The Virtual School IAQ Walk-Through

Putting IAQ Info into Action

Rich Prill & Dave Blake

COOPERATIVE EXTENSION
WASHINGTON STATE UNIVERSITY

northwest CleanAir agency

IAQ Walk-Throughs:

Reduce exposures and *improve IAQ*

through *on-site:*

discussions

observations

measurements

Framework for Effective School IAQ Programs

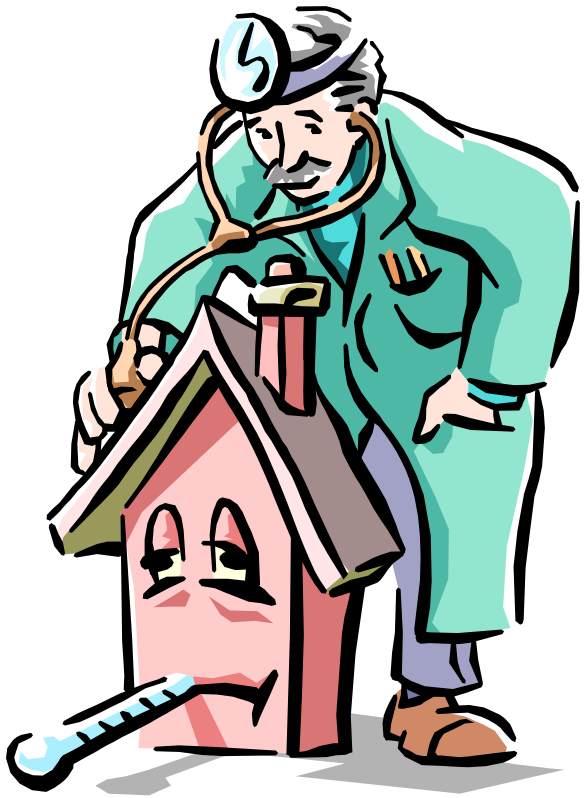
IAQ Pro-Tip

Schools are dynamic …

monitoring is your early warning system

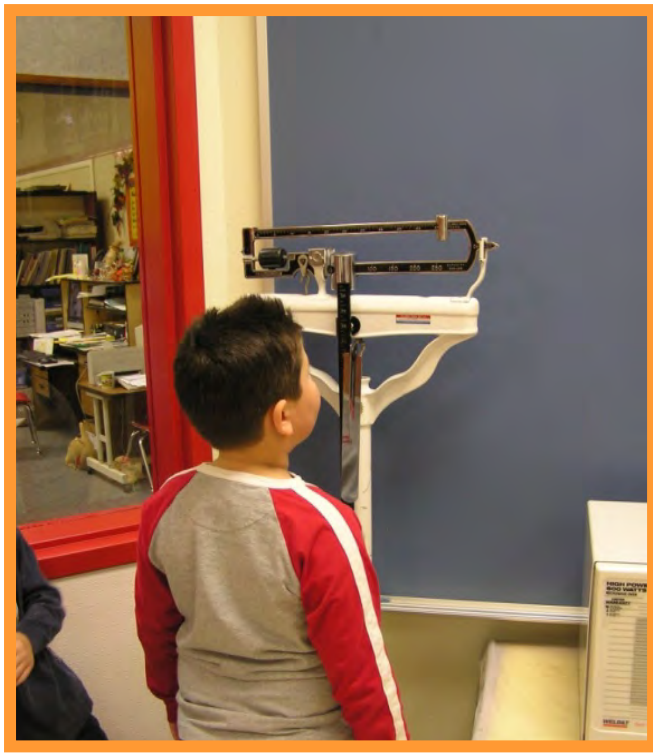
Routine Health Check-Up Analogy

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



Routine Health Check-Up Analogy

- ✓ Checks the usual (not the exotic)
- ✓ Specialist if needed
- ✓ Opportunity for communication



Routine Health Check-Up Analogy

"What gets measured gets controlled or fixed"

Documentation establishes a *"baseline"* for goals and priorities

Routine Health Check-Up Analogy

Immediate feedback:

reduces anxiety &

provides peace of mind

Monitoring Results

- ✓ Carbon Dioxide
- ✓ Carbon Monoxide
- ✓ Relative Humidity
- ✓ Temperatures
- ✓ Air flows
- ✓ Particles
- ✓ Formaldehyde
- ✓ Radon

The Walk-Through

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

Opportunity to establish team member *credibility*:

Show:

what you know

that you care

that you listen

Primary Team

Facilities director

Head custodian

Principal

Team of 3 to 5 members

is optimal for

information and access

Other Stakeholders

Nurse
HVAC technician
Risk/Safety representative
Teachers

School board rep.
Health department
Volunteers

Visit during occupied hours

Insights into *actual* building operation

Advanced notice of visit:"proactive"


"What are you doing?"

Not a science project …

look for "good practice"

