Indoor Air Quality (IAQ)

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Indoor Air Quality (IAQ)

- What is it?
- Is it an problem?
- Is it important? Why?

Indoor Air Quality (IAQ)

- We spend about 80-90% of time indoors
  - Pollutants are concentrated indoors (house=box)
  - Pollutant levels can be 100 times higher than outside levels
  - Science Advisory Board has consistently ranked iaq among the top ten environmental risks to public health

Indoor Air Pollutants

- Asbestos
- Benzene
- Biologicals (mold,mildew, dust mites, dander, saliva protein,)
- Chemicals/VOCs (Remodeling by-products/cleaners/solvents/
- pesticides)
- Combustion products (CO, CO2, NO2)
- Formaldehyde
- Lead dust
- Mercury
- Ozone
- Particulates
- Radon
- Secondhand smoke (ETS)

- Many others, MSDS sheet!!!

IAQ - What/Who

- Factors affecting IAQ
  - Temperature/humidity (affect dispersion/ volatility)
  - Contaminant type/concentration
  - Square footage
  - Duration of exposure

IAQ

- IAQ problems caused by indoor pollutants can be subtle, do not always produce easily recognized health effects (many variables/flu like)
- Children, elderly, cancer patients, transplant patients are more susceptible

IAQ - nomenclature

- Is it Indoor Air Quality (IAQ) or Indoor Environmental Quality (IEQ) ?
  - Odors, temperature, ventilation, stresses, medical history, humidity, aesthetics, outside influences
    - Workplaces: air velocity/movement, lighting, crowding, stress, aesthetics, ergonomics, noise, vibration, equipment selection, location, disgruntled? etc.

IAQ – function of…..

- Building/systems (O&M)
- What we bring into bldg (dander etc.)
- What kinds of activities take place (hobbies/cooking etc.)

Home Concerns are….

- Existing Home – Remodeling/maintenance
- New Home (off gassing)

- Problems can be:
  - Design
  - construction
  - Operations/lack of maintenance

IAQ

- Thermal comfort – big issue/most complaints
  - Too stuffy, too cold, too humid, too hot,
  - Average 20% will not be happy
  - Usually involves more than one issue

  (many variables)

  IAQ Concepts are easy to understand, but figuring out cause(s) can be complicated

Signs of IAQ Problems

- Odors, stale/stuffy air, lack of air movement –feel better outside home?
- Dirty/faulty central HVAC
- Damaged flue/chimney pipes
- Excess humidity
- Tight homes/remodeling/molds/mildew
- Health reactions after remodeling/weatherization/new home/furniture/household or hobby products

IAQ Good News

- Most problems can be resolved inexpensively, corrected easily, and prevent future problems
- Cleanliness and good housekeeping practices make a big difference
- Motto: be proactive, educated homeowner, preventive maintenance is key

Biological - Sources

- Main biologicals in homes (molds,mildew, dust mites, pet dander + salvia, humidifiers, house plants, ventilation systems)
- Main problem – water intrusion!!
- Pollens from outside/use ac
- areas of high humidity/use dehumidifier
- Problem when airborne

Biologicals – health effects

- Allergic reactions
  - water eyes, runny nose, sneezing, nasal congestion, itching, coughing, wheezing, headaches, difficulty breathing
- Note: Dust mites are single most studied trigger for asthma attacks

Biologicals – transported….

- Molds grow on any material
- Need moisture/food source/low light
- Molds produce spores to populate
- Pollens enter through windows/pets
- Other biologicals such as bacteria/viruses passed by personal contact/droplet nuclei

Biologicals - control

- Look for water stains/standing water/moisture
- Keep humidity below 50%
- Dry items within 24-48 hrs
- Wet soft items should be disposed
- Increase ventilation/use dehumidifiers – keep them disinfected
- HEPA vacuum

New Home Smell – the price

- **Formaldehyde** – used as preservative, adhesive in pressed wood products (paneling, furniture, solvents/resins, particle board)
  - Causes eye, nose, throat irritations, wheezing, coughing, fatigue, skin rashes, headaches, loss of coordination, nausea, damages kidneys, liver, CNS, severe allergic reactions, linked to cancer

New Home vs Remodeling

- older homes have problems that new homes do not (lead, asbestos)
- new homes have problems that older ones do not (formaldehyde, VOCs,)
- All homes require proactive, educated homeowners, preventive maintenance is key

