



The IAQ TOP 10 Fixes

BOC Webinaire

March 19, 2009

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(complete paper available at above website)



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Licensed Professional Engineer - Mechanical Engineering

Certified Industrial Hygienist - ABIH

B.S. (1976) and M.S. (1985) in Mechanical Engineering

Staff Scientist: IAQ Program, Lawrence Berkeley Laboratory

Member of USBGC LEED EQ Technical Advisory Group

Co-Chair ISIAQ HVAC Hygiene Task Force

Member of ASHRAE Standard 62 Ventilation for Acceptable IAQ

Member of the Cal-OSHA IAQ Advisory Committee

Published 26 Peer-Reviewed Studies on Building Air Quality

IAQ Diagnostics/Mitigation in over 2000 Buildings (30 years - 2009)

BOC 106 – Indoor Air Quality - Instructor



IAQ Myths

IAQ Top 10 Fixes

Is IAQ a New Issue ?



“I considered fresh air an enemy, and closed with extreme care every crevice in the room I inhabited. Experience has convinced me of my error. I am persuaded that no common air from without is so unwholesome as the air within a closed room that has been often breathed and not changed.”

**Benjamin Franklin
(18th Century)**

IAQ Myths



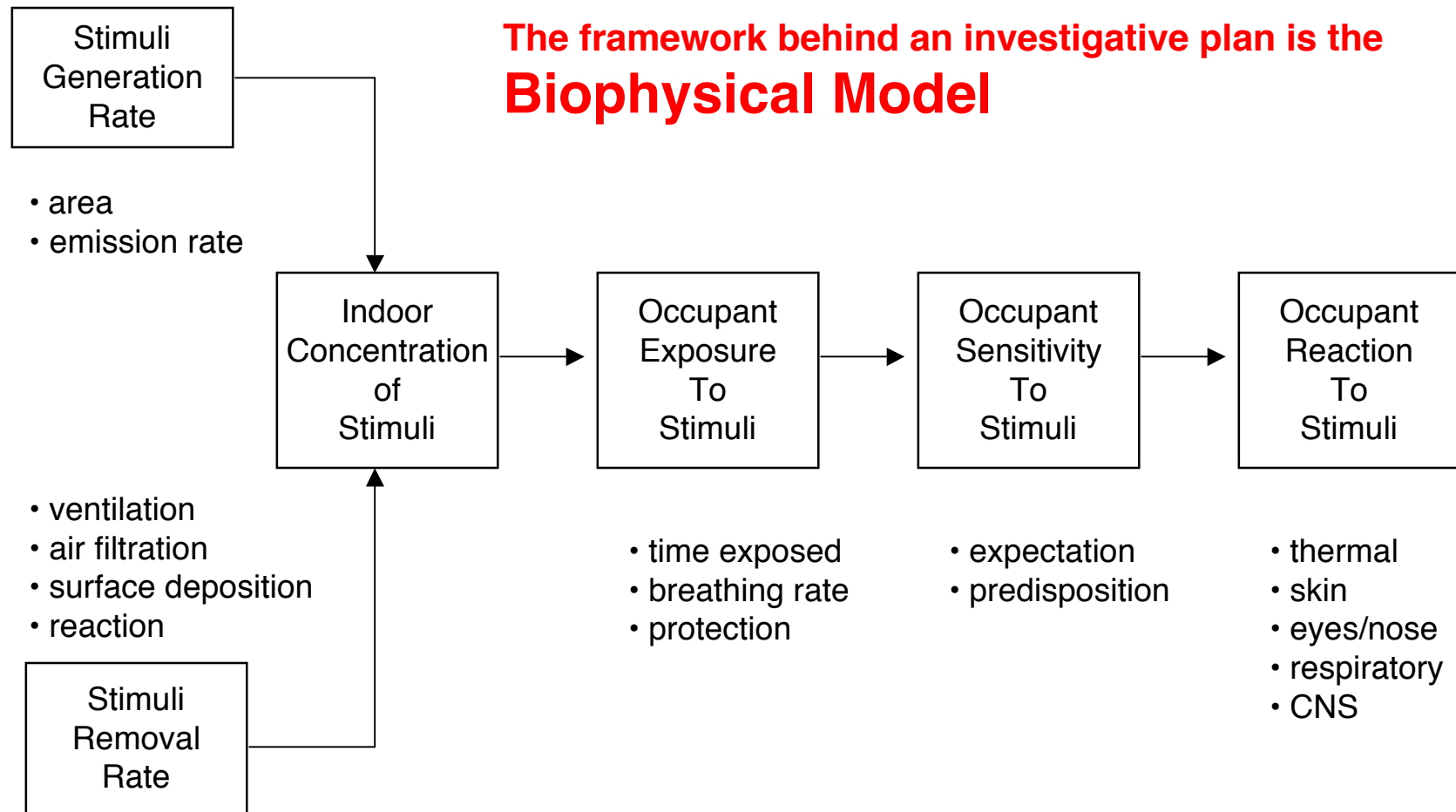
Popular Indoor Air Quality Myths

- Man-made chemicals are bad, and natural chemicals are OK
- Natural ventilation (e.g., openable windows) is superior to mechanical ventilation
- Indoor plants clean the air of air contaminants
- “Tight” buildings cause indoor air quality problems
- Air cleaners eliminate all pollutants
- Carbon dioxide (CO₂) is a major cause of indoor air pollution

