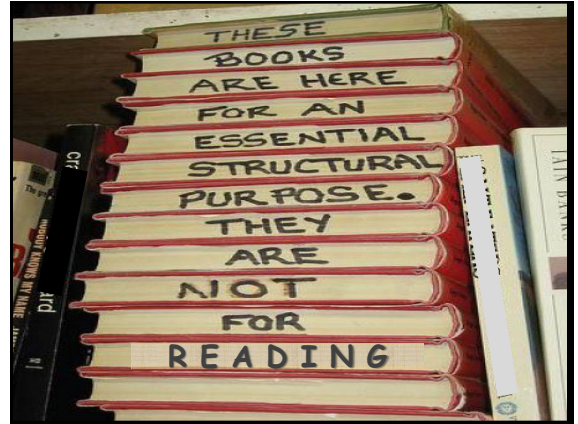
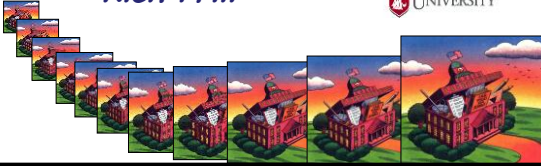


— The Virtual School IAQ —
— Walk-Through —

*Putting IAQ Information
into Action*

Rich Prill

Extension Energy Program
WASHINGTON STATE
UNIVERSITY



*"My school doesn't need an
IAQ Program . . .
it will just raise the issues
and cost us time and money"*



*"Budget cuts often result in
"break-down" maintenance*

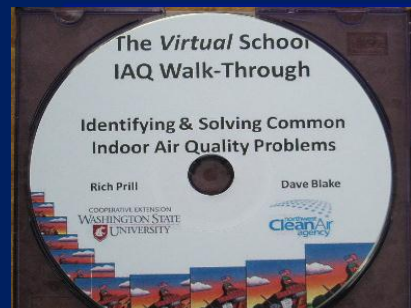
**Break-down maintenance
is not
appropriate for people**

**Keller SD:
"Good IAQ doesn't cost, it pays"**

**You can't address,
what you don't assess ***

* Stolen from Stacy Murphy

DVD available online



Northwest Clean Air Agency

IAQ Walk-Throughs
Reduce exposures
Improve IAQ
Understand Issues

discussions

observations

measurements



IAQ Pro-Tip

Schools are dynamic ...
monitoring is your
early warning
system

Routine Health Check-Up Analogy

Prevention makes the most sense
(find problems before they find you)



Routine Health Check-Up Analogy

"What gets measured
gets controlled or fixed"



Documentation establishes
a "baseline" for actions,
goals, and priorities



You don't know unless you look



Identify *issues* before they
turn into *problems*

Good luck reasoning with
"emotional" people



Sends a *positive* message
to staff and parents



Key to Success:
Get buy-in from Administration



The Walk-Through

About $1/2 - 3/4$ of a school day

Opportunity to establish *credibility*:

demonstrates . . .
you care
you listen
you take action



Primary Team

Facilities director
Head custodian
Principal



Team of 3 to 5 members
optimal for information and access

Secondary Team

Nurse
Teachers
HVAC technician
Risk/Safety
representative

School board rep.
Health department
Concerned stakeholders



Visit during occupied hours
insights into *actual* building operation



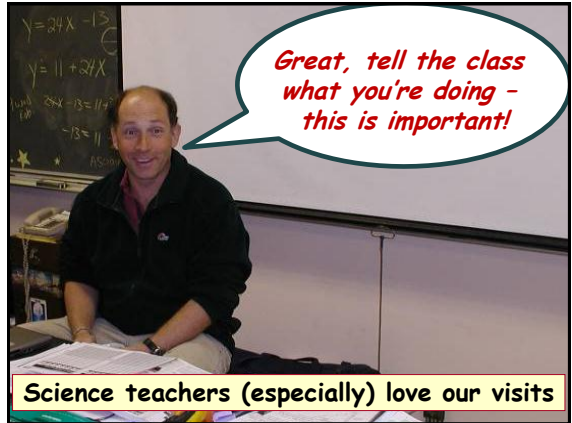
Advanced notice of visit: "proactive"



"What are you doing?"



Great, tell the class what you're doing - this is important!



Science teachers (especially) love our visits

Walk-throughs can inspire students and teachers



Involve students!

Loowit *Alternative* High School

Kelso, Washington

Student IAQ Project

Radon (free kits)

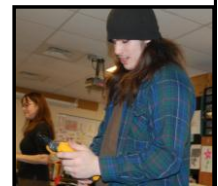
Ventilation (CO₂)

Comfort

Particles:

Classrooms with/without carpet

School HVAC filters



Spring 2012

" A great opportunity to educate ourselves on air quality and ways to improve the air around us - - - and let other people know ways to improve the air in their home, work, etc."

Amber Helenberg



"This was a great experience to learn more about my environment and it taught us the school needs to vacuum more."

Forrest Hille



"It was a very engaging project to be able to use actual air quality tools when performing the tests."

Liz Etchison



Not a science project ... look for "good practice"



Top to Bottom



Inside Outside



Rich's 5 Benchmarks

Dry

Clean

Comfortable

Pollutants Controlled

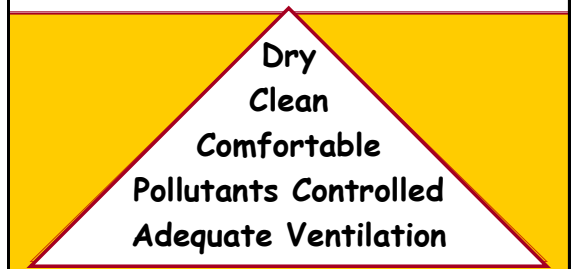
Adequate Ventilation



Essential "Good Practices"

Observations & Measurements

Compare to common sense benchmarks:



Walk-Throughs:



Non-threatening
Non-regulatory

A Practical Learning Opportunity



One-on-One
skills training

Point out ***potential*** problems,

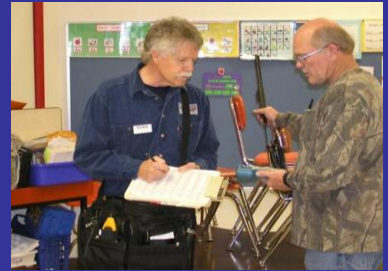
Don't over-react
or be alarmist

Remember: ...
School IAQ is *always a work in progress!*



Build relationships & skills

Do Not
criticize anyone's job performance



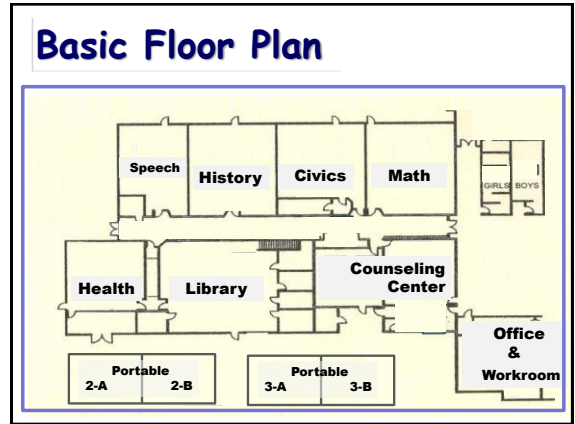
"Team Up" with credible resources



Walk-Through Kits

Walk-Through Kits

- ✓ **Take Notes**
- ✓ **Look**
- ✓ **Listen**
- ✓ **Ask**
- ✓ **Measure**



Walk-Through Checklist

Start simple (K.I.S.S.)