Remodeling - concerns

- **Asbestos**
  - auto brakes/clutches
  - textured paint
  - floor tiles, siding
  - plaster wrap, fire retardant or pipe wrap

  - Cancer causing (Mesothelioma, lung disease)
  - Worker's family (handling of clothing)

Remodeling – cleanup time

- **VOCs** – evaporate easily, flammable
  - Used as wood strippers, finishes, waxes, cleaners, adhesives
  - Typically hazardous cpds: petroleum distillates, mineral spirits, chlorinated solvents, carbon tetrachloride, methylene chloride, trichlorethane, toluene, formaldehyde.

Remodeling – cont'd

- **VOCs** (paint stripping, finishes, adhesives)
- **Lead** (neurological toxin) used in paints and gasoline, discontinued in early '80s
  - Affects children mostly, irreversible affects
  - Risk of ingesting dust/chips
  - Delays development, lowered IQ, hyperactivity, high blood pressure, anemia, kidney/reproductive problems

Combustion

- Typically gas and/or particles
- From smoking and burning fuels: natural gas, kerosene, oil, wood, propane, coal, pellets
- Produce CO, NO2, SO2, particulates, excess water vapor, benzene

Combustion Problems – How they happen

- Heating systems
  - blocked openings to flue/chimney
  - cracked or disconnected flue pipe
  - dirty filter in furnace
  - rust/cracks in heat exchanger, soot/creosote build-up
  - exhaust odors into home

Combustion – **concerns**

- CO is odorless/fatal
- NO2 damages respiratory tract
- SO2 irritates eyes, nose, respiratory tract
- Smoke/particulates irritate eyes, nose, throat, cause cancer
- Excess moisture = possible mold

Combustion – in the home

- **Heating appliances**
  - furnace, boilers, water heaters, fireplaces, stoves, space heaters, range, clothes dryer exhaust, grills brought inside
  - **Other activities**: smoking, auto exhaust from garage, welding, soldering, use of internal combustion engines

Combustion – What to do?

- Increase ventilation
- Difference in pressures between inside/ outside of house (pressurization) helps
- Annual inspection of appliances/maintain them
- Reduce exhaust in garage
- use detectors where appropriate (realize low levels may not be detected)

Combustion – indoor vs outdoor?

- How do you know if you have a problem?
  - Symptoms disappear when you are outside the home
  - Noticeable increase in moisture can be a sign of combustion pollutants

Carbon Monoxide (CO)

- Odorless, colorless, may be fatal
- Symptoms flu like/allergies
- Low levels cause nausea, dizziness, weakness, muscle aches
- High levels cause impaired judgment, paralysis, coma or death

CO

- Use of unventilated space heaters, ovens, ranges, grills indoors
- Exhaust from garages,
- Incomplete combustion (air/fuel ratio)
- Back drafting (diff. press./down draft kitchen power vent)

Lead Dust

- Used in paint until 1978, gasoline
  - From solder
  - fixtures and piping in older homes
  - lead related hobbies/occupations (stained glass) ceramic cookware/pottery
  - children's toys
- Young children at risk, accumulates in body, irreversible affects
- Test blood for lead levels

Lead – Where's it coming from/what to do?

- Older homes, remodeling, chipping
- Lead paint in good condition is not a hazard until it begins to crack/chip
- Control lead dust with damp mopping/vacuuming can disperse dust
- Use lead test kit, remove easy sources
- Encapsulate rather than remove

Secondhand Smoke - ETS

- Mixture of exhaled smoke/burning end of cigarette, pipe or cigar
  - First leading cause of lung cancer
  - Classified as group A carcinogen
  - Causes up to 300,000 lower respiratory tract infections, up to 15,000 hospitalizations/yr (4.6 million deaths/yr)
  - Reduces lung function/causes respiratory irritation, cough, excess phlegm, wheeze, ear infections

ETS – What to do?

- Do not allow smoking in your home
- Increase ventilation/use exhaust fans
- Quit smoking

Radon Gas…….

- Second leading cause of lung cancer up to 22,000 die/yr
- Smoking + radon exposure increases risk dramatically
- Uranium decay products enter lungs, particles release burst of energy damaging lungs
- Found everywhere

Radon – Where's it coming from?