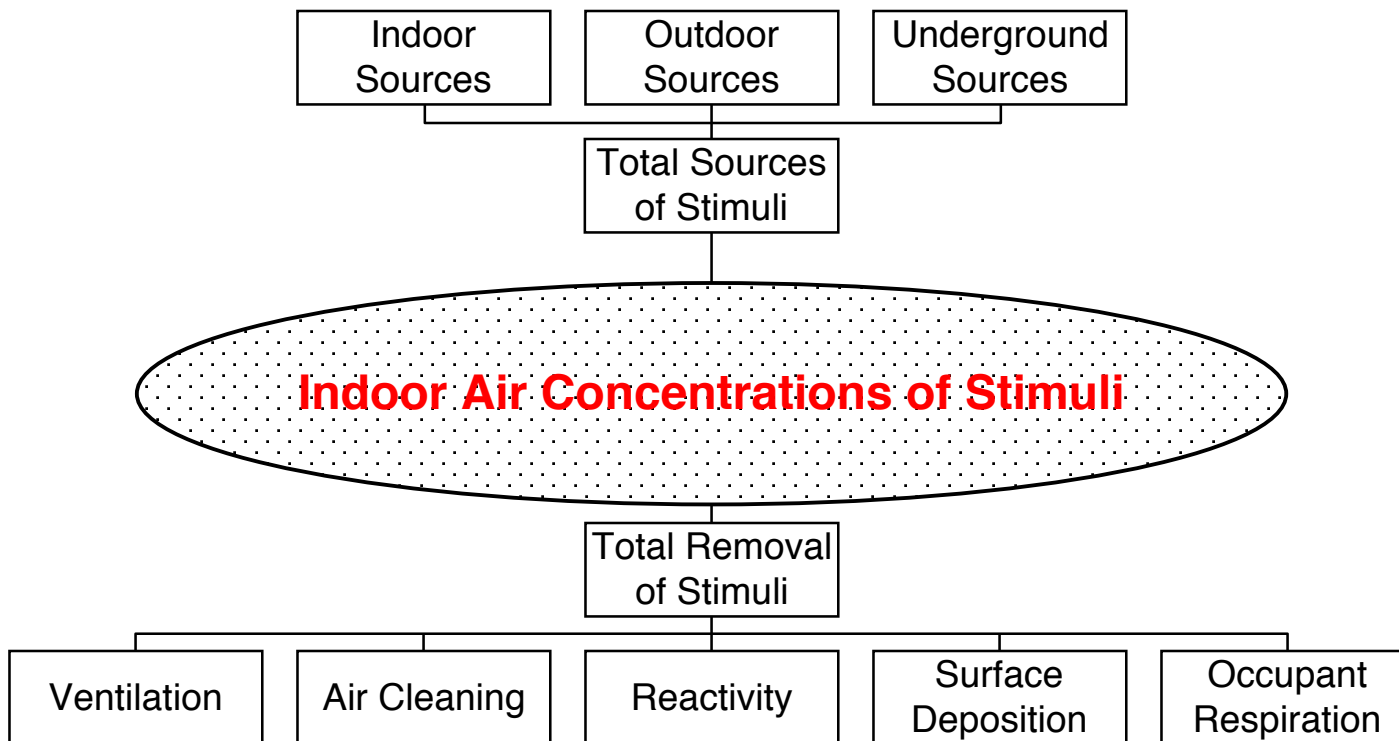
Understanding IAQ



The framework behind an investigative plan is the **Biophysical Model**



Understanding IAQ



IAQ Economics



HEALTHY BUILDINGS MAKE GOOD ECONOMIC SENSE (\$\$\$)

BUILDING COSTS

| | |
|----------------------|---------------------------------|
| • Construction Costs | - \$16 per ft ² - yr |
| • Operation Costs | - \$4 per ft ² - yr |
| | ----- |
| Total Costs | - \$20 per ft ² - yr |

EMPLOYEE COSTS - \$500 per ft² - yr

Therefore a 1% increase in worker productivity justifies a 25% increase in building construction and operating costs.

IAQ Economics



HEALTHY BUILDINGS MAKE GOOD ECONOMIC SENSE (\$\$\$)

In addition to worker productivity \$ savings other savings include:

- Reduced Tenant Complaints, Reduced Trouble Calls
- Reduced Industrial Hygiene/Engineering Testing Costs
- Reduced Liability Risks
- Increased Rentability

Diagnosing IAQ Problems



Commonly Encountered Occupant Complaints

- Thermal Comfort
- Odors
- Eye/Nose/Throat Irritation
- Skin Irritation

Diagnosing IAQ Problems



There are four necessary ingredients for all IAQ problems.

The Four Ps

- People
- Pollutant
- Pathway
- Pressure

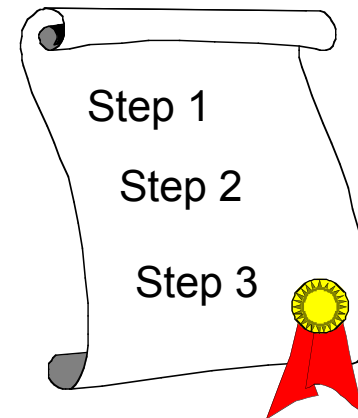
Remove any one ingredient - and no more problem

