, lack of custodial care, due to inadequate cleaning- short staffing
3. Too hot, too cold
4. Chemical sources- printing, custodial, diesel in incoming air, many others

5 IEQ concerns

5. Moisture and high relative humidity leading to microorganism growth, dust mites, roaches

Often, poor IEQ is caused by a combination of these factors, none of which is particularly extreme- no Eureka moment!

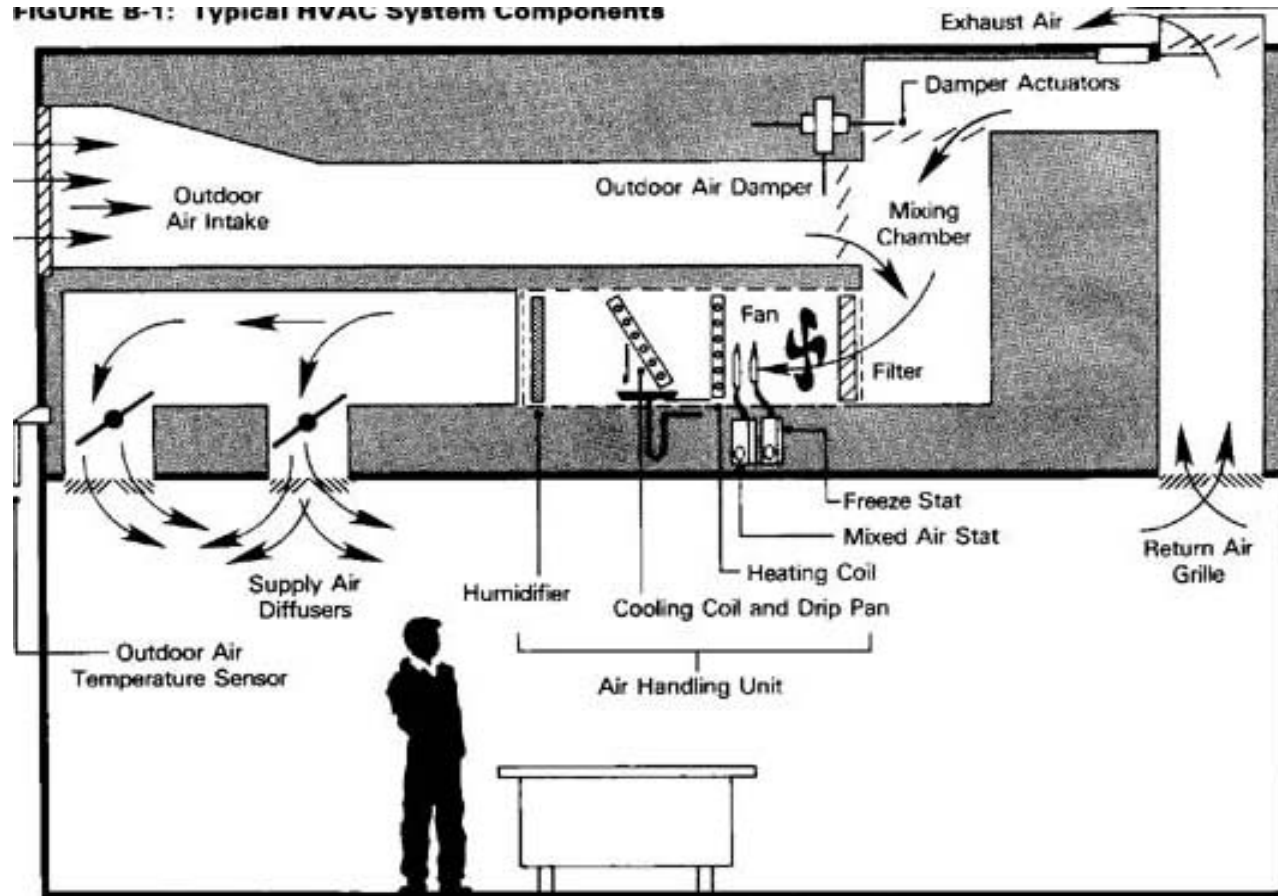
Hard to solve- what do you change?

The HVAC system

- Heating, Ventilating, Air-Conditioning
- These three systems are independent- can have poor air quality with properly tempered air, air can be too hot or too cold and poor quality, or the temperature may be uncomfortable with good air quality
- What are the systems in your workplace?