- Radon enters homes through basement/crawlspace/slab
- Test private well water for radon
- Radon concentrates in areas w/granite, shale, phosphate/pitchblende
- Testing is easy and inexpensive
- Mitigation costs range ($1200-2000)
- Consider mitigation if levels >4pCi/l

Sulfur Dioxide

- Combustion of kerosene
- Inhalable particulates and PAHs
- Strong gas, pungent odor, detected at 0.5 ppm
- Upper respiratory irritant
- About 5% of population is sensitive
- Acts synergistically with ozone @ 0.15ppm

Nitrogen Dioxide

- Burn fossil fuels
- Pungent @ 0.11-0.22 ppm, stinging/suffocating/irritating smell
- Lung damage, biochemical changes @ 0.2ppm/30 minutes in lung
- Asthmatics responsive @ 0.5 ppm
- Interferes w/ transport of oxygen

Ozone

- 3 atoms of oxygen, 3rd one interacts with organic material, harmful
- Chest pain, coughing, shortness of breath, worsens respiratory diseases
- From ozone producing air cleaners
- EPA max. 8 hr. avg of 0.08 ppm
- Not recommended

Particulates

- Wood burning which includes Polycyclic aromatic hydrocarbons
- Carcinogen w/ >2 benzene rings
- From incomplete combustion
- Oral intake may be higher
- Found in smoked/broiled/refined food and in water

Formaldehyde – What it is!

- Pungent gas
  - Causes watery eyes, burning sensation in eyes, nose, throat, wheezing, coughing, fatigue, skin rashes, headaches, loss of coordination, nausea
  - CNS depressant, cancer in animals
  - Used as preservative, adhesive, anti-wrinkle agent

Formaldehyde - Uses

- Particleboard, plywood, fiberboard in cabinets, veneered/laminated, plywood furniture, sub flooring, paneling, floor finishes
- Carpeting, durable press drapes, textiles, glues, adhesives
- Urea formaldehyde foam insulation (older trailer homes)
- Combustion byproduct/cosmetics

Formaldehyde – Decrease off-gassing

- Can be blocked by coating w/ varnishes/sealants
- Apply these coatings to edges, surfaces, undersides of countertops, interiors and drawers to reduce exposure
- Control humidity, it increases off gassing

VOCs /Household Products

- Solvents, paints, paint strippers, wood preservatives, aerosol sprays, moth repellants, air fresheners, stored fuels, automotive products, hobby supplies, pesticides, cleaners and disinfectants, personal care products, dry cleaned clothes
- Watch out for flammables/high VOC content

VOCs/Household Products

- Cause eye,nose, throat irritation, headaches
- Loss of coordination, nausea, damage to liver, kidney, CNS
- Some organics can cause cancer in animals and suspected of causing cancer in humans

VOCs/Household Products

- Follow directions for use/ventilate
- Avoid mixtures/use for intended purpose only
- Keep in original containers w/ safety info. and directions
- Keep away from children/pets

VOCs/Household Products

- Remove source/dilute/alternative
  - Quickly attend to spills/stains
  - Consider green non toxic alternatives
  - Use as directed/only amount needed
  - Use in ventilated area
  - Don’t mix products (bleach/ammonia)

IAQ – Points to remember

- You can reduce in-home exposure, everyday
- This is something only you can do for yourself
- Become an educated/proactive consumer and homeowner
- Many, many benefits to good iaq

Heating and Cooling

Furnace

Hot water

Sump Pump

Sump Pump

Radon vent pipe

Windows

Outside air

dehumidifier

Dehumidify your space

Dryer

trap water

Chemicals

Computer/other equipment

TV's

CO

MAY 28 2004

Exhaust

Formaldehyde?

formaldehyde?

Too many cleaners

Combustion

To smell or not to smell?

Smell or not to smell?

Camouflage with scents?

Scented candles

ETS

Bathroom exhaust

Foot wear….