OK	See Notes	Major Categories
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Entries & Hallways
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Classrooms & Portables
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ventilation & Mechanical
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Staff Lounge/ Workroom
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Science Labs & Shops
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Custodial & Storage
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Basements, Crawl, Tunnels
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Exterior & Roof

WSU Walk-through Data Form

Building: Skyview MS Date: 4-24-2012

Room	Time	People	CO ₂	Room	CO ₂	Supply	HVAC	mg/m ³	Room Air*	Supply Air*	Particles
202	11:08	27	850	600	600		ON		0.3	14,500	8,700
candles, Ozone air cleaner, chemicals @ sink											
									0.5	2,000	1,100
									1.0	340	280
									2.0	500	230
									5.0	35	0
									10.0	12	0
									10.0	10.0	10.0

Inventory "pollutant sources"

Edgecattum Middle School
8003 Dairyaire Drive
USA

- Chemistry
- Physics
- Biology
- Art
- Home Science
- Custodial
- Rest Rooms
- Workroom
- Locker Rooms
- Kitchen
- Boiler Room



Air goes where it's pushed or pulled

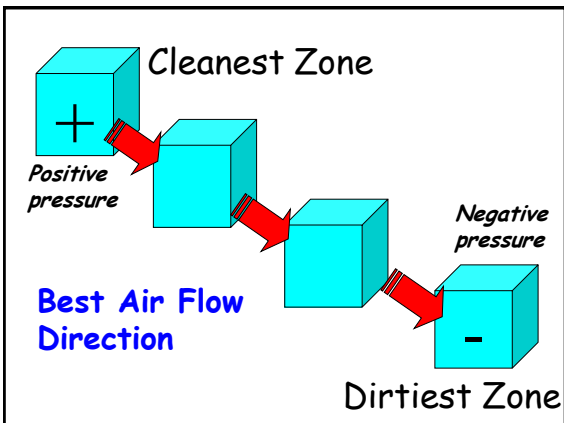


tracer smoke



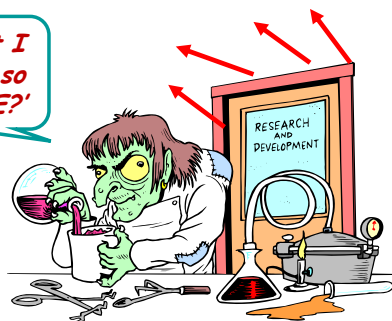
IAQ Pro-Tip

Air should move from "clean" to "dirty" to outside

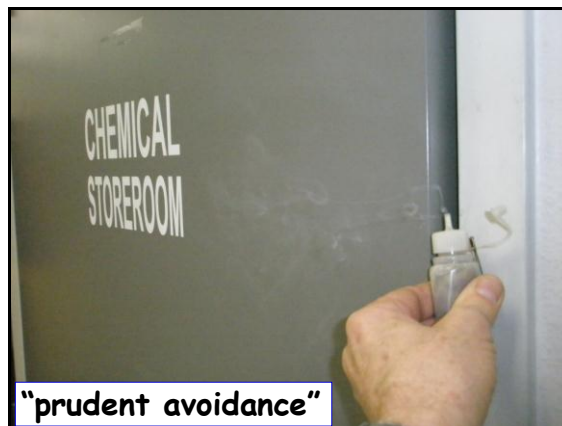


Contain Pollutants with Pressures

'Why must I always be so NEGATIVE?'

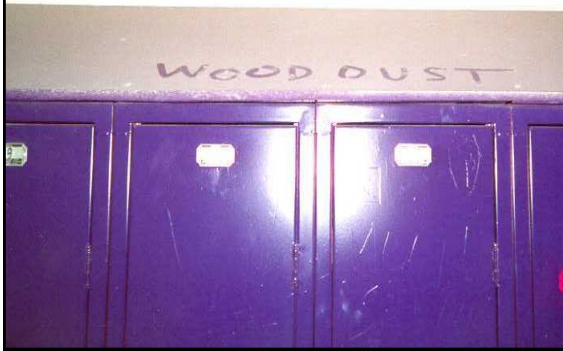


Positive Pressure = Air Out
Negative Pressure = Air In
Neutral Pressure = No Air Flow



"prudent avoidance"

Faulty school shop exhausts

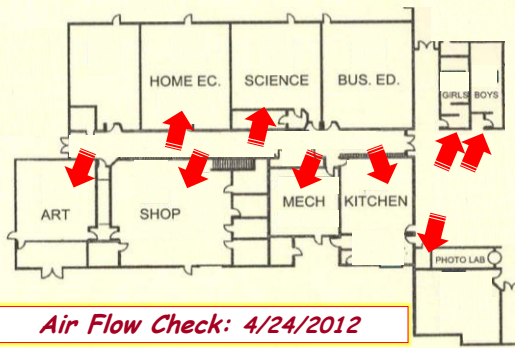


Check Air flow at critical areas



Wrong Pressure = Exposures

Air Flow: "clean" → "dirty"



Air Flow Check: 4/24/2012



IAQ Pro-Tip

Measure only
what you can
reasonably interpret

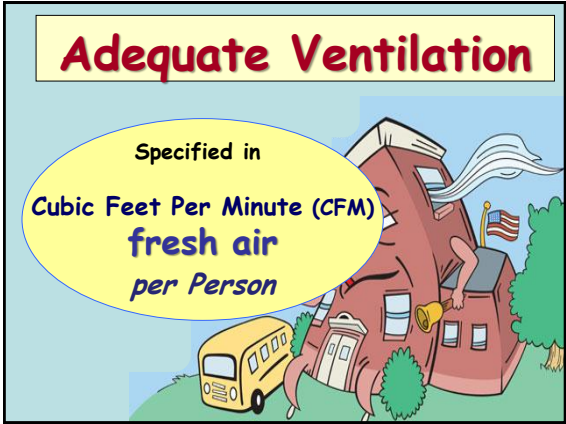
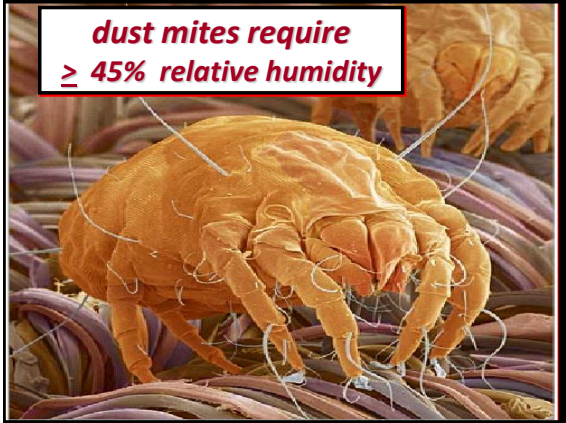
Measure Only What You
Can *Reasonably Interpret*