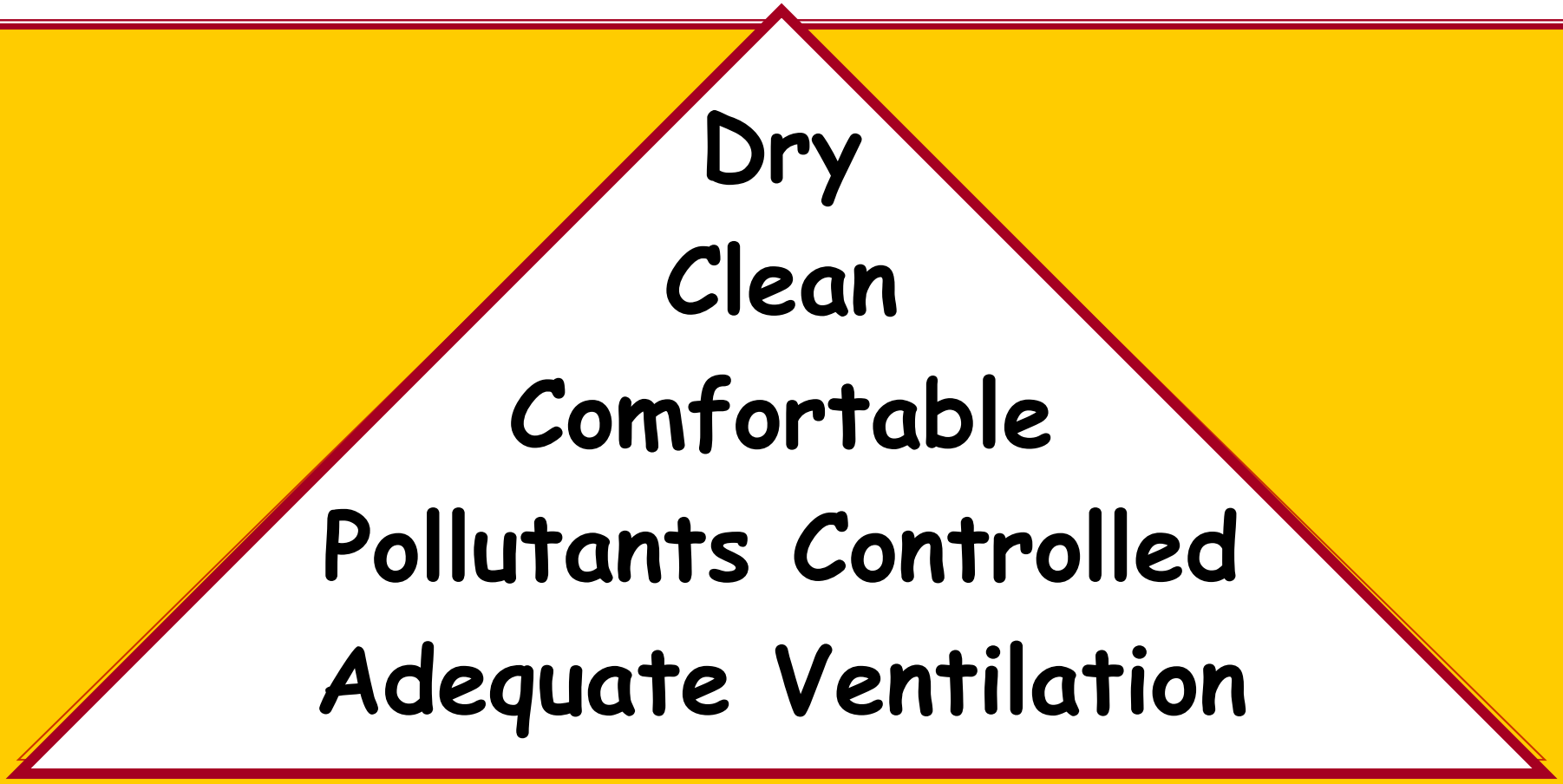
Top to Bottom

Inside Outside

Essential "Good Practices"

Observations & Measurements

Compare to common sense benchmarks:



Get BUY-in from the Administration

"Sell" gently and realistically

(but don't burn any bridges if you can't)

Walk-Throughs:

Non-threatening
Non-regulatory

Send a positive message to staff …… and parents

A Practical Learning Opportunity

One-on-One skills training

Build relationships & skills

Not there to find fault
with anyone's job performance

DeLuxe Walk-Through Kit

IAQ Pro-Tip

Measure only what you can reasonably interpret

Walk-Through Checklist

OK	See Notes	Major Categories
☐	☐	Entries & Hallways
☑	☐	Classrooms & Portables
☑	☐	Ventilation & Mechanical
☑	☐	Staff Lounge/ Workroom
☐	☐	Science Labs & Shops
☐	☑	Custodial & Storage
☐	☐	Basements, Crawl, Tunnels
		Exterior & Roof