Tupperware

Dander, Dander

More Dander

Carpet

Curtains

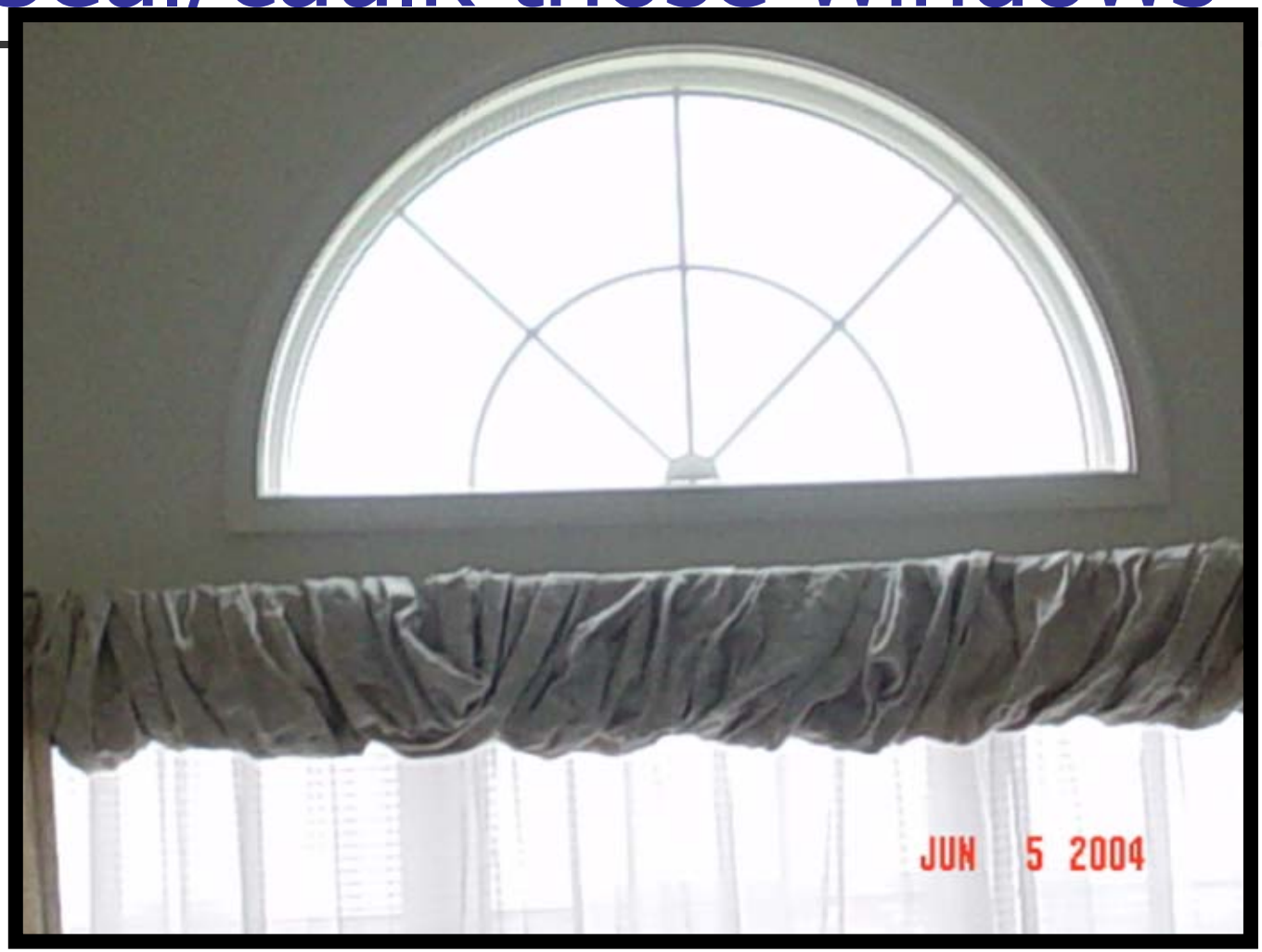
HEPA VACs are in…

Roof issues….

Attic Air

Windows

Seal/caulk those windows



Gutters/downspouts

Gutters

Gutters need attention!

Drain away….

Downspouts too close

Drain water away from home

Drainage

Drain away, brick loves water

Ventilate that space

Vehicles in garage,

Combined storage?

VOCs

MINWAX
MAKING WOOD BEAUTIFUL FOR 100 YEARS
Wood Finish
Penetrates, Stains & Seals
CHERRY 235
JUN 5 2004

Off gassing?

Too much paint?

Too many cleaners

ventilate your space

Asphalt

driveway pitch away...

Dry or wet?

Dry or wet construction?

Tyvek, felt or both?

Both

Stucco or brick?

Brick is porous, seal it

seal/caulk windows,

Soffits show interior mold

Mold took hold here..