Comfort and RH%

Relative Humidity	Air Temperature						
	70°F	75°F	80°F	85°F	90°F	95°F	100°F
0%	64°	69°	73°	78°	83	87°	91°
10%	65°	70°	75°	80°	85°	90°	95°
20%	66°	72°	77°	82°	87°	93°	99°
30%	67°	73°	78°	84°	90°	96°	104°
40%	68°	74°	79°	86°	93°	101°	110°
50%	69°	75°	81°	88°	96°	107°	120°
60%	70°	76°	82°	90°	100°	114°	132°
70%	70°	77°	85°	93°	106°	124°	144°
80%	71°	78°	86°	97°	113°	136°	
90%	71°	79°	88°	102°	122°		
100%	72°	80°	91°	108°			



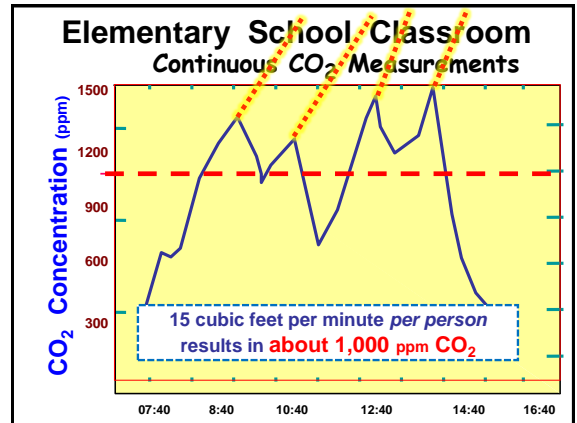
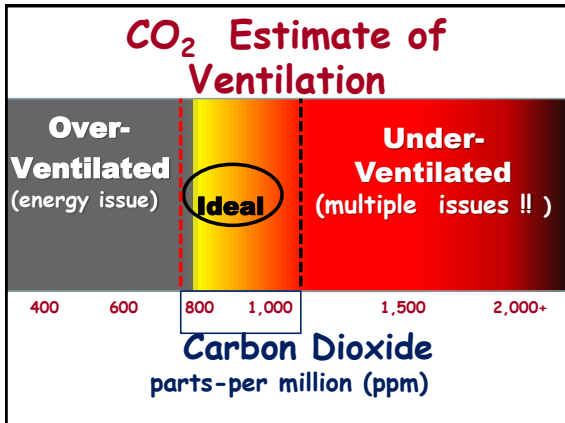
Cubic Feet per Minute (CFM)

15 cubic feet per minute, *per person*,
results in **about 1,000 ppm CO₂**



Carbon Dioxide vs. Ventilation

CO ₂ (ppm)	Outside Air (Ventilation rate)
2,400	--- 5 cfm/p Unacceptable
1,400	--- 10 cfm/p Poor
1,000	--- 15 cfm/p Classrooms
800	--- 20 cfm/p Offices
600	--- 25 cfm/p
~ 380	← → Outdoors

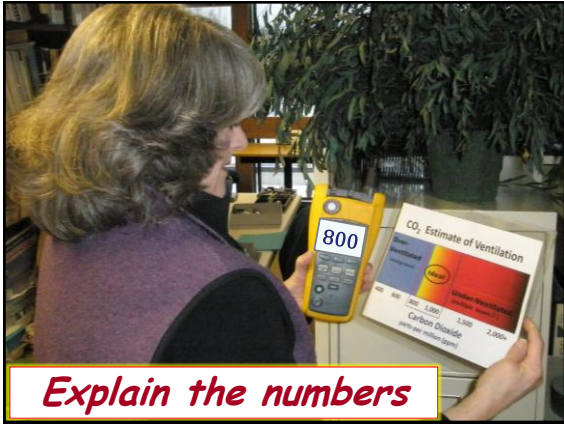


i IAQ Pro-Tip

As CO₂ builds up, so does "everything else"...

"Everything else" is too difficult to measure and interpret

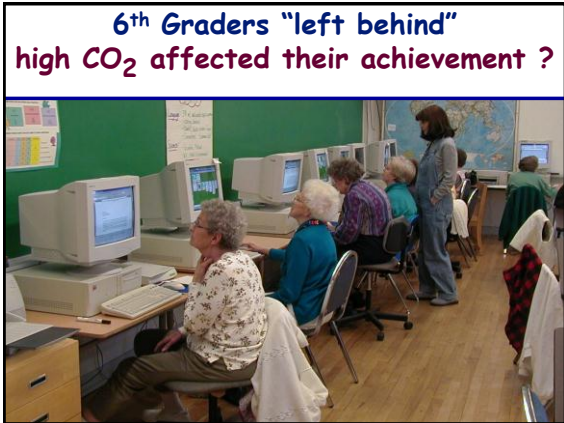




Explain the numbers



Elevated CO₂ may impact performance



**6th Graders "left behind"
high CO₂ affected their achievement ?**

CO₂ needs to build up in classes
Meanwhile, check

- ✓ Outside
- ✓ Tunnels
- ✓ Attic
- ✓ Custodial
- ✓ Storage
- ✓ Lockers
- ✓ Mechanical

The image includes two illustrations: on the left, a person in a white shirt and dark pants is kneeling and shining a flashlight; on the right, a diagram shows a cross-section of a building with various areas labeled, including an attic, storage, and mechanical rooms.



Start Outside

i IAQ Pro-Tip
*what's outside
gets inside*
*what's inside
builds up*

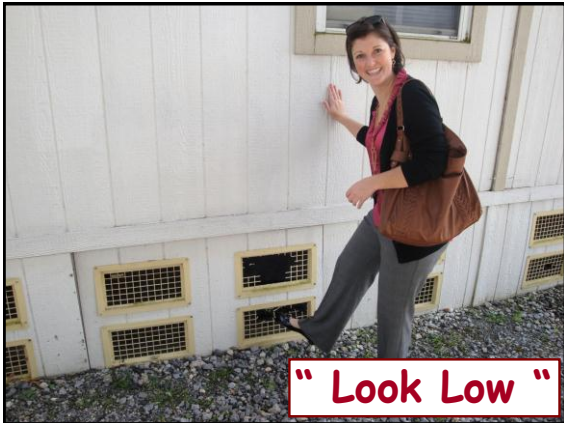
The text is set against a background of a white, textured surface, possibly marble or stone.