HVAC System Components

FIGURE B-1: Typical HVAC System Components



Basic ventilation

- Proper ventilation should supply air with acceptable temperature, humidity, and air quality
- Starts with outdoor air- is it clean?
- Normal treatment- filtration
- Adequacy of filtration? Can remove molds, pollen, dander, other particulates if adequate



Ventilation, continued

- Air is filtered on entering ventilation system
- Huge range of filtration quality
- See through fiberglass filters vs HEPA
- 10% vs 99.97% filter efficiency
- Good- 30-90% efficiency (MERV value 7-11)
- No good- 10-20%
- Why filters? To remove mold, pollen, dust



Ventilation, continued

- Outdoor air is mixed with recirculated indoor air
- What is the percentage of recirculated air?
- Should not be more than 85%, except under exceptional extremes of temperature- so at least 15 % fresh air
- Economizer- 100% outdoor air
- Air is then heated or cooled, delivered to spaces- is it well distributed? “Dead zones”

Ventilation, continued

- Carbon dioxide measurements can help determine if ventilation is adequate- basic first test
- Standard, from American Society of Heating, Refrigerating, And Air-Conditioning Engineers, (ASHRAE) is that carbon dioxide should be less than 700 parts per million plus outdoor level, or around 1100 ppm.

Carbon dioxide check of air supply diffuser- should be the freshest air in the building



Ventilation, continued

- In fact, we prefer more fresh air, so that carbon dioxide is below 800 parts per million
- Another way of expressing standard- 10 cubic feet of fresh air per person per minute, in most school spaces
- Ventilation for Acceptable Air Quality- ANSI/ASHRAE 62.1-2016

ASHRAE 62, copyrighted and costs \$'s, very technical



ANSI/ASHRAE Standard 62.1-2013
(Supersedes ANSI/ASHRAE Standard 62.1-2010)
Includes ANSI/ASHRAE addenda listed in Appendix J

Ventilation for Acceptable Indoor Air Quality

See Appendix J for approval dates by the ASHRAE Standards Committee, the ASHRAE Board of Directors, and the American National Standards Institute.

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 Manager of Standards. The latest edition of an ASHRAE Standard may be purchased from the ASHRAE Web site (www.ashrae.org) or from ASHRAE Customer Service, 1791 Tullie Circle, NE, Atlanta, GA 30329-2305. E-mail: orders@ashrae.org. Fax: 404-321-5478. Telephone: 404-436-8400 (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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Testing for indoor air quality

- Indoor air quality meters are readily available which can measure carbon dioxide, temperature, relative humidity, and carbon monoxide
- Smoke tubes for air flow and distribution
- Length of stain detector tubes for chemicals
- Moisture meters for dampness, water in materials such as drywall, wood, carpets

Temperature and Humidity

- Supply air must be tempered- ASHRAE has a standard for temperature-with proper clothing for the season!
- Hard to satisfy more than 80% of occupants
- Use thermometers and logs to record- can be adjusted by working with management, building engineers.
- ANSI/ASHRAE 55-2013- Very technical

Temperature

- Winter- 68-74 degrees, with 60% relative humidity (RH)
- Summer- 73-79 degrees, at 60% RH
- Must be dressed appropriately- no tee shirts in winter or sweaters in summer
- Temperatures generally centrally controlled- to prevent dueling thermostats

Humidity

- Critical for mold growth, >65 % Relative Humidity, mold will grow
- Controlled by air conditioning, dehumidifiers- only work if building is kept sealed up- no open windows
- Moist air leads to mold growth, odors

Humidity continued

- Due to dangers of legionnaires disease, humidity almost never added
- Dry air causes mucous membrane irritation, respiratory irritation, colds- winter
- Ideally, humidity kept in 30-60% relative humidity (RH) range

Temperature and Humidity

- Inexpensive digital meters available to measure temperature and humidity

Chemical Contamination of Air

- Thousands of potential contaminants
- Come from indoors and out
- Where are the air intakes, and are they protected?
- What products are used in the building?
- What processes occur- printing, copying, art, science, custodial care, renovation, etc.

Surveying for chemical contamination

- Use your eyes and nose
- Look for chemical containers, open sources
- With good ventilation, the inevitable low levels should be diluted and removed from the building- that is the point of the ventilation system
- Higher levels may need to be specially exhausted- toilets, copiers, fume hoods, etc.

