Twenty Examples of Design/Construction Issues Impacting IAQ

Dale Walsh, MS, CIH, LEED-AP BD+C
Walsh Certified Consultants, Inc.
Las Vegas, Nevada

AIHA GBIAQ Management Planner Registry Team
ASTM D22 Air Quality Committee Member
Wrote portions of IAQ Chapter in IGCC
USGBC Nevada Chapter Past Director

Learning Objectives

- Identify twenty building design, construction and use issues that historically and currently can negatively impact IAQ
- Analyze how these twenty issues may negatively impact IAQ
- Develop potential means of preventing or mitigating the issues identified
- Provide insights regarding reasons for these issues continuing to be used

Twenty Reasons

Non-Cleanable Interior Ventilation Surfaces

- Lined Ductwork:
  common,
  for noise reduction,
  accumulates dust,
  can be installed dirty

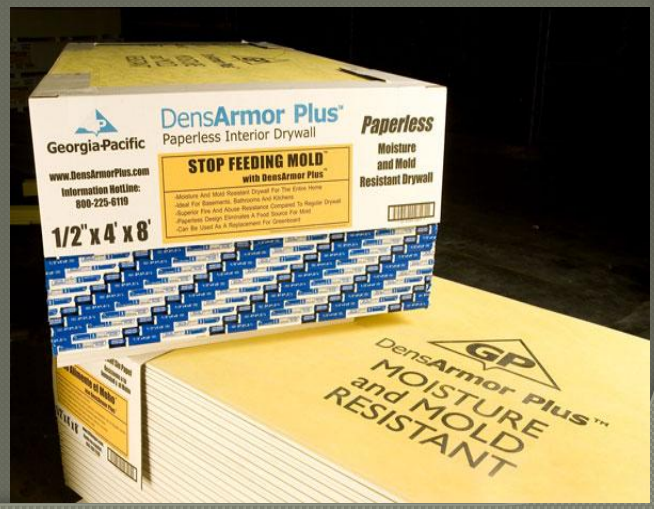
- Flex Duct:
  residential can tear when cleaned; cannot clean 100% due to uneven surfaces; when turn air back on can blow out left over dirt

Too Much Dry Outdoor Air

- Low humidity (<30%)
- Heaters dry out air
- AC units take out humidity
- Eye irritation
- Coughing
- Congestion
- Skin irritation/rashes

Cellulose Materials in High Water Use Areas

- Concept of *Damp Indoor Spaces* – much more than just mold
- Paper (cellulose) coated drywall in bathrooms, kitchens – mold food
- Cement board and fiberglass coated drywall alternatives
- Wallpaper adhesive - cellulose; hides mold



The Devil Made Me Do It

Roof Pollutant Sources Near Air Intakes

- Sewer vents near outdoor air (OA) intakes
- Improperly vented grease traps
- Bathroom exhaust near OA
- Cooking exhausts near OA
- Cooling towers near OA

4 cont *Legionella* Sources

What is SMACNA?

a) **Slightly Mad Anarchistic Contractors of North America**
b) **What you say when someone asks if they can smack you**
c) **An organization that discourages Heroin (*smack*) use**
d) **Sheet Metal and Air-conditioning Contractors' National Association**

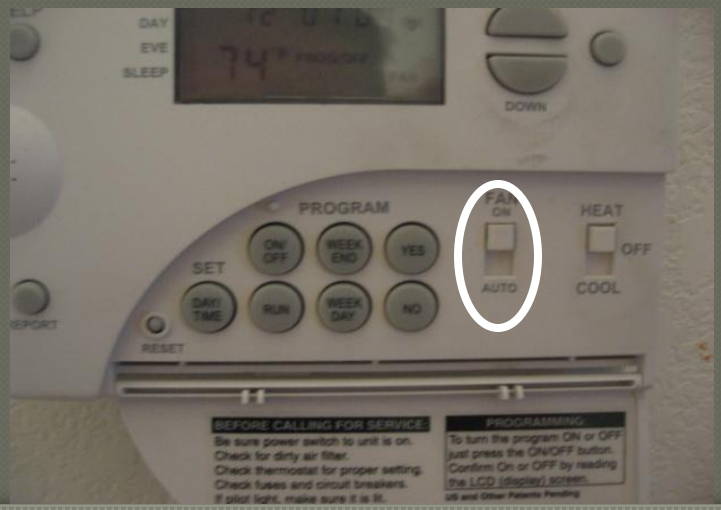
Construction Pollutants Left on New Building Surfaces