Neighborhood sources



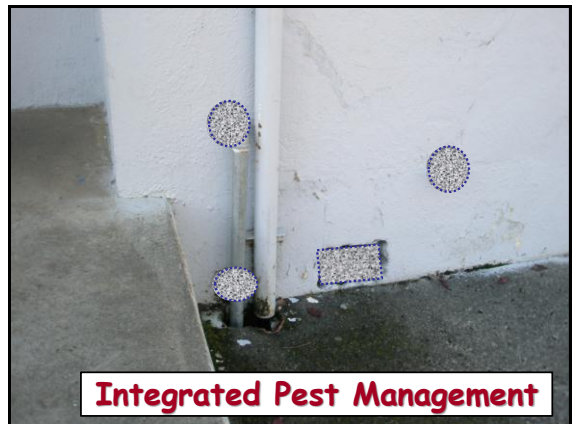
" Look High "



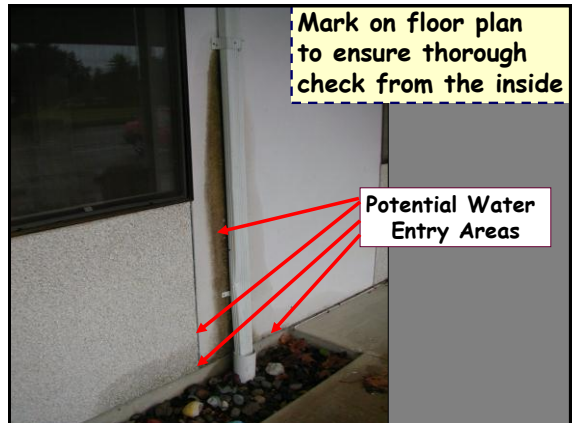
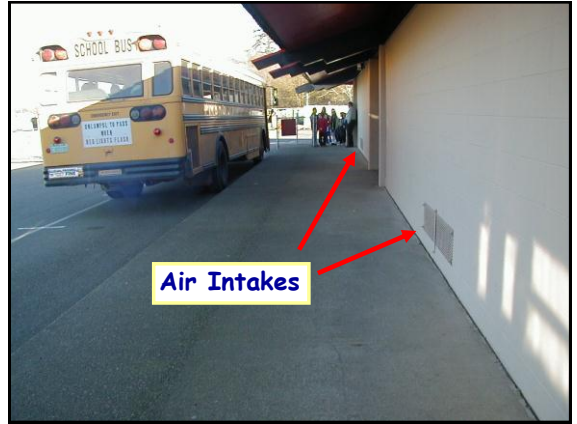
" Look Low "



**Dirt Control
Plants
Moisture
Vehicle Exhaust
Pests**



Integrated Pest Management





Why "stuffy" classroom? Outside fresh air intake completely plugged



Learn about mechanical equipment on the roof



**Note conditions
Ask questions
"Show Me"**





Inspect everywhere



Check out attic spaces



Bat Guano over a 3rd grade classroom



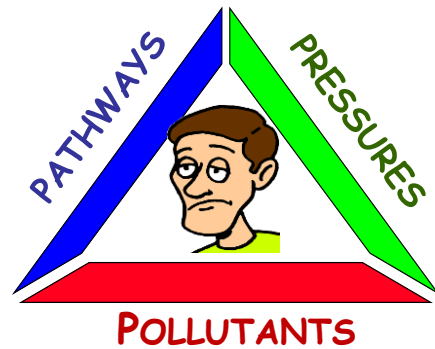
Warm Air Rises



Portable is damp & smells moldy



Essential IAQ Dynamics



Crawlspaces, Tunnels, Etc.



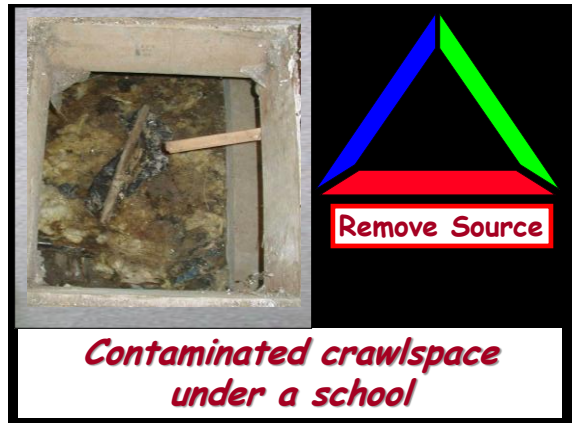
Crawlspaces, Tunnels, Etc.