Dealing with chemicals

- Remove, isolate, or diminish the source
- Ventilate
- Substitute- water-based for solvent-based paint
- Sampling- methods are generally available to assess levels if needed- contact union or management

OSHA/NYS-DOL PESH and Chemicals

- OSHA/PESH has standards for many chemicals- speed limits
- Called PEL's- permissible exposure limits
- VERY rare for IEQ issues to involve PEL's, or even come close
- Exception- high hazard chemicals, like asbestos, lead, hydrogen sulfide (sewer gas)

Construction and Renovations

- Often a cause of concerns
- Communication about project from first conception is paramount
- Scope, timing, controls, etc
- Committee process all during planning, scheduling, and actual work
- Set up process for questions and complaints

Construction and Renovation

- Sometimes people must be relocated from area
- Sometimes temporary barriers and enclosures will be adequate- to control odors and noise
- Negative pressure in work zone- exhaust
- Test with pressure gauges or smoke
- Noise and vibration? Hard to isolate

Construction Issues

- Chemicals- Many types and sources
- Paints, welding fumes, glues, formaldehyde in wood products, asbestos, lead, PCB's in caulk, cement dust, VOC's
- Noise- can be extreme
- Vibration

People want to know what is happening and how long

Negative air and isolation





Think Fungi...

Mold, Mildew and Fungus- same thing

- Molds and mildew are fungi, which includes yeasts, mushrooms, rusts, etc.
- >100,000 species, grow everywhere, as normal part of environment
- We breathe in mold every breath we take from the first to the last!
- Not normally a problem- except for allergy

Mold growth

- Molds need temperatures from 40-100 F. to grow
- Molds need moisture or dampness
- Molds need carbon and other nutrients- for food
- This food is everywhere- even a dirt smudge on concrete or steel
- Prefer wood, paper, cardboard, dust



Mold and Fungus, continued

- Molds can spread by spores, which are microscopic seeds
- Spores float in the air, especially in warm moist weather, tens of thousands of mold spores in a cubic meter outdoors
- Always in the air, some are removed by air filters

What is dust?

- Lots of pollen, mold spores, bacteria
- Mold spores are waiting for water to grow
- Dead spores are foreign protein, this alone causes allergy in sensitive people, if they get airborne
- Dust and mold spores also come in on feet
- Many allergens and irritants

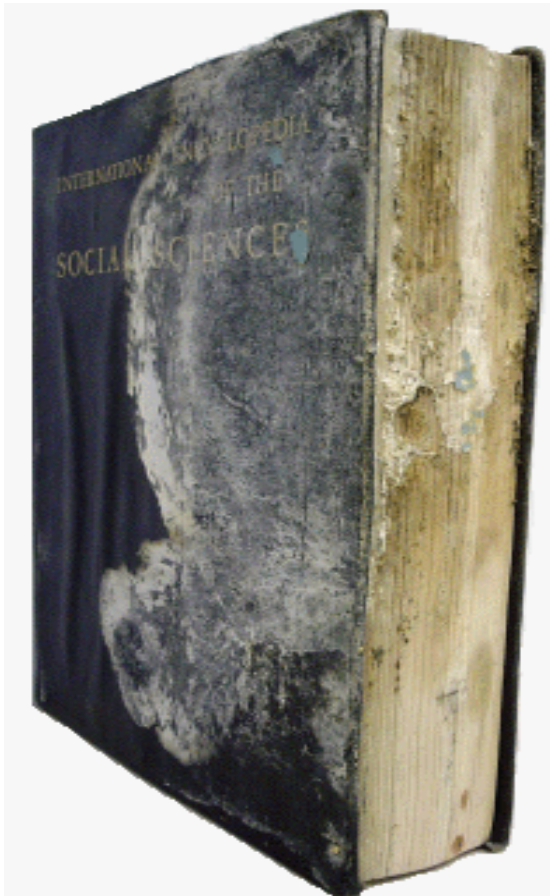
Dust, continued

- Normal cleaning and filtration should remove dust, so that most studies have shown that indoor air in commercial buildings is cleaner than air in homes- higher levels of filtration, no pets, etc.
- Dust has many other constituents such as rock, soot, plant parts, skin, insect parts- all bad

When are microorganisms a problem?