- SMACNA Std – IAQ management during construction
- Trash in plenums
- Paint, drywall dust, site dust in ductwork
- Wetted materials with mold because they were left unprotected on construction site

Ventilation Fan Cycling On and Off

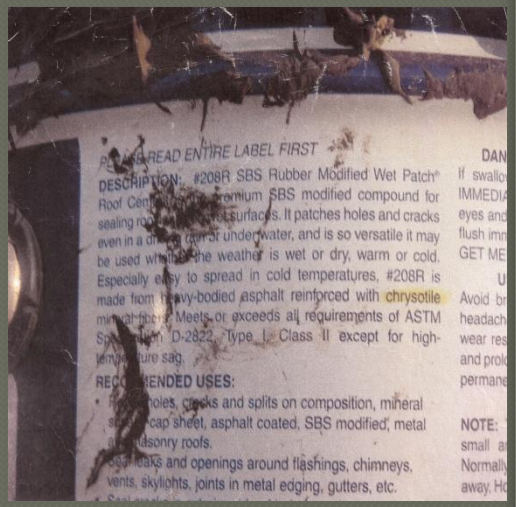
Leave Fans ON

- Better air filtration and temperature distribution
- Minimal noise and energy impact
- Need to change filters more frequently
- On & off more likely to dislodge debris



Using Hazardous Materials in New Buildings

- Asbestos-still legal
- Lead paint-low levels still allowed
- Chinese drywall
- Silica-ubiquitous
- Imported materials (e.g., vapor barrier, high density baseboards)
- Solvents

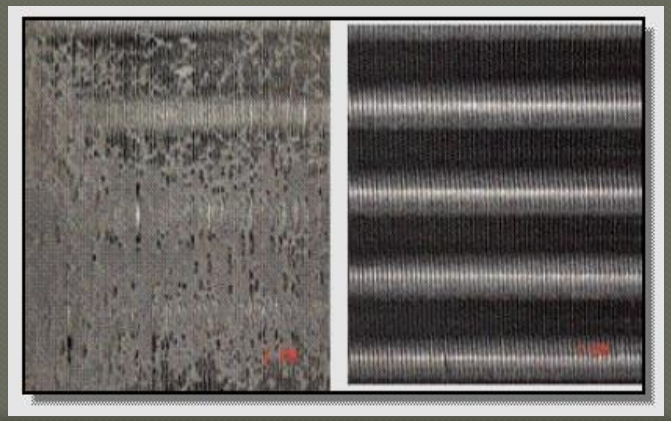


Building Features that Can Lead to Moisture Intrusion and Mold Growth

- Exterior sprinklers hitting walls
- Flat roofs
- No weep screeds
- Planters
- Landscape slope
- Dirt on wall
- Window drains backwards

Ventilation Units with Poor Access

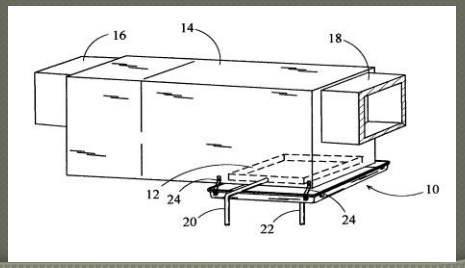
- AHUs designed with difficult access to the coils, condensate pan, and fan for cleaning
- Filters located in hard to access areas or have obstructions
- Discourages proper maintenance



Condensate Lines in Bad Locations

- Primary Pan:
  dry floor drains,
  lips on drain pipe,
  sloped wrong

- Secondary Pan:
  function poorly communicated
  sometimes drains into occupied area
  can cause hidden mold