Contaminated air enters occupied areas through unplanned pathways

Check air flow direction



"Contaminated" Crawlspace

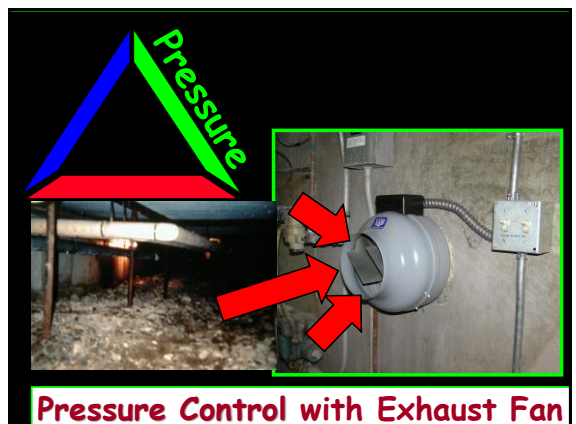


Contaminated crawlspace under a school

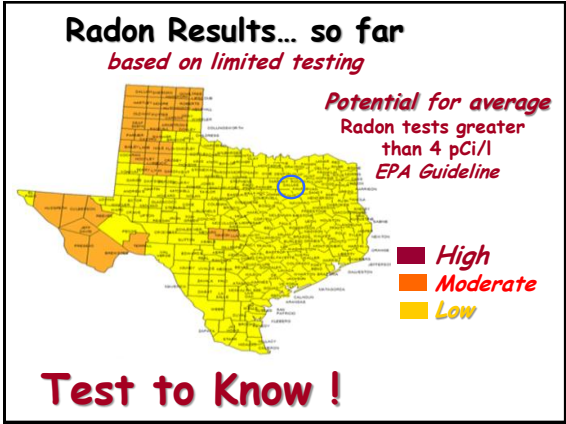


Block Pathway

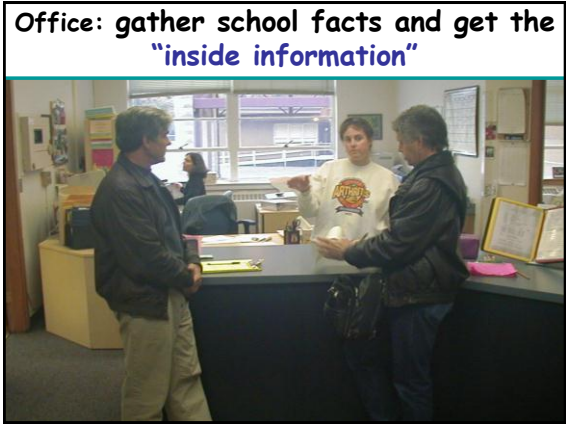
Pathway



Pressure Control with Exhaust Fan



Offices
Work rooms
Staff room

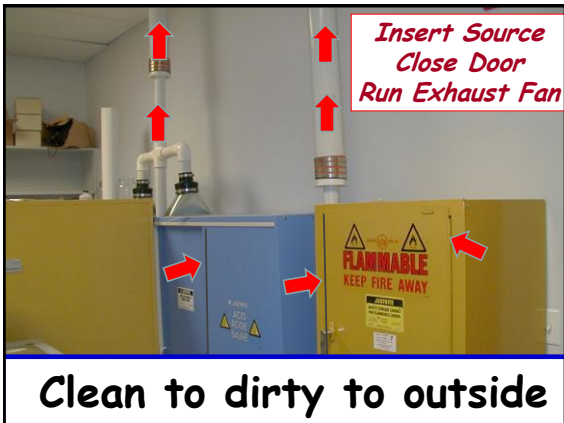




Un-vented laminators

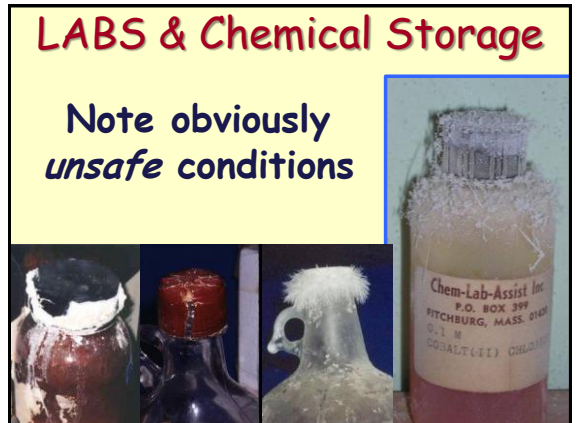


**Storage
Custodial
Mechanical Areas**



*Insert Source
Close Door
Run Exhaust Fan*

Clean to dirty to outside



LABS & Chemical Storage

Note obviously unsafe conditions



Exhaust 24/7



Old photo chemicals

Dispose of Chemicals ...

- ✓ Useless
- ✓ Dangerous
- ✓ Decrepit
- ✓ Excessive
- ✓ Incognito



www. Rehab the Lab



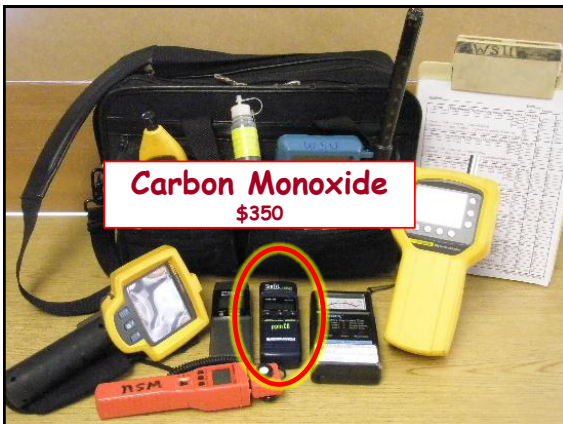
Use Personal Protection where needed



Gas cooking equipment ?



Carbon Monoxide
\$350



Check pressures in "combustion zones"



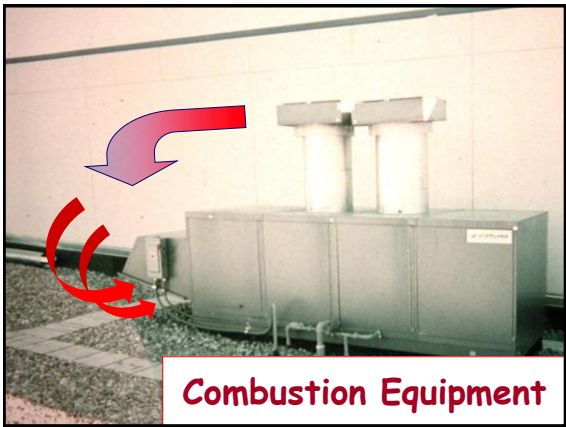
CO Alarm?



spillage !



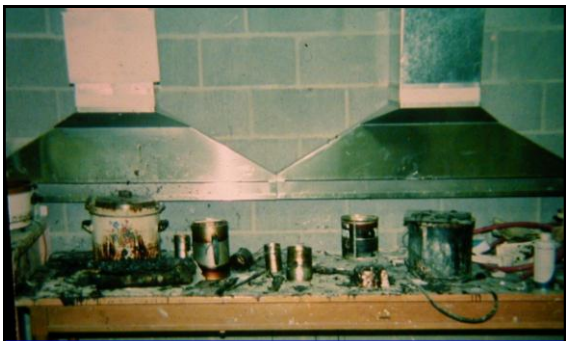
Flue gases into fresh air intakes



Combustion Equipment



Vent kilns



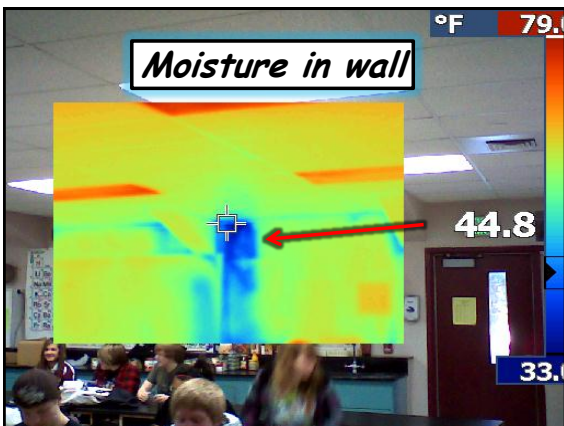
Capture and exhaust = less exposure



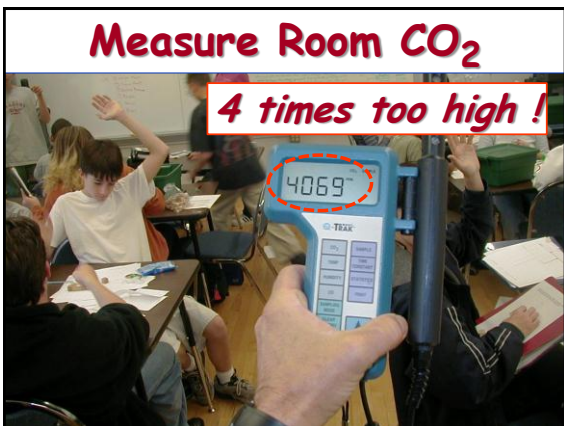
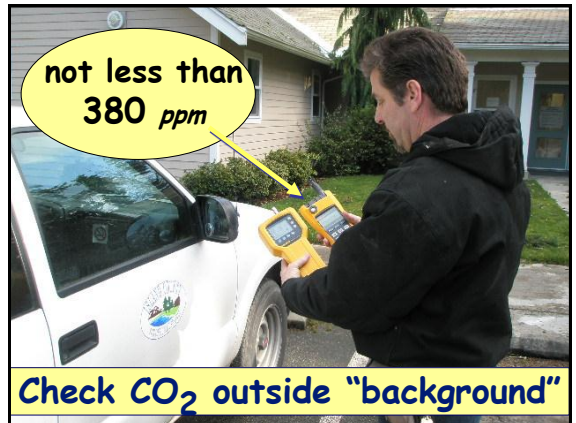
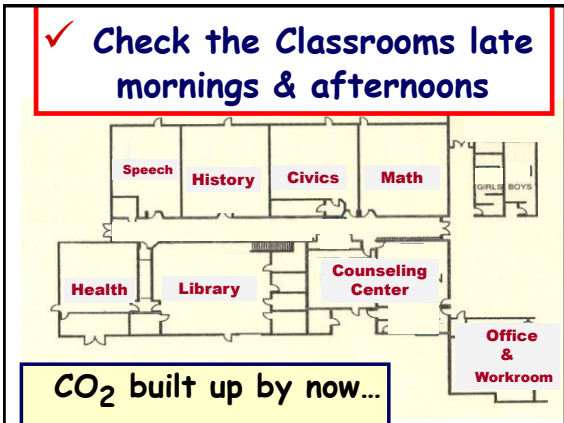
**Molds:
Just Add Water**