- When there is visible growth or odors
- When there is significant water damage
- If people are hypersensitive- tests can confirm
- Mold allergy is not as widespread as allergy to pollens, cats, dogs, mice, roaches
- Bacteria and mycobacteria part of the problem, not just fungus/mold

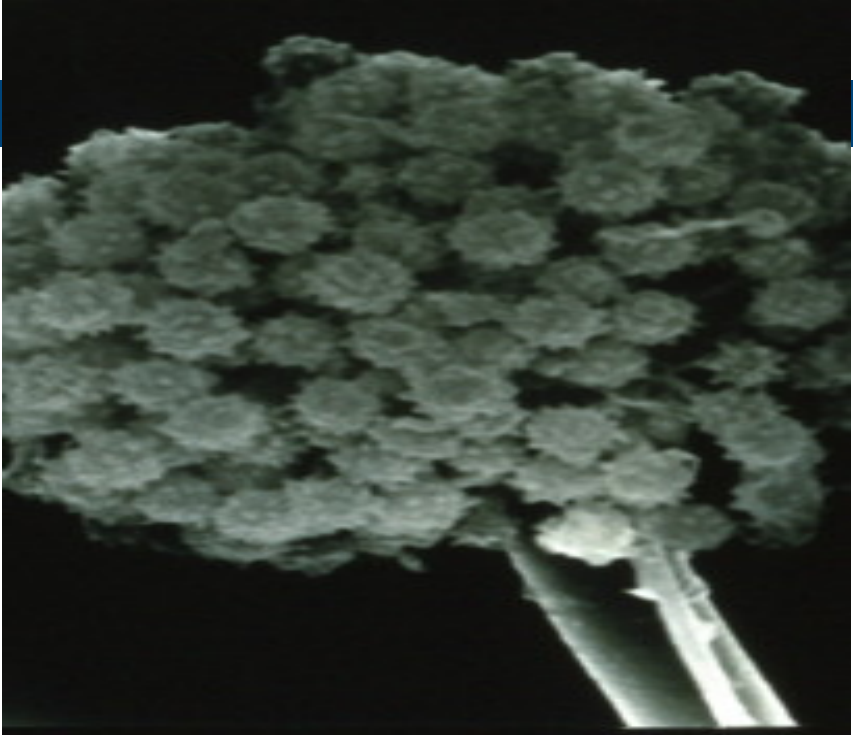
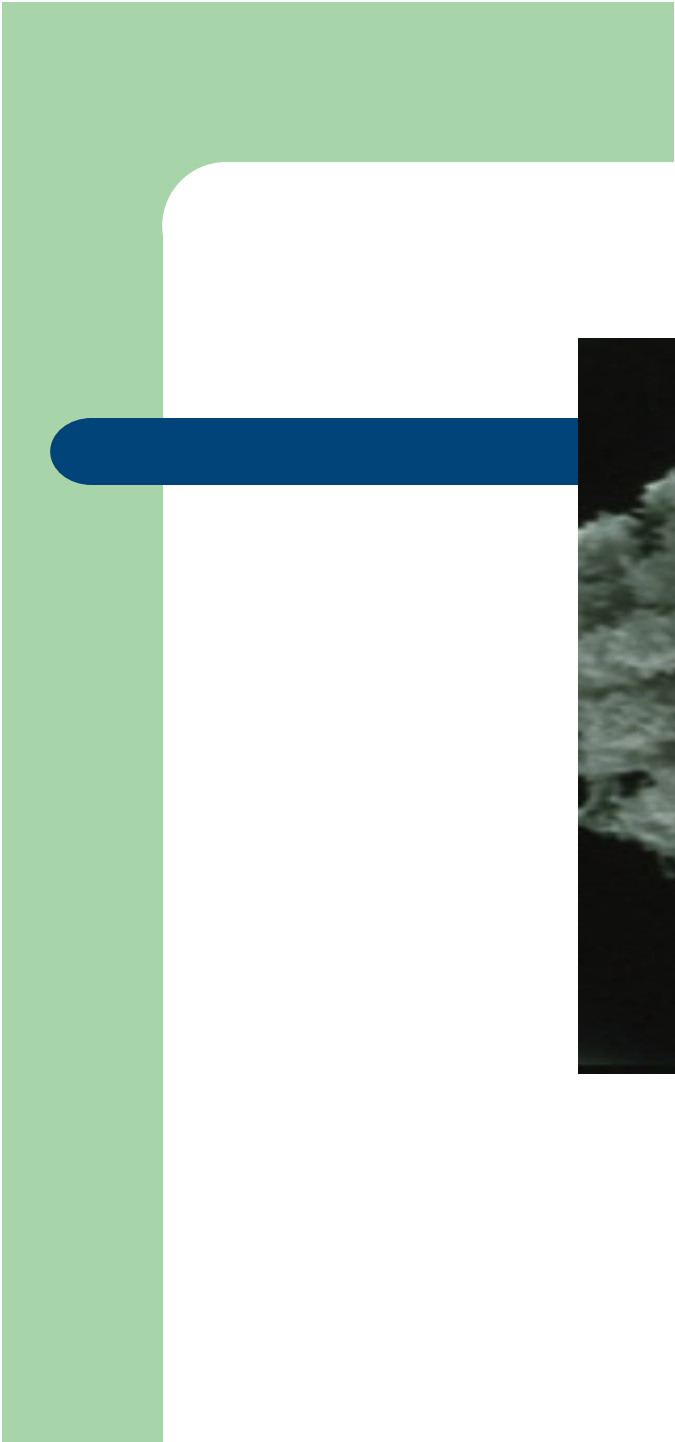
Water damage and mold growth





