

INDOOR AIR QUALITY

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OBJECTIVES

- Review what we know about IAQ (“sick building syndrome”)
- Typical causes of problems – fixes
- Chemical monitoring – direct and non-direct reading: limitations and tips
- Microbial pollutants – limitations and tips
- AIHA Professional Analytical Testing Program (PAT)
- Questions and Discussion



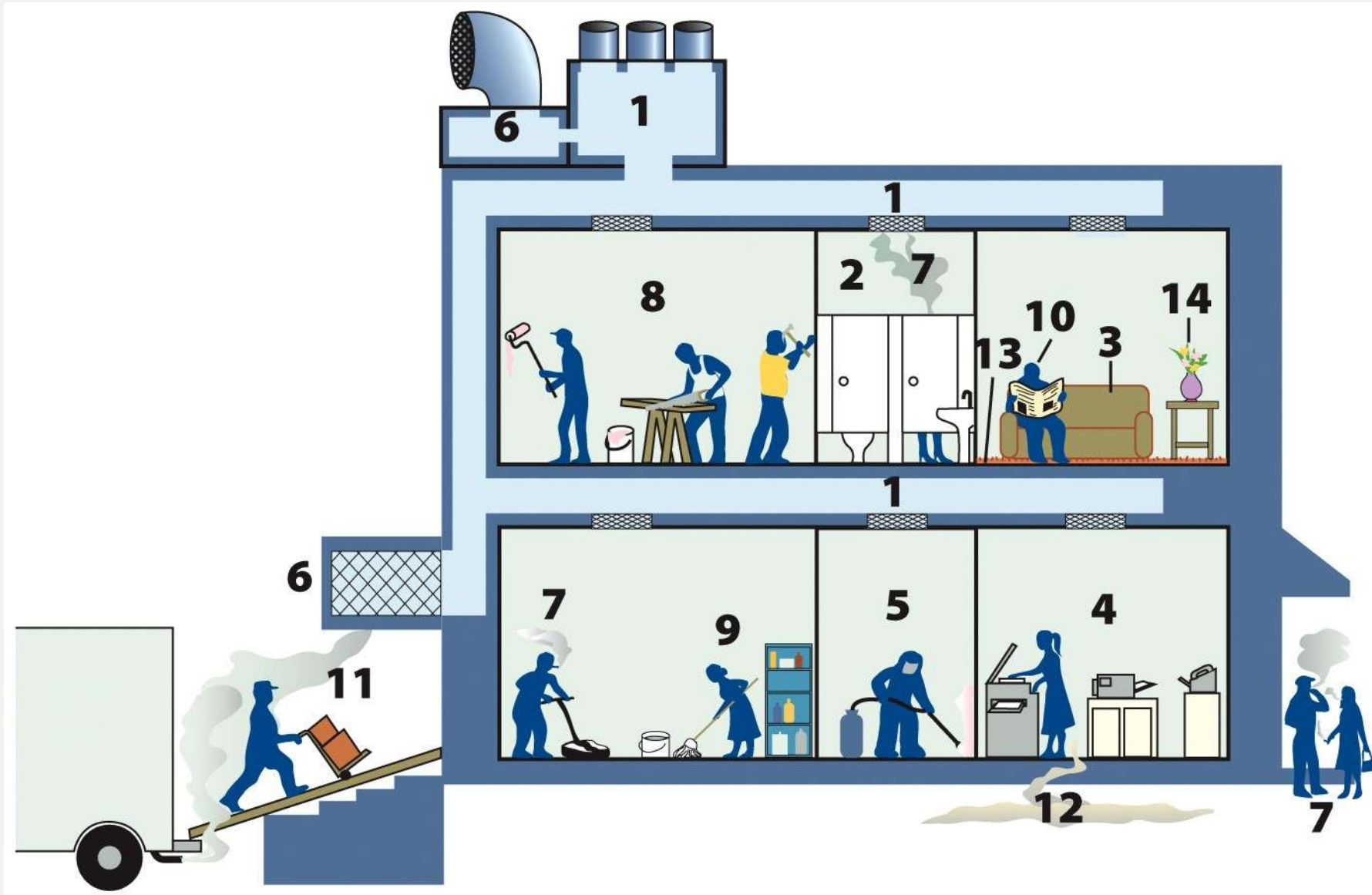
INDOOR AIR POLLUTION BASICS

- “Indoor air pollution is worse than outdoor pollution”...true for at least some pollutants
- Two major types: chemical and microbiological
- Exposures can be great since most people spend 80 to 90% of the time indoors