Diagnosing IAQ Problems



The main and essential TOOL for ALL types of IAQ investigations is a rational

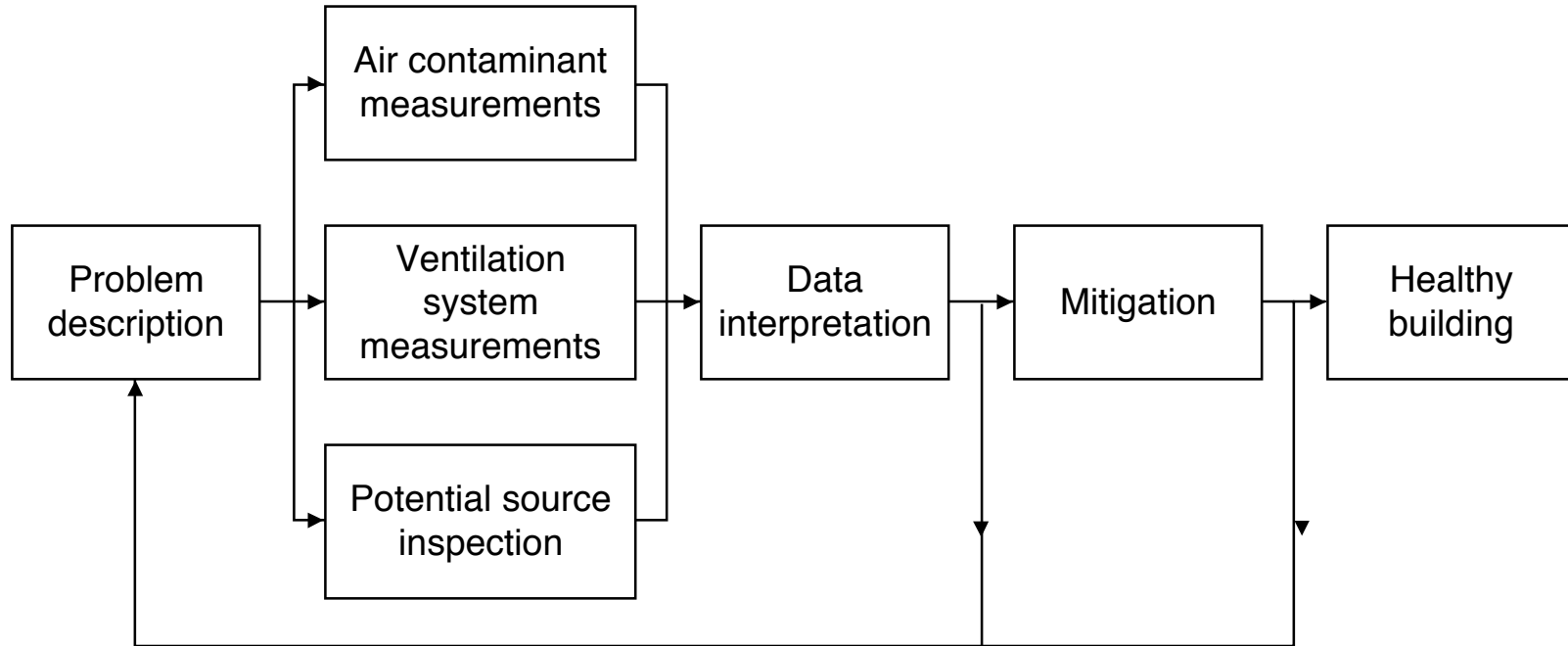
INVESTIGATIVE PLAN.



Diagnosing IAQ Problems



INVESTIGATIVE PLAN for Reactive Investigations- Occupant Complaints



Top 10 IAQ Fixes



The following are my top 10 things to check and fix to reduce indoor air quality complaints

These were derived from my 30 years experience and over 2,000 IAQ investigations

Top 10 IAQ Fixes



IAQ Issue #1

Air Temperature (70-74 °F)



Wired deep into our brains is a strong aversion to warm air. This warm air is often judged as stale or not being fresh. Sometimes a “suffocation panic” reaction occurs.

“Ventilation should be served like champagne, cool and dry”.
My mentor: Professor Ole Fanger - Technical University of Denmark

Top 10 IAQ Fixes



IAQ Issue #2

Air Pressure (positive 0.01-0.03 inches of water with respect to outdoors and special use areas)

Buildings with negative air pressures are very unforgiving to many types of problems (e.g. odors from dry sewer traps, moisture condensation in walls)

Remember “Sick buildings SUCK and healthy buildings BLOW”

Top 10 IAQ Fixes



IAQ Issue #3

Outdoor Air Ventilation (at least ASHRAE 62.2 minimums, or preferably 15 cfm/occupant or 15 cfm/100 ft², whichever is greater)

Make sure that the thermostats for small unit ventilators have the fan switch set in the “on” position not the “auto” position.