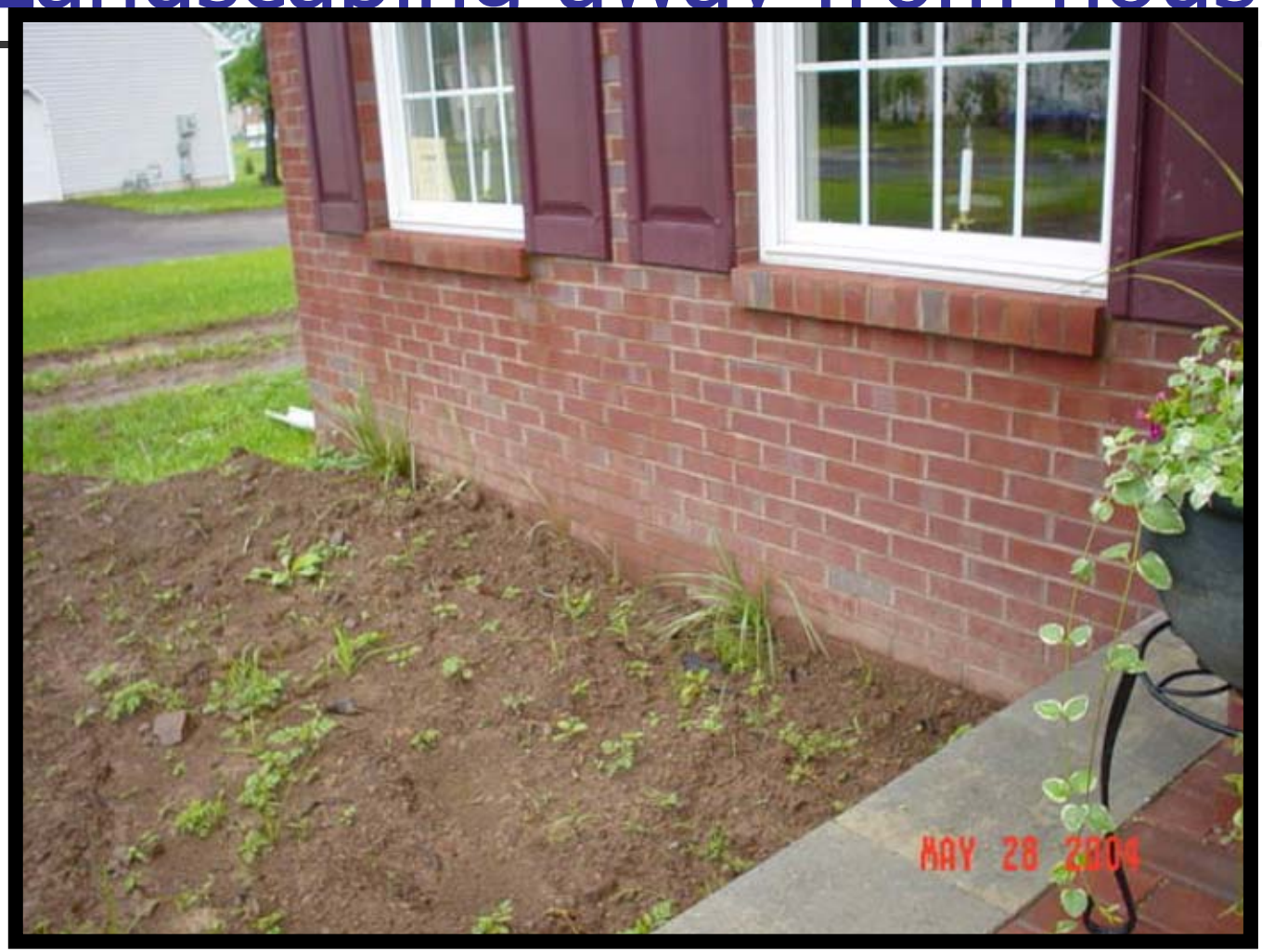
Mold

Landscaping

Landscape

Landscaping

Landscaping away from house!



landscape away

IAQ Tools for Schools (TfS)

- Voluntary iaq focus on schools
- Promotes teamwork/outreach/education
- Helps schools identify and resolve iaq problems, no cost/low cost
- EPA provides technical assistance
- www.epa.gov/iaq