Quick Quiz – True or False

1. Lined and flex type air ducts are easy to clean **False**
2. Very low humidity can cause allergic-like symptoms in some occupants **True**
3. Cellulose containing building materials do not support mold growth **False**
4. As long as roof sewer vents are located at least 10 feet from OA intakes (per code) there is no problem with gas entrainment **False**

Quick Quiz – True or False

5. Dusty or wet ventilation duct is never installed into new buildings **False**
6. Ventilation systems filter air better when the fan is on all the time **True**
7. Asbestos is no longer legal in the U.S. for installation in buildings **False**
8. Flat roofs can be more problematic than sloped roofs regarding pooling of rain water and leaking **True**

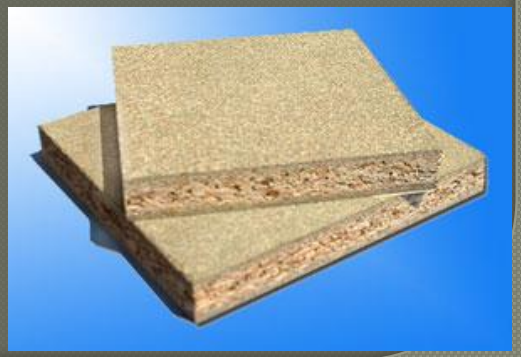
Quick Quiz – True or False

9. AHUs are always designed for easy access to the coils, condensate pan and fan for easy cleaning **False**

10. Secondary condensate drain pans and lines are designed to provide a tell-tale that indicates the primary pan is not functioning and/or overflowing **True**

Improper Use of Products Identified as Low Emitting

- Low emitting materials may be slow emitting
- Low emitting may be low when compared to similar materials – but are still high emitting
- Roof mastic indoors as floor sealant
- Latex paint sensitivities



Inappropriate Air Quality Evaluation Parameters & Methods

- Carbon monoxide inappropriate in new building
- Total VOCs misleading
- PM10 for outdoor air – not indoor; need to know types of particles
- 4-PCH is of minor importance
- Methods give varying results – same location can pass and fail with different methods
- Testing often fails due to non-building issues

Testing Equipment

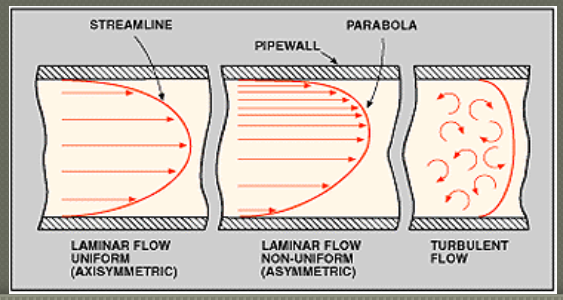
Depending Too Much on Building Flush Out

- Flush out good for volatiles that off-gas quickly and very small particles
- Pollutants with low volatility and slow off-gassing and large particles not removed effectively
- Unless airflow laminar to remove pollutants effectively it has limited value

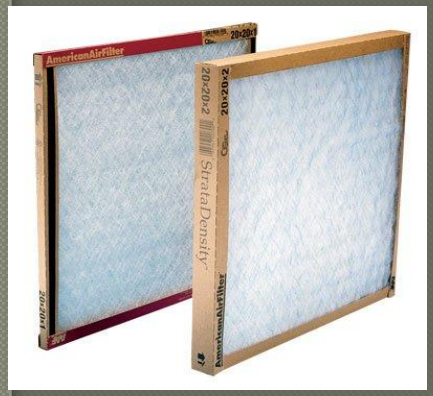
USE CAR'S EXHAUST TO CLEAN CUSHIONS

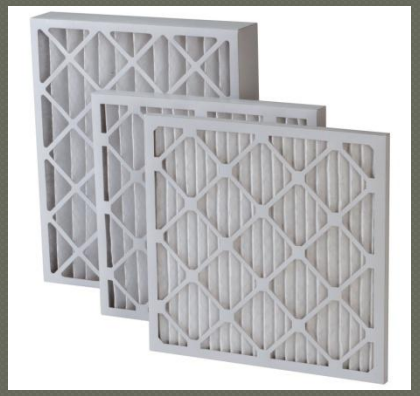
Using the exhaust gas of the automobile to clean the upholstery is the accomplishment of a recently invented device. An aluminum attachment is fastened to the exhaust pipe and the engine is allowed to idle. As the exhaust gas passes through this device suction is created at the inlet hole. Collected by a nozzle, the dust and dirt are drawn through the hose and expelled into the air at the rear of the car. It is made in three models, for cars of different size.