Point out *"potential"* problems,

Don't over-react

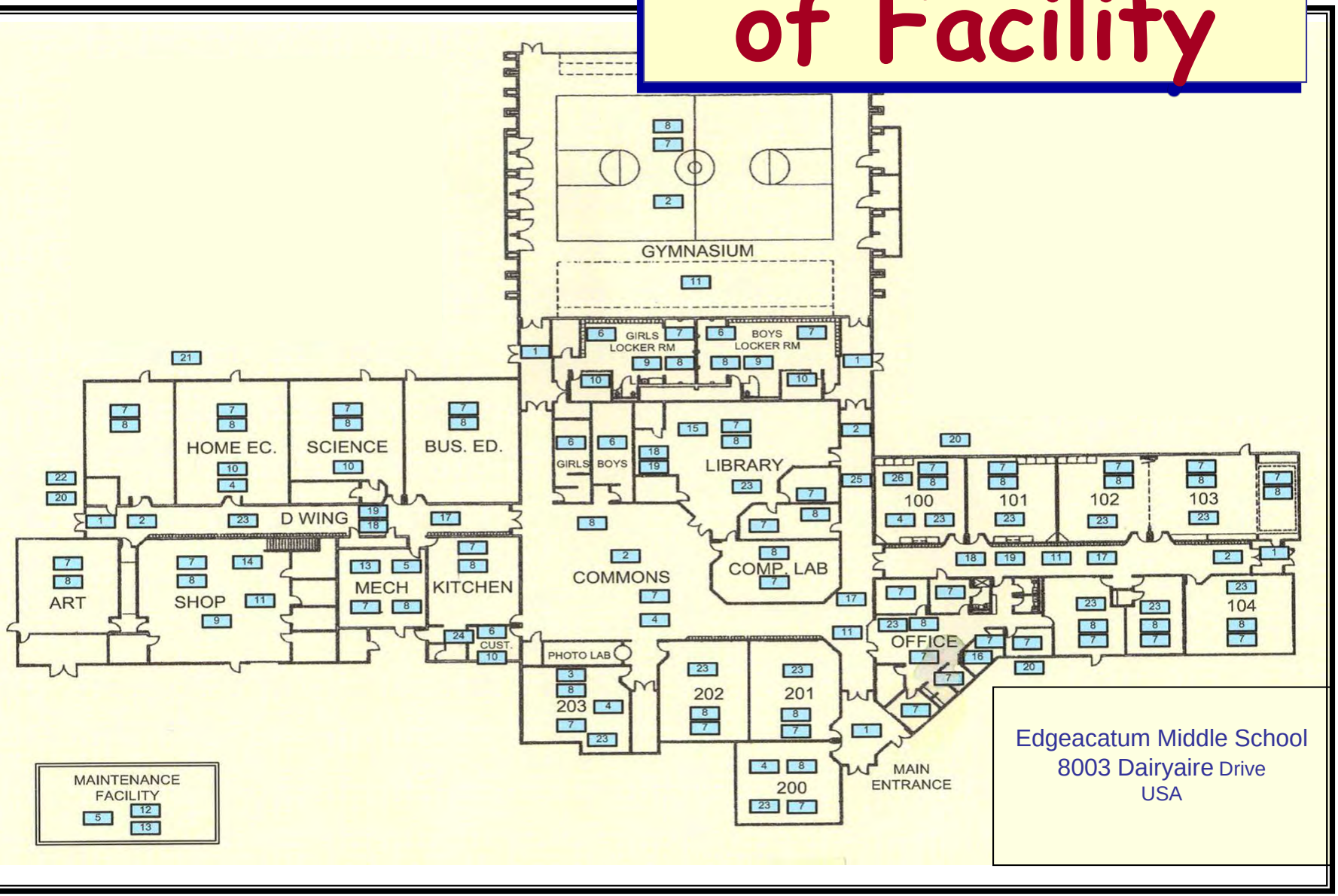
or be alarmist

Remember:…

School IAQ is *always a work in progress !*

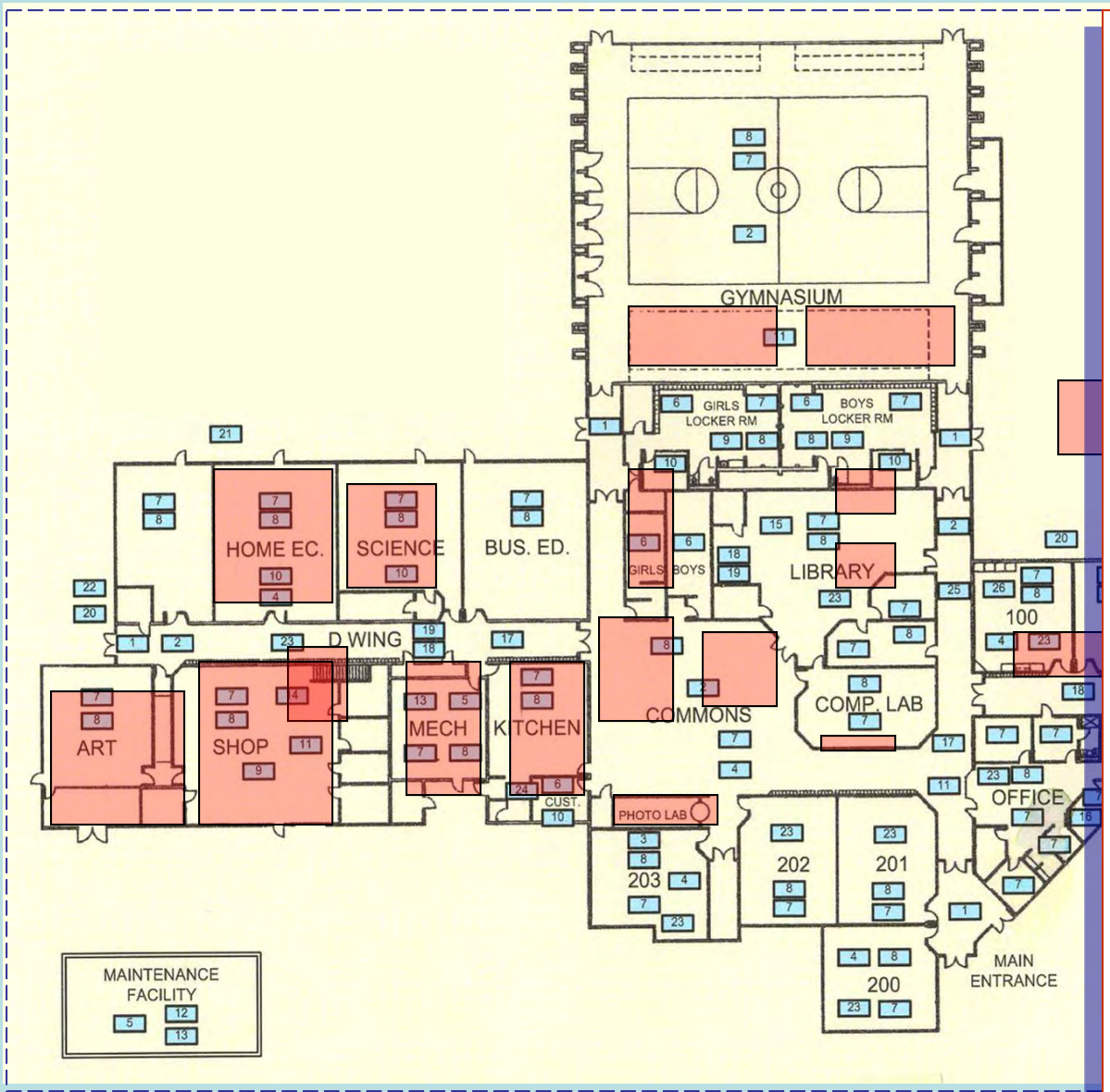
Fire Escape Plan

Basic Map of Facility



Edgeacatum Middle School