Allergy to fungus

- Fungal allergy estimated at 10% of all people
- Asthmatic response from 5% of people to mold and fungus
- Generally takes higher levels
- All fungus, mold, mildew bad if growing in buildings



How can you detect mold and microorganism growth?

- Visible growth- all colors, white, black, grey, green, yellow, red, orange
- Odors
- Moisture meters
- Technical sampling- culture, spore traps, vacuum, microscopic, bulks, etc.
- Should compare indoor vs outdoor levels, and complaint vs non-complaint areas

Pin type moisture meter



Mold testing

- Use nose, eyes, look for water damage, growth
- Use moisture meters
- Mold testing not recommended by most competent authorities, but some contractors and labs make lots of money on it
- No accepted standards for mold, no regulations

Water Problems

- Fungi is limited indoors by the availability of moisture
- Water can come from condensation due to low temperatures or high humidity, roof, window or wall leaks, plumbing leaks, moisture sources such as showers and cooking, soil in basements, foundation leaks and floods

Water problems

- Water and moisture also encourages the growth of bacteria, mycobacteria, roaches, mice, dust mites, etc.
- Dampness in buildings is unhealthy
- Stop the moisture problem!
- Water is a toxic substance?

Water is the problem



"When the waters subside, the problem's going to be mold."

What can be done about water problems?

- Immediately address water problems
- Immediately and aggressively dry wetted materials- fans, heaters, dehumidifiers
- Repair and replace water damaged materials

Aggressive response to water intrusion needed to prevent mold



Sources of Assistance

- Your local union/management safety committee should be the starting point for iaq discussions and investigations of concerns
- Take complaints seriously and investigate
- Familiarize yourself with EPA's Tools for Schools Action Kit, lots of checklists and other helpful tools
- Higher levels of technical assistance available

Sources of Information/Assistance

NYSUT/UUP H & S- Wendy Hord

- Your nearest NYS Occupational Health Clinic
- NYS-DOH
- IAQ issues are almost never an OSHA/PESH concern- due to high PEL's, no biological standards- exception- "serious health hazards"- legionnaires, asbestos, radon, extensive mold growth, PCB's, lead, etc.