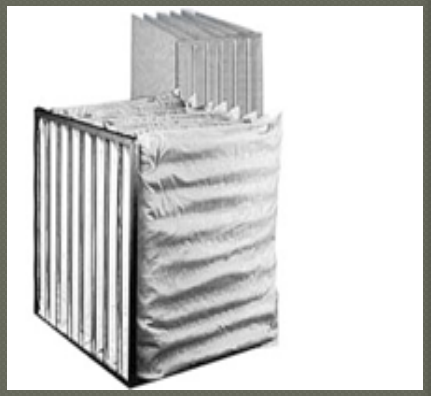
With the car's engine idling, gas from the exhaust creates a vacuum that cleans the cushions



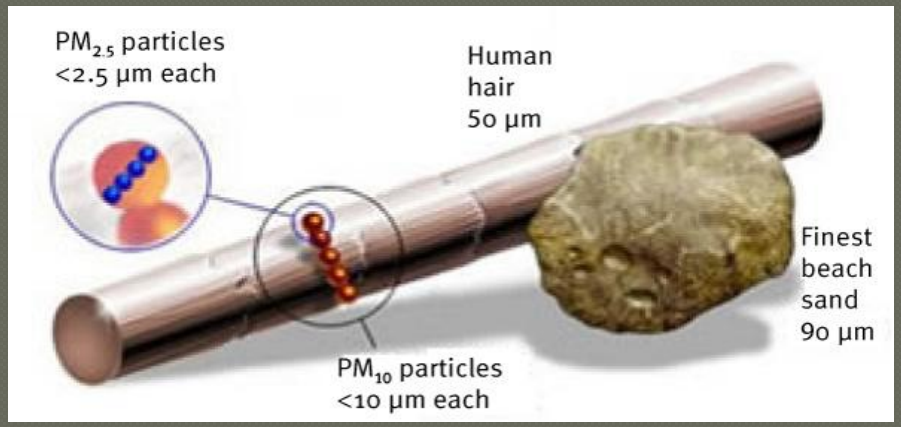
Filters Not Performing Per Design Due to Maintenance/Installation Issues







- MERV rating, seals, unusual sizes



What is MERV?

a) A man who invented the talk show genre.

b) Short for Mervyns - a department store chain

c) Mobile Electric Red Vehicle

d) Minimum Efficiency Reporting Value

MERV level	Dust spot, percent	Typical particulate-filter type	Percent 0.3 to 1.0 µm	Percent 1.0 to 3.0 µm	Percent 3.0 to 10.0 µm
1	NA	Low-efficiency fiber-glass- and synthetic-media disposable panels, cleanable filters, and electrostatically charged media panels	Efficiency too low to be applicable to Standard 52.2 determination		
2	NA				
3	NA				
4	NA				
5	NA	Pleated filters, cartridge/cube filters, and disposable multidensity synthetic link panels			20 to 35
6*	NA				36 to 50
7	25 to 30				50 to 70
8	30 to 35				Greater than 70
9	40 to 45	Enhanced-media pleated filters, bag filters of either fiber-glass or synthetic media, and rigid box filters using lofted or paper media		Greater than 50	Greater than 85
10	50 to 55			50 to 65	Greater than 85
11	60 to 65			65 to 80	Greater than 85
12	70 to 75			Greater than 80	Greater than 90
13	80 to 85	Bag filters, rigid box filters, and minipleat cartridge filters	Greater than 75	Greater than 90	Greater than 90
14	90 to 95		75 to 85	Greater than 90	Greater than 90
15	Greater than 95		85 to 95	Greater than 90	Greater than 90
16	98		Greater than 95	Greater than 95	Greater than 95
The following classes are determined by a methodology different than that of ANSI/ASHRAE Standard 52.2-1999, *Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency* by Particle Size					
17	NA	High-efficiency-particulate-air/ultralow-penetration-air filters evaluated using Institute of Environmental Sciences and Technology (IEST) method of test. Types A through D yield efficiencies at 0.3 µm and Type F at 0.1 µm	99.97-percent IEST Type A		
18	NA		99.99-percent IEST Type C		
19	NA		99.999-percent IEST Type D		
20	NA		Greater than 99.999-percent IEST Type F		