8003 Dairyaire Drive
USA

Pollutant Control: Source Inventory



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

IAQ Pro-Tip

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

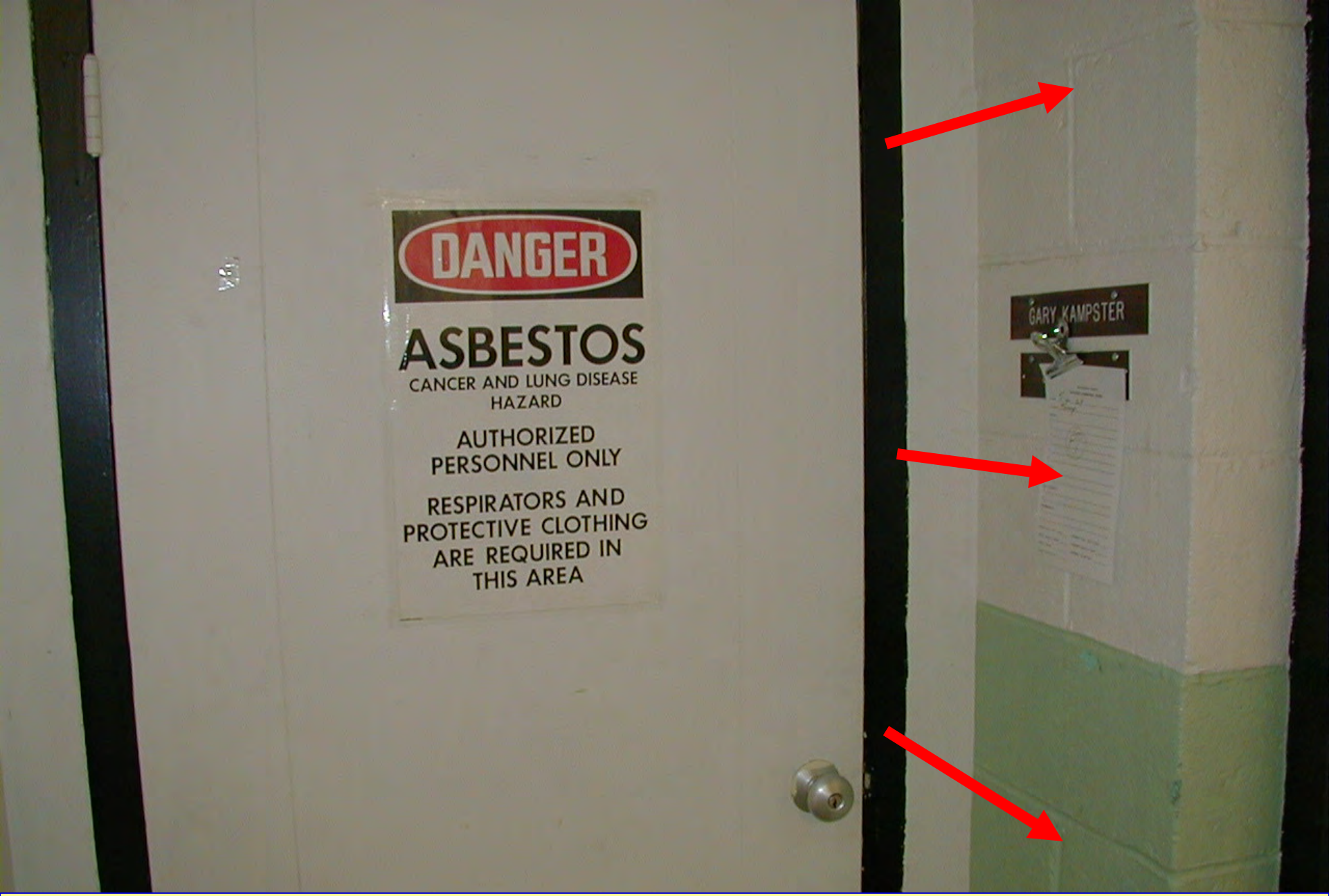
Air goes where it's pushed or pulled