IEQ References

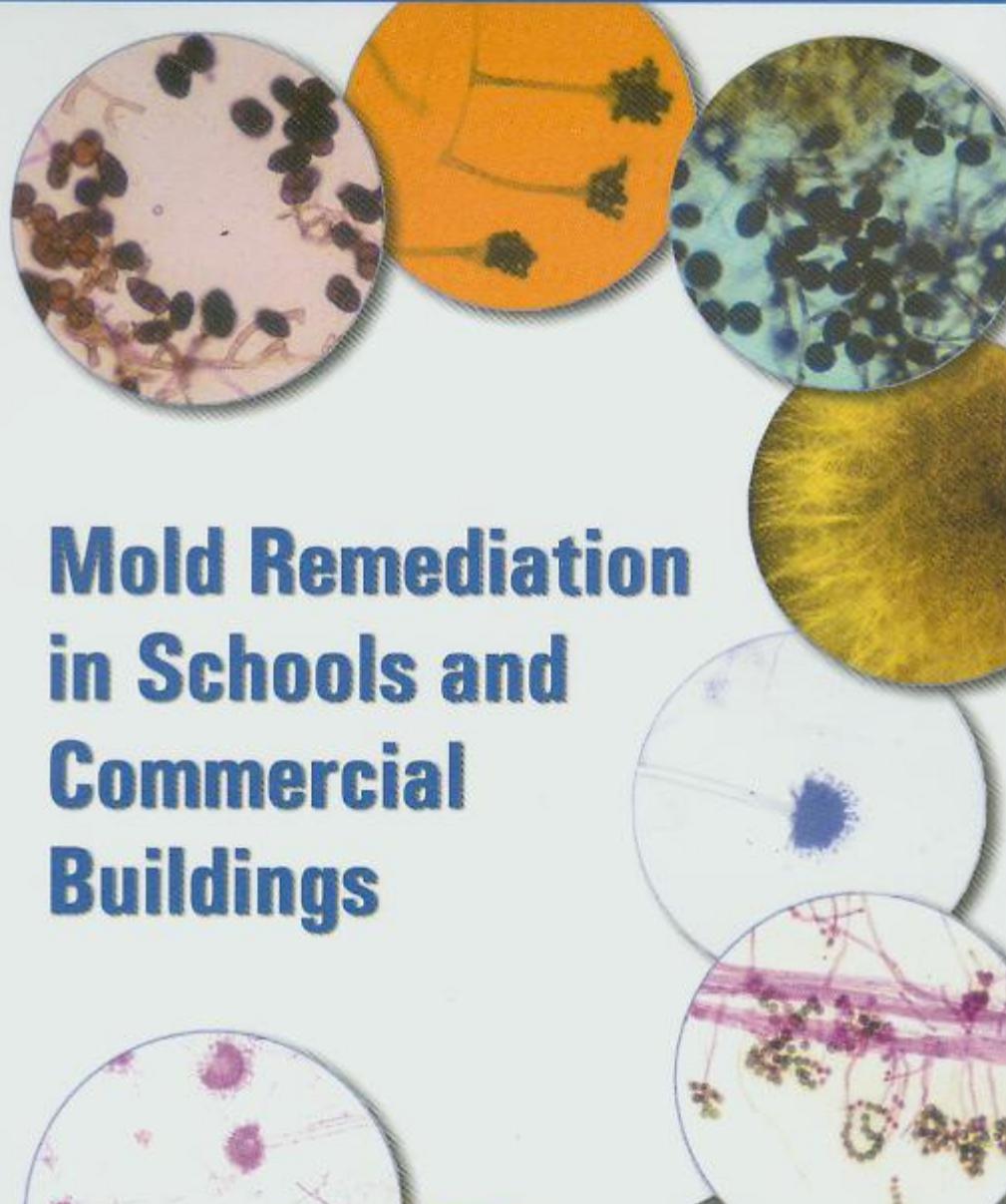
- ANSI/ASHRAE 62.1-2016, Ventilation for Acceptable Air Quality, American Society of Heating, Refrigeration, and Air Conditioning Engineers, Inc. Atlanta 2016
- ANSI/ASHRAE 55-2013, Thermal Environmental Conditions for Human Occupancy, ASHRAE, Atlanta 2013
- Mold Remediation in Schools and Commercial Buildings, US-EPA 2001, available on the web
- Building Air Quality, A Guide for Building Owners and Facilities Managers, US-EPA 1991, and IAQ Action Plan, 1998, available on the web



United States
Environmental Protection
Agency

Office of Air and Radiation
Indoor Environments Division
(6609J)

EPA 402-K-01-001
March 2001



Mold Remediation in Schools and Commercial Buildings

Online Resources

- www.osha.gov
- www.cdc.gov/niosh
- www.epa.gov/iaq
- Many state and local health departments- see California, Minnesota and New York City for iaq, mold

Online resources, continued

- University websites- see especially University of Minnesota for general indoor air quality and maintenance issues