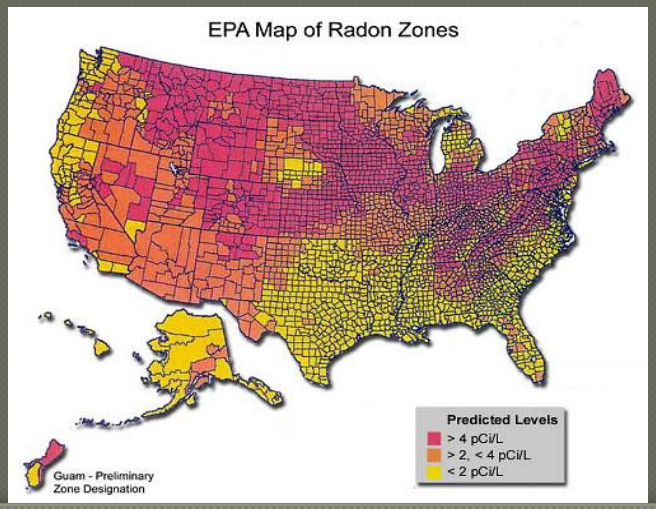
*MERV 6 level prescribed by ANSI/ASHRAE Standard 62-2001, *Ventilation for Acceptable Indoor Air Quality*, for minimum protection of HVAC systems

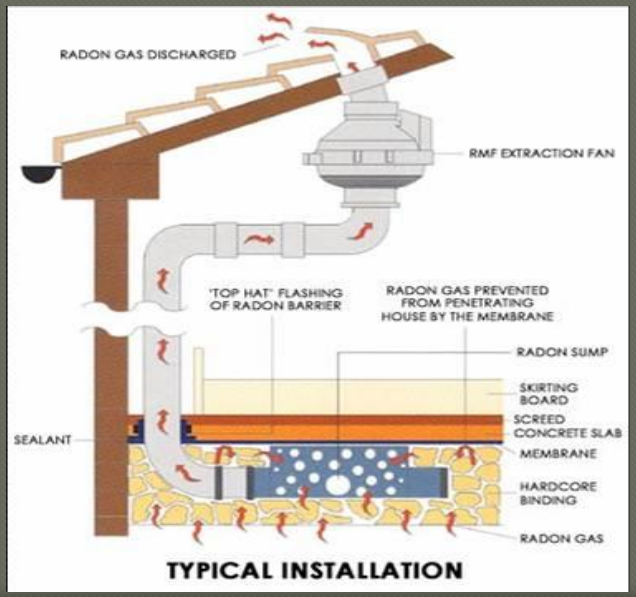
Installing Drywall Before Roof or Windows are in Place

- Unexpected rain wets drywall and causes mold or other damage
- Often times building code enforcement requires removal due to integrity issues

Not Designing for Radon Mitigation

- Radon is second leading cause of lung cancer behind cigarettes
- More difficult after building built
- Simple – install hole and vent system in foundation to prevent radon gas intrusion
- EPA initiative