tracer smoke


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


CHEMICAL
STOREROOM

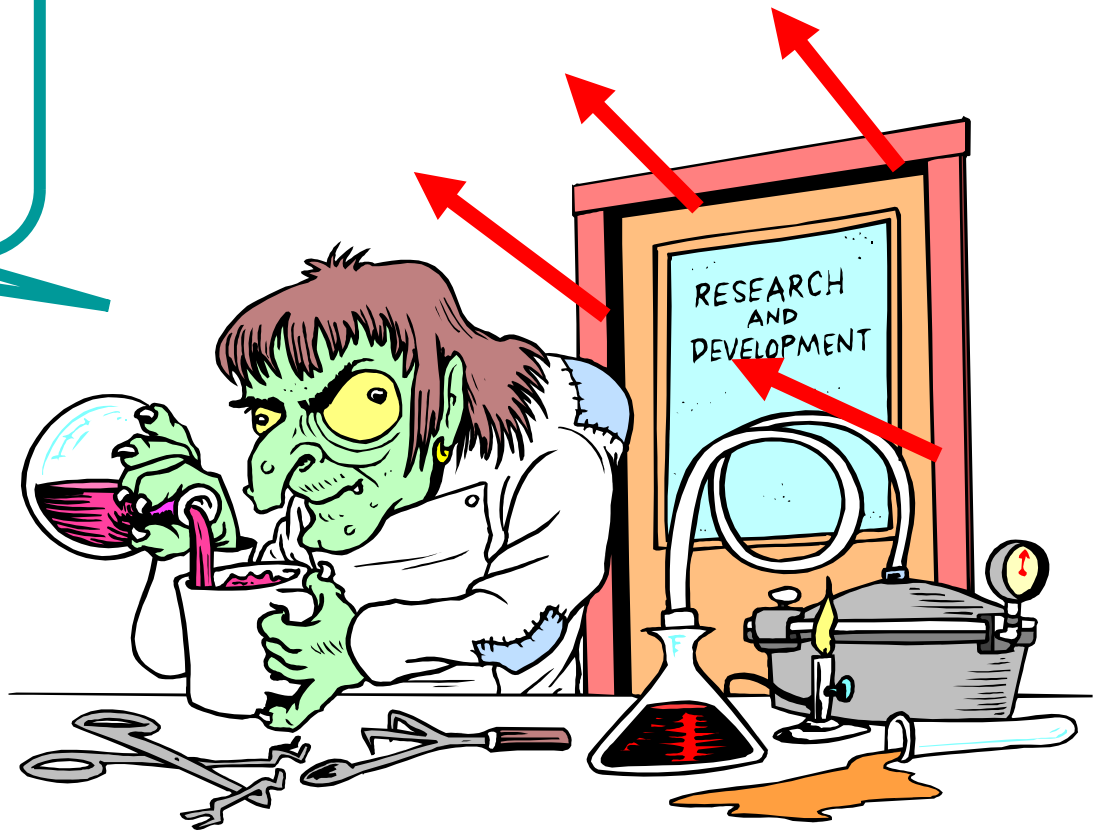
Check Air flow = Check Pressure



Wrong Pressure = Exposures

Contain Pollutants with Pressures

'Why must I always be so NEGATIVE?'