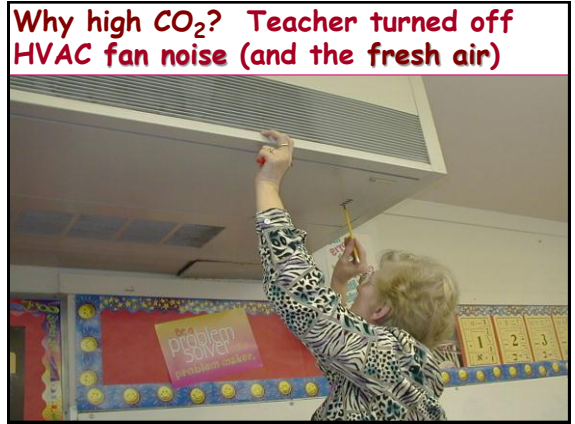
Keep moisture away from mold food - - until leak is fixed



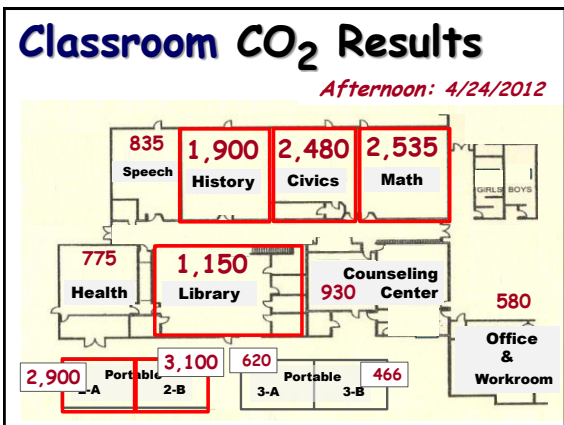
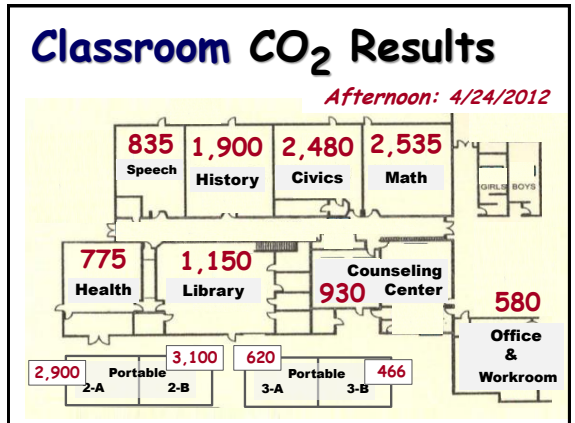
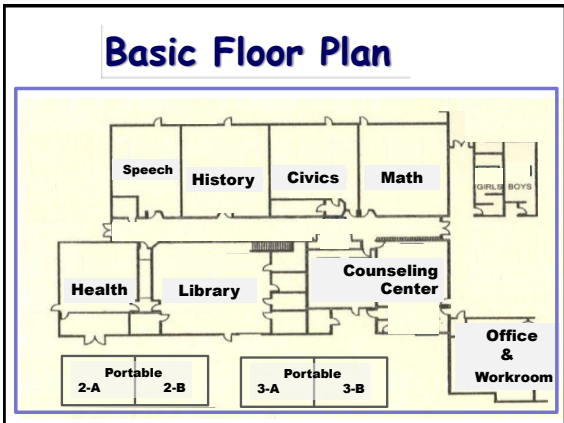




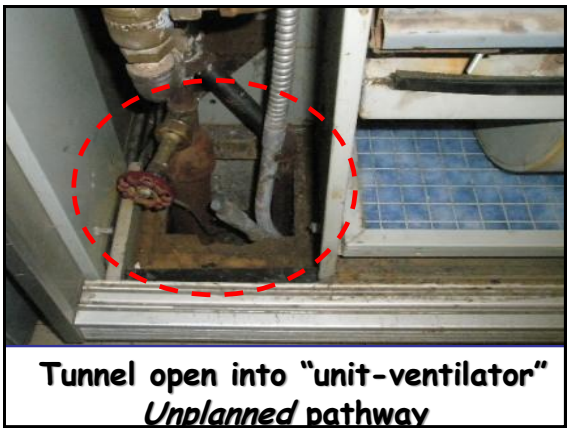
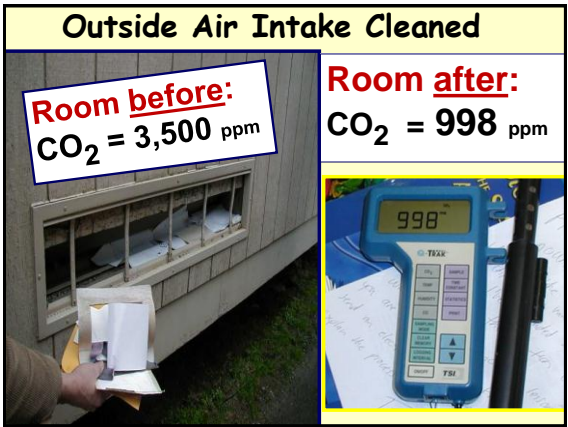
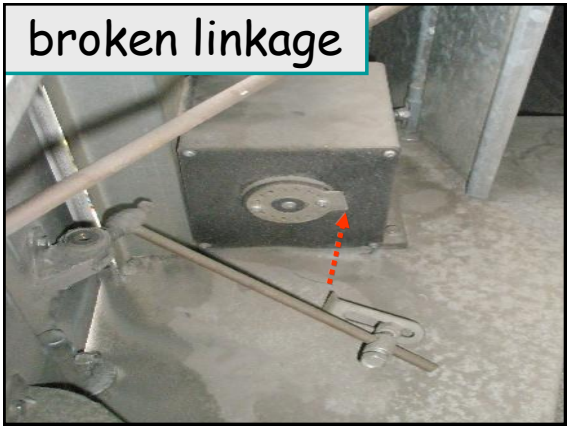