CHEMICAL INDOOR AIR POLLUTION

- Both outdoor and indoor sources
- Outdoor sources: pollution from industries, vehicles, radon gas, pesticides applied outside
- Indoor sources: smoking, new carpets, new flooring, new furnishings, consumer products, cooking, paint, pesticides, attached garages



POLLUTANT SOURCES

- Fuel-burning combustion appliances
- Tobacco products
- Building materials and furnishings as diverse as:
 - Deteriorated asbestos-containing insulation
 - Newly installed flooring, upholstery or carpet
 - Cabinetry or furniture made of certain pressed wood products
- Products for household cleaning and maintenance, personal care, or hobbies
- Central heating and cooling systems and humidification devices
- Excess moisture
- Outdoor sources such as:
 - Radon
 - Pesticides
 - Outdoor air pollution.

CHEMICAL INDOOR AIR POLLUTION, CONTINUED

- Major kinds of indoor air chemicals
- Formaldehyde from wood products, carpeting, furniture and curtain fabrics, insulation, permanent press fabrics, environmental tobacco smoke
- Benzene from vehicles in attached garages, consumer products, environmental tobacco smoke.
- Other volatile organic compounds from adhesives, caulking, carpeting, wood products, paints, stains, and varnishes
- Carbon monoxide, nitrogen oxides, and sulfur oxides from appliances, cooking, and gas heaters
- Carbon monoxide, formaldehyde, benzene, toluene from tobacco smoke



MICROBIAL INDOOR AIR POLLUTION, CONTINUED

- Major concern is for indoor molds
- Mold facts: various mold species are found everywhere, outdoors and indoors
- In most cases, indoor mold comes from outdoors
- Types of mold indoors should be similar to what is found outdoors
- Indoor levels should be lower than outdoor levels



MICROBIAL INDOOR AIR POLLUTION, CONTINUED

- When types of mold inside are significantly different from outdoor types, or if indoor levels are greater than outdoor, this indicates an indoor source of mold
- Some species are more of a problem than others; e.g. *Stachybotrys*, the so-called “black mold” or “toxic mold”.
- The greater the levels of mold, the greater the possibility of adverse health impacts

HEALTH EFFECTS OF INDOOR AIR POLLUTION

- Like any other situation, it is the dose of chemical or microbial agent that determines whether or not an adverse health effect will occur
- Possible effects if and only if exposures are high enough: eye, nose, throat, and skin irritation; fatigue, lightheadedness, headaches, nausea.

HEALTH EFFECTS OF EXPOSURE TO INDOOR CHEMICAL POLLUTANTS

- Mostly irritation type effects: itchy, watery eyes; sneezing; cough
- Probably from exposure to formaldehyde, other aldehydes
- Neurological effects: fatigue, nausea, headache
- Most likely from reaction to smelling odors, “stuffy” or “stale” air rather than direct toxic effects from chemicals

HEALTH EFFECTS FROM EXPOSURE TO INDOOR MICROBIAL POLLUTANTS

- For most people, reactions to mold and other microbial contaminants will be an allergic response (irritation of eyes, sneezing, etc.).
- More serious health effects, such as microbial infections, are possible in people with depressed immune systems (transplant patients, patients receiving chemotherapy, HIV/AIDS patients).

HEALTH EFFECTS FROM EXPOSURE TO INDOOR MICROBIAL POLLUTANTS

- Concern over mold-related health effects in indoor environments has been over-stated in most cases
- Media portrayal of “toxic mold” scares
- Lawsuits in which home owners or workers attempt to get money from insurers or employers
- Remember, mold is everywhere...



PEOPLE WHO SPEND TIME IN DAMP BUILDINGS ARE MORE LIKELY TO REPORT:

- Respiratory symptoms (such as in nose, throat, lungs)
- Development or worsening of asthma
- Hypersensitivity pneumonitis (a rare lung disease caused by an immune system response to repeated inhalation of sensitizing substances such as bacteria, fungi, organic dusts, and chemicals)
- Respiratory infections
- Allergic rhinitis (often called “hay fever”)
- Bronchitis
- Eczema

HOW TO IMPROVE INDOOR AIR QUALITY

- Go “green” with building materials and furnishings
- Make sure there is adequate fresh air coming into home and that AC units are large enough
- Find any water leaks and fix them to prevent indoor growth of molds
- Do not allow smoking indoors
- Choose personal and cleaning products with an eye toward limiting chemical exposures