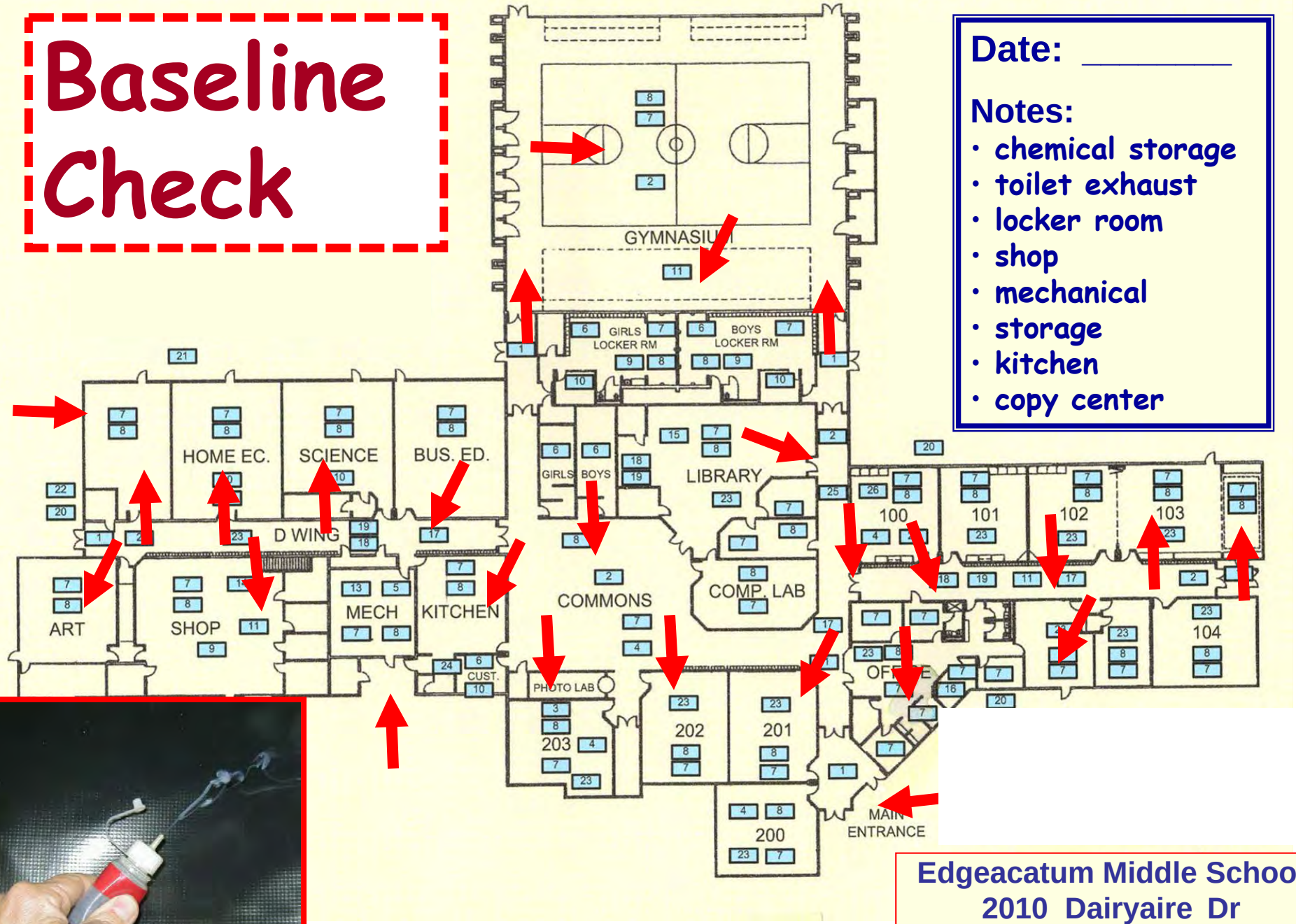


Baseline Check

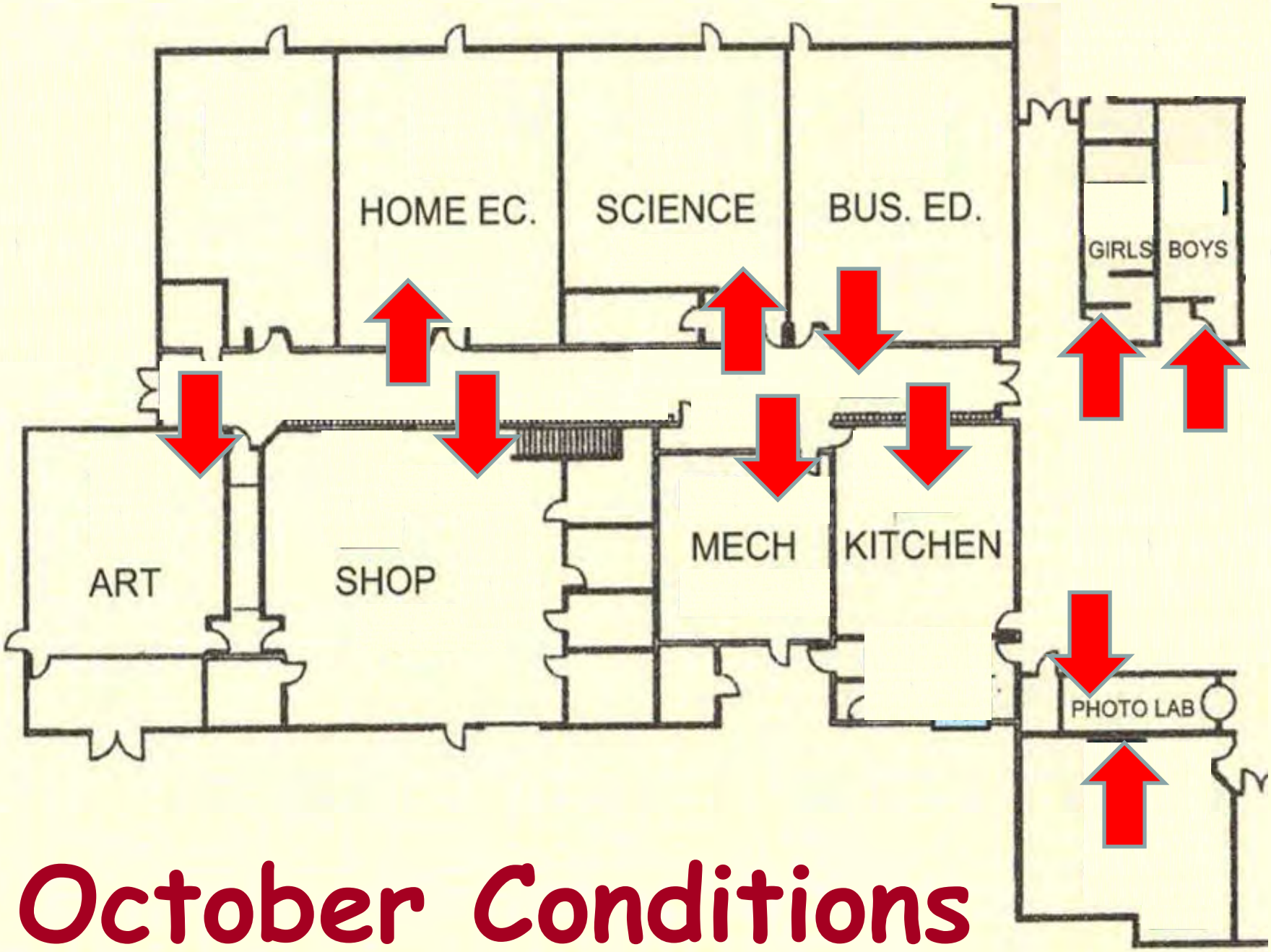
Date: _____

Notes:

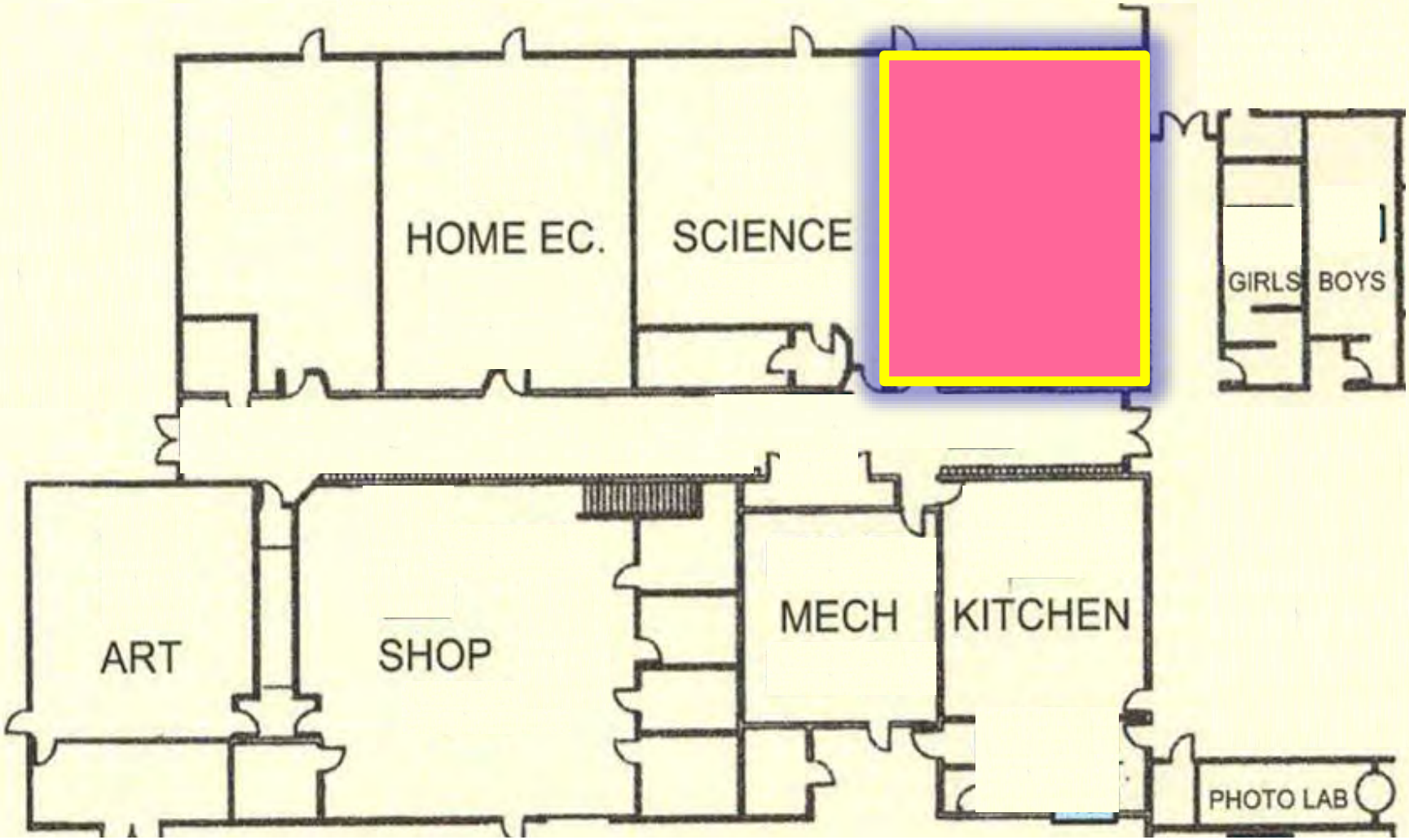
- chemical storage
- toilet exhaust
- locker room
- shop
- mechanical
- storage
- kitchen
- copy center