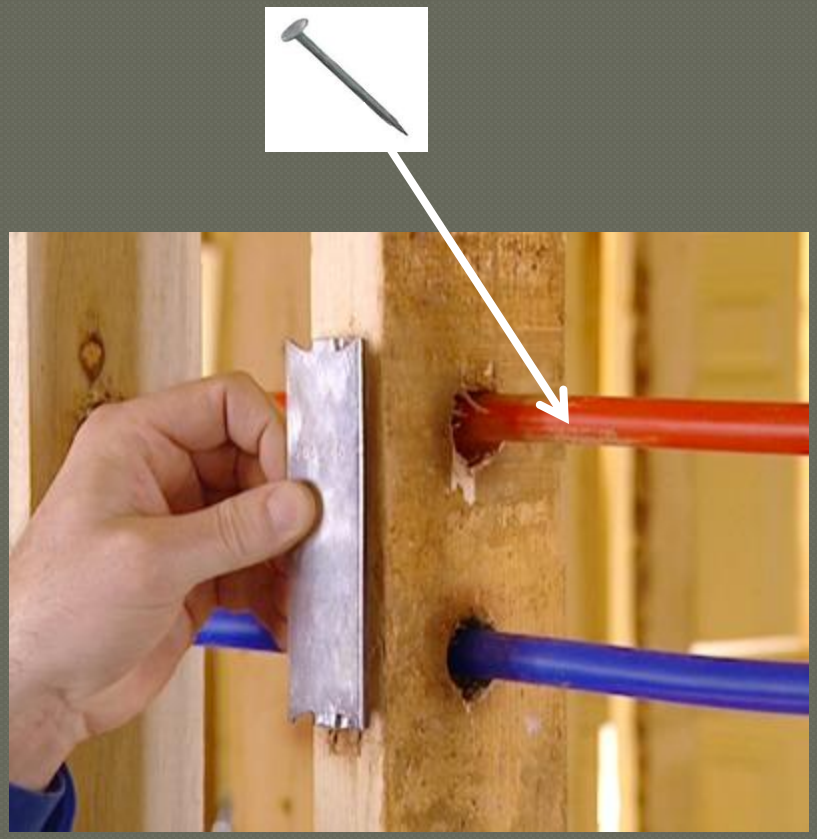


Exposed Fiberglass in Return Air Plenum Above Ceiling Tiles

- Releases fiberglass into plenum air stream
- When lift ceiling tiles for maintenance fiberglass released into occupied area

Plumbing Construction Defects

- Broken pipes/drains in ground, foundation or building
- Shower drains not tightened
- Nails thru plumbing
- Uncompleted vent pipes
- P-traps not present or not enough bend
- No p-trap primers when needed

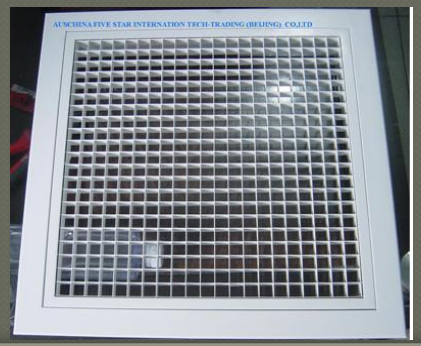


Nail in plumbing

Inadequate Air Balance and Distribution

- Supplies and Returns: flow, number, locations, balance
- Short circuit
- Positively pressured bathrooms
- Floor registers accumulate dirt and potentially get wet with mopping floor

Short circuit



Poor Control of Office Equipment & Cleaning Pollutants

- Pollutant sources (e.g., ETS, janitor's closets, copy rooms, blueprint printers) need to have more exhaust than supply
- Ozone – good up high, bad nearby

Quick Quiz – number/letter match

1. low VOC emitting building materials
2. air sampling methods
3. not good for semi-volatiles and large particles
4. washable, passive electrostatic filters
5. Drywall installed, no roof, SURPRISE - it rains

a. flush out
b. mold growth likely
c. differences can determine passing or failing air tests
d. may not be low if used improperly
e. not good for very small particulates

Quick Quiz – number/letter match

6. radon gas
7. very irritating to throat and skin when airborne
8. no p-trap
9. proper bathroom pressurization
10. more exhaust than supply

f. sewer gas
g. copy rooms, janitor's closets
h. second leading cause of lung cancer
i. fiberglass
j. negative


FURTHER DISCUSSION
?

THANK YOU,
Thank You Very Much