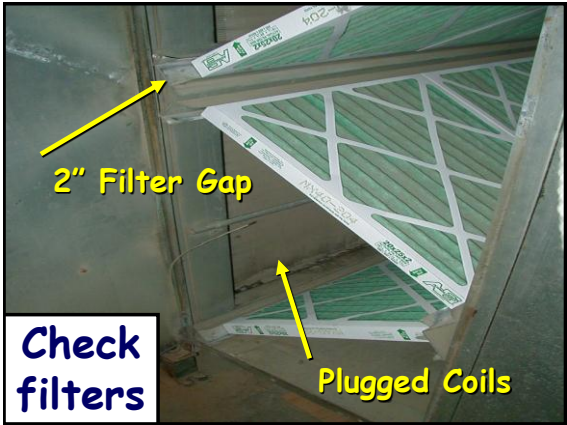


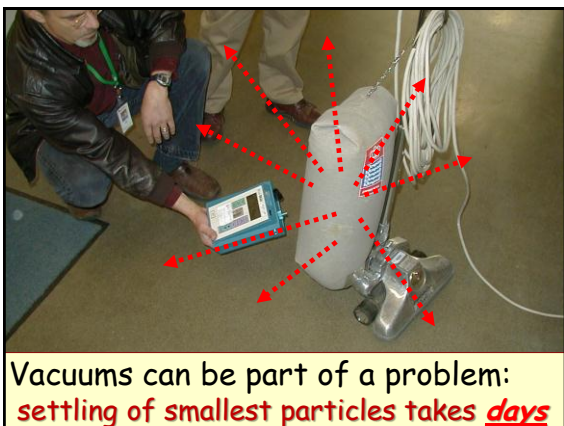
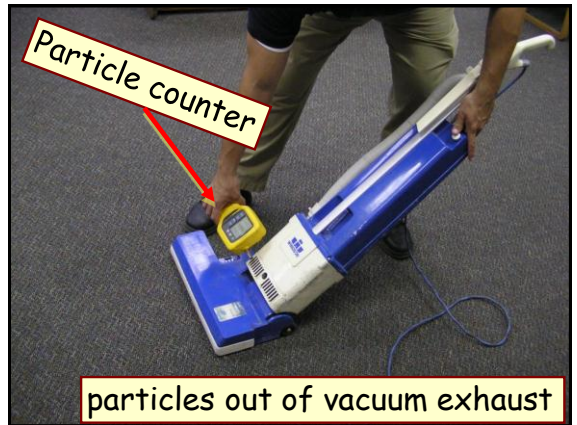
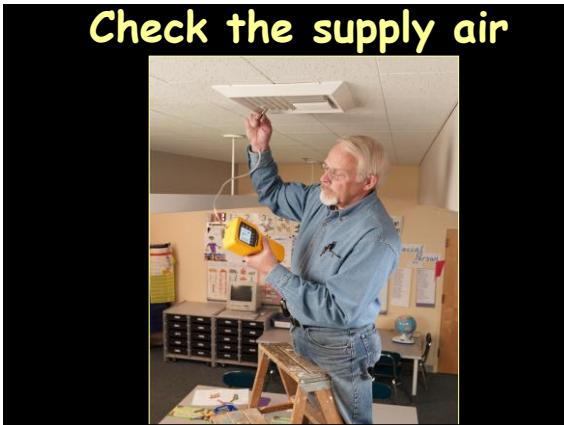
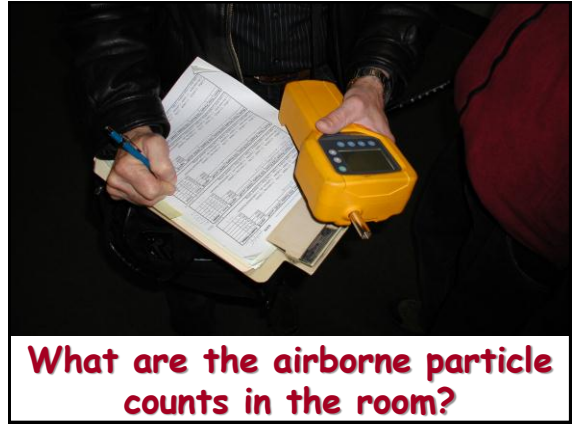
Why high CO₂? Teacher turned off HVAC fan noise (and the fresh air)



Why Supply CO₂ too high?









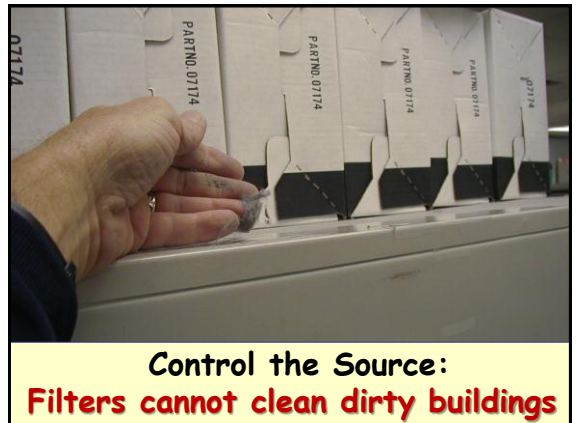
Asbestos tile removal required



Clean Enough ?



Clean Enough ?



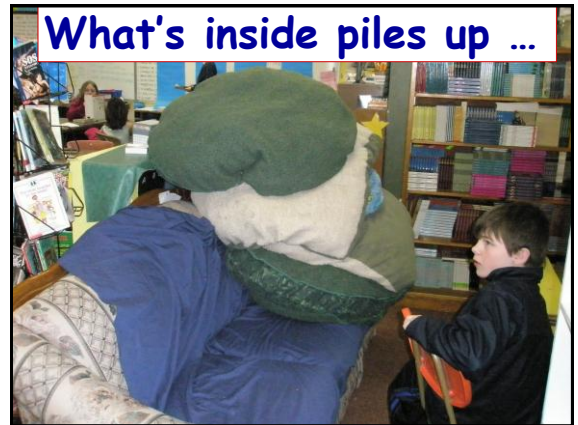
**Control the Source:
Filters cannot clean dirty buildings**



Custodian's nightmare



Give custodians a fighting chance!



"cultural change" takes time

Adopt a policy: "visiting" animals only
(no permanent residents)



Avoid odor "masking" with chemicals

Strong pollutants overwhelm
typical ventilation rates



Asthma Triggers



Ozone generators
Not
recommended

Pollutants ?
Hazards ?