Edgeacatum Middle School
2010 Dairyaire Dr
USA

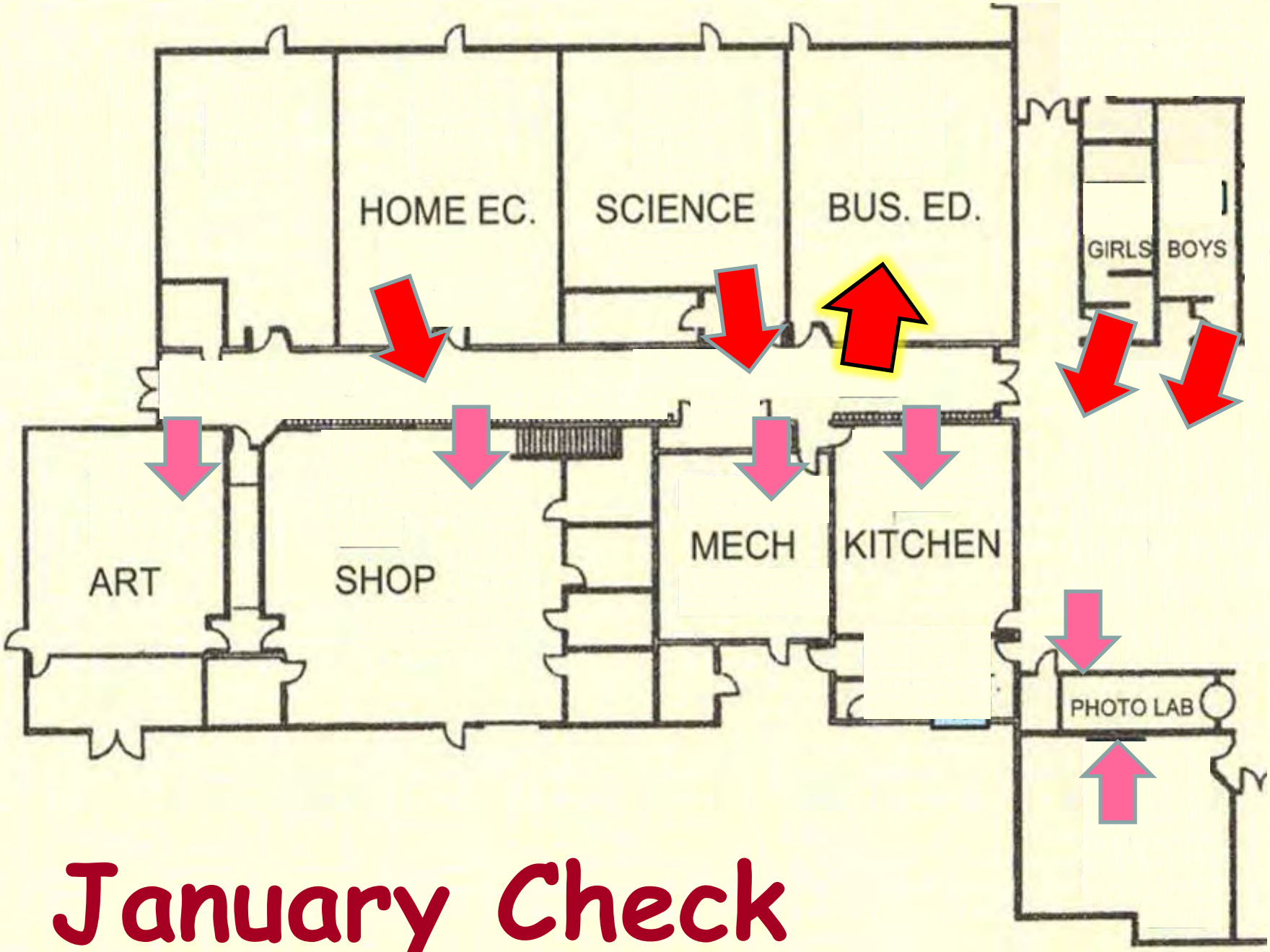


October Conditions

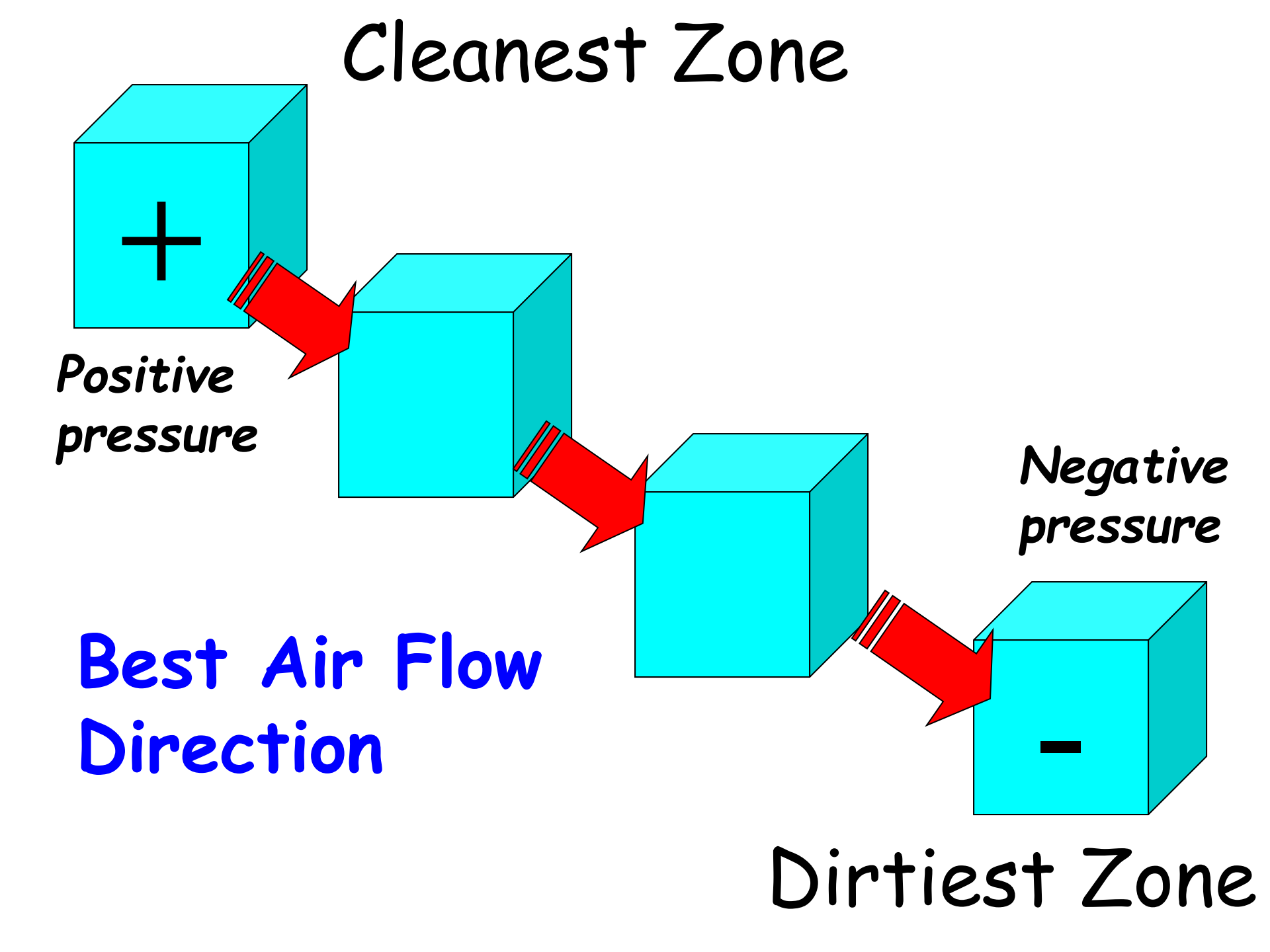


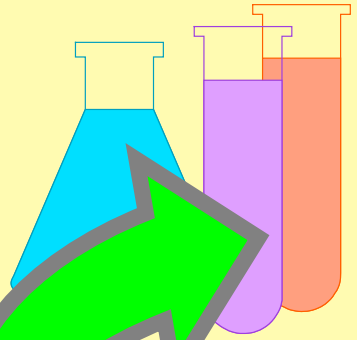
. . . January

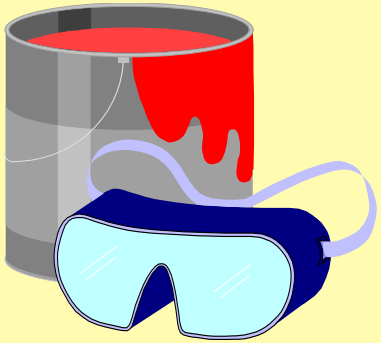
IAQ Issue in Business Ed