HEATING, VENTILATION, AND AIR- CONDITIONING SYSTEMS

- Systems are designed to provide a comfortable indoor environment for people.
- Design depends on a number of variables
 - Including the activity of people in the building, air temperature and humidity, and air quality.
- Done correctly it will
 - Provide thermal comfort for people inhabiting the building.
 - Provide the necessary ventilation (utilizing outdoor air)
 - Remove common air pollutants via exhaust fans and filters



PATHWAYS, PROCESSES, AND DRIVING FORCES

- Many air pollutants originate within buildings and may be concentrated there because of lack of proper ventilation.
- Other air pollutants may enter by infiltration,
 - Through cracks and other openings in the foundations and walls (Radon, VOC's)
 - Or by way of ventilation systems. (proximity to roads)



PATHWAYS, PROCESSES, AND DRIVING FORCES

- A chimney effect (or stack effect)
 - Occurs when there is a temperature differential between the indoor and outdoor environments.
 - Warmer air rises in the building to the upper levels, it is replaced in the lower portion of the building by outdoor air.
 - Secondhand smoke, may also be drawn into a building by the chimney effect.



BUILDING OCCUPANTS

- People living or working in particular indoor environments react to pollutants in different ways:
 - Some groups of people are particularly susceptible to indoor air pollution problems.
 - The symptoms reported by people in a particular environment vary.
 - In some cases, the symptoms reported result from factors other than air pollution.

PARTICULARLY SUSCEPTIBLE PEOPLE

- A person's susceptibility to a particular air pollutant also depends on genetic factors, lifestyle, and age.
 - Sometimes a matter of concentration rather than susceptibility.
 - Older people and children are generally more sensitive.
 - People suffering from chronic lung or respiratory diseases are more susceptible.
 - Individuals who have suppressed immune systems.
 - Some people, when exposed to chemicals, develop multiple chemical sensitivity (MCS).

SYMPTOMS OF INDOOR AIR POLLUTION

- A great variety of symptoms can result from exposure to indoor air pollutants.
 - Nosebleeds, chronic sinus infections, headaches, and irritation of the skin or eyes, nose, and throat.
 - More serious problems include loss of balance and memory, chronic fatigue, difficulty in speaking, and allergic reactions, including asthma.
 - Other pollutants cause dizziness or nausea.
 - Radon, asbestos, and chemicals such as benzene, may have long-term chronic health effects (cancer).

HOW TO EVALUATE?

- Comfort and health complaint tracking & surveys
- Walk through assessments
 - Identify sources and processes
 - Evaluate heating, ventilation and cooling systems (HVAC)
 - Proper maintenance (e.g., cooling towers)
 - Balancing (e.g., remodels, make up air volumes)
 - Outdoor source intakes
- Air monitoring



SICK BUILDINGS

- When the cause is not detected. A number of things may be happening:
 - The complaints result from the combined effects of a number of contaminants present in the building.
 - Environmental stress from another source is responsible.
 - Employment-related stress may be leading to the symptoms reported.
 - Pollutants or toxins may be present but not identified.

ENVIRONMENTAL TOBACCO SMOKE

- Environmental tobacco smoke (ETS)
 - Secondhand smoke
 - Comes from two sources:
 - smoke exhaled by smokers
 - smoke emitted from burning tobacco in cigarettes, cigars, or pipes.
 - People who are exposed to ETS are referred to as passive smokers.

STRATEGIES TO CONTROL INDOOR AIR POLLUTION

- Ventilation: General ventilation system; local ventilation or exhaust fans.
- Source removal and material or product substitution (e.g., smoking areas)
- Source modification: change in combustion design (e.g., stoves), using materials with low emissions, applying barriers to release of emission.
- Air cleaning (pollutant removal): particle filtering, gas and vapor removal.
- Education: consumer information on products and materials and use.

CONTROL OF INDOOR AIR POLLUTION

- One of the principal means for controlling quality is by dilution
 - Fresh outdoor air mixed via a ventilating air-conditioning system and windows that can be opened.
- Various types of air-cleaning systems reduce potential pollutants
 - Such as particles, vapors, and gases.
 - Can be installed as part of the heating, ventilation, and AC system or as stand-alone appliances.

CONTROL OF INDOOR AIR POLLUTION

- Education also plays an important role
 - May involve deciding not to install unvented or poorly vented appliances.
 - Educated people are more aware of their legal rights with respect to product liability and safety.
 - Education provides people with the information necessary to make decisions concerning exposure and strategies to avoid potentially hazardous conditions in the home and workplace.



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AIHA PAT Programs provides participants with the opportunity to improve and refine the analytical skills of their staff, while testing new procedures or training different analysts. These programs allow participants to demonstrate their ability to correctly analyze workplace and environmental samples.

Discussion & Questions?

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