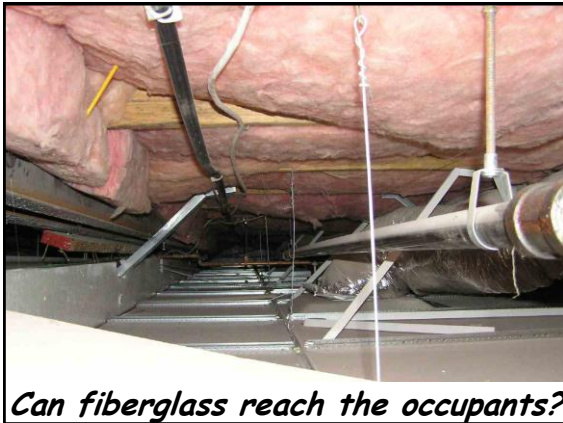
No chemicals "from home"



Look Above Suspended Ceilings



Gravity Always Wins !



Can fiberglass reach the occupants?

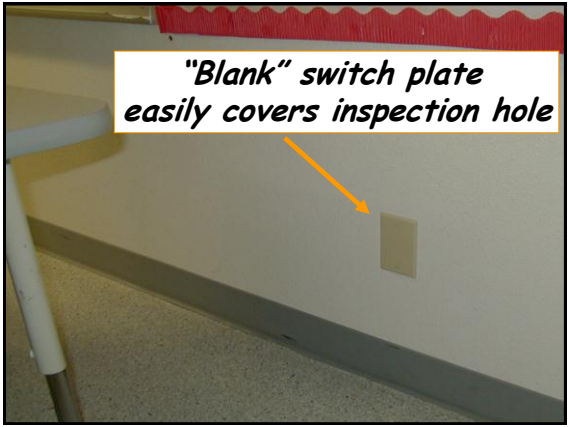
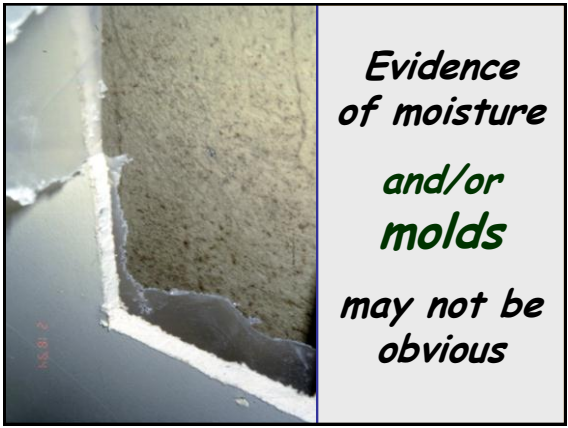


Remove or Contain Fiberglass

Measure Moisture



Moisture Meter \$300





Damp carpet under chair mat?



Concrete wicking moisture

'Post'
Walk-Through
Debrief



Meet with Principal, coordinator, facility manager, and other stakeholders

Summarize findings -
Discuss the good and not-so-good
Emphasize immediate risks

Post the Walkthrough Results

April 25, 2012

- Air off in 3-A
- Bad fan in science lab
- CO₂ = 2,450 Room 103
- CO₂ = 1,800 Room 111
- Air out of lab
- Air out of lockers
- Air out of boys R/R
- Wet carpet in art room

- 1) Rank Priorities
- 2) Set Timelines
- 3) Document Fixes



Formalize "good practices" into plan

Institutionalize good practices to prevent & solve IAQ issues

Environmental Protection Agency
Region 10
TOOLS FOR SCHOOLS
INDOOR AIR QUALITY IMPLEMENTATION
3 EASY STEPS

Adopt an IAQ Program

Select from a "menu" of about 80 items

3 Easy Steps:

1. Select IAQ coordinator
2. Conduct walk-through
3. Adopt a program

www.energy.wsu.edu

Take Home Messages:

Prudent Avoidance:

Don't allow it in
Contain & minimize
Ventilate

Control and/or remove asthma triggers

Fragrance FREE zone

Due to allergies

Respect sensitivities of others



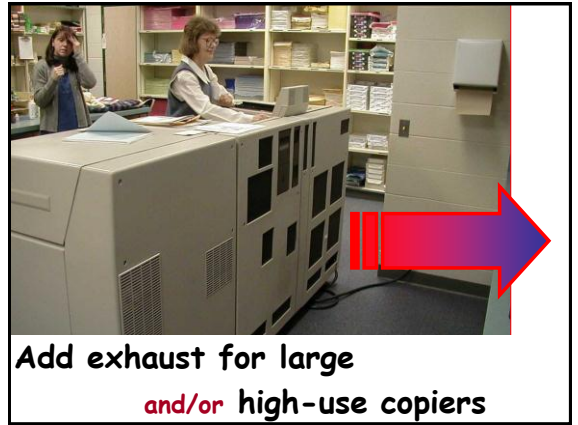
Send chemicals home



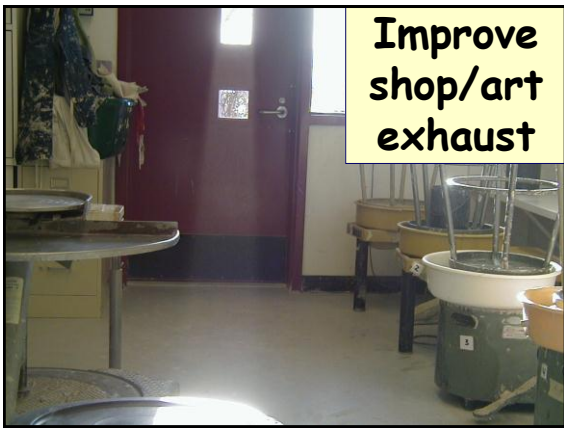
Control Pollutants



Remove contaminated materials



**Add exhaust for large
and/or high-use copiers**



**Improve
shop/art
exhaust**



Fight Moisture

Prudent Avoidance: Clean to dirty air flows



Strive to adopt
"cleaning for health"



BIRCHWOOD ELEMENTARY SCHOOL
INDOOR AIR QUALITY

ACTIONS TAKEN BY BSD TO ADDRESS IAQ ISSUES:

- Change Supply Air Filters Every Season
- Use of Backpack Vacuums
- 1995, Replace Roof
- Reduce use of chemicals/Install Automatic Mixing Stations
- 1996, Requested Health Departments help for IAQ
- 1997, Imple...

Communicate!

- ...replace windows in original building w/Insulated windows
- 2001, Replace windows in Office/Staff Break room
- 2002, Replace backpack filters to near HEPA quality
- 2003, Change all chemicals to current "Green" label
- 1998, Visit by NWAPA and EPA, air system adequate for Health

Publicize your IAQ efforts

PUBLIC MEETING

PARENTS AND TEACHERS WELCOME

Certificate of Implementation
Dairy-Aire Elementary School
Has Adopted *Tools For Schools*
Indoor Air Quality Practices
To Help Ensure A Safe, Healthy, and Productive Learning Environment

Presented by
The Environmental Protection Agency Region 10
Awarded November 29, 2005

EPA Region 10
Air Program Director

Rich Psill
Indoor Air Quality Specialist
Washington State University

Want to know more about
IAQ measurement & testing ?

**"Responding and Solving
IAQ Problems"**

Webinar slides available
contact: Michelle Curreri, EPA