Remember “Build it tight, but ventilate it right”.

Top 10 IAQ Fixes



IAQ Issue #4

Outdoor Air Inlet (locate inlet away from sources of air contaminants and odors)

Locate the inlet away from stinky things such as sewer vents, kitchen, and bathroom exhausts, loading docks, garbage dumpsters, etc.

Remember “The nose of the building is the outdoor air inlet”.

Top 10 IAQ Fixes



IAQ Issue #5

Indoor Sources (use low emitting materials, isolate tenant improvement/construction areas, flush out areas following construction activities)

Select materials from the CHPS Low Emitting Materials (LEM) Table

http://www.chps.net/manual/lem_table.htm

Top 10 IAQ Fixes



IAQ Issue #6

Moisture (don't let materials get and stay wet for more than 2 days)

As described in the “California Builders’ Guide to Reducing Mold Risk”

<http://iee-sf.com/workshops-seminars/pdf/BuildersMoldGuide.pdf>

- 1.) keep the water away with proper site drainage
- 2.) keep the water out with proper window/door flashing, foundation water proofing, vapor retarder placement, and wall drainage systems, and
- 3.) limit mold growth while moisture dries out with selection of moisture tolerant materials.

Top 10 IAQ Fixes



IAQ Issue #7

Soiling Around Supply Air Diffusers (clean soiling around diffusers and improve air filtration)



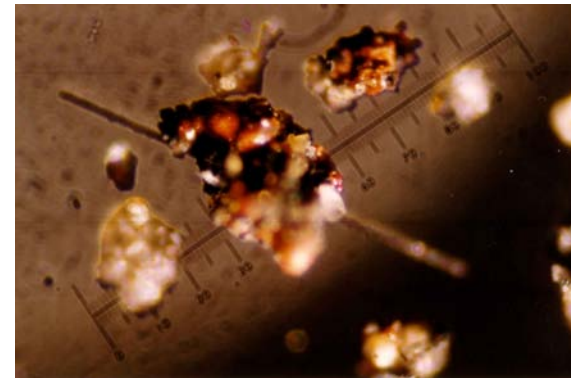
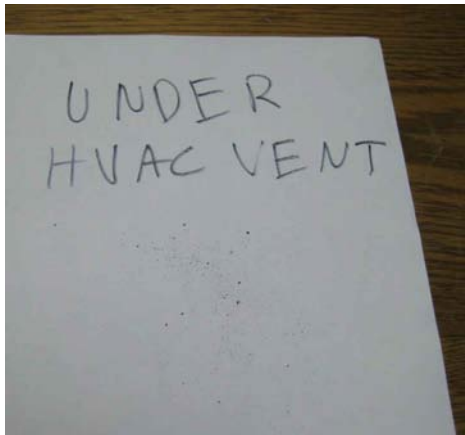
This is NOT an indication of a need to clean ducts rather, an indication of a lot of particles in the room air which deposit quickly near the diffuser because of the boundary layer effects caused by the jet of air at the diffuser.

Top 10 IAQ Fixes



IAQ Issue #8

Particle Emissions from Ventilation Systems (fix soundliner erosion and clean ducts)



Often caused by degrading soundliner. Disturbing for tenants to see on their work space and can cause skin irritation and upper respiratory irritation.

Top 10 IAQ Fixes



IAQ Issue #9

Air Filtration (minimum of MERV 8 and preferably MERV 11 or 13, no ozone, electrostatics, or UV)



Make sure filters do not become overloaded and that there is no air bypass in the filter rack.

Top 10 IAQ Fixes



IAQ Issue #10

Occupant Complaint/Response System (implement one, or get a tricorder)



Since we do not have Star Trek tricorders, we must rely on feedback from the occupants regarding the acceptability of the indoor air and this means having a formal complaint and response plan where the occupants can communicate with building operators.

The occupants are our IAQ sensors - use them.



The IAQ TOP 10 Fixes

??? Questions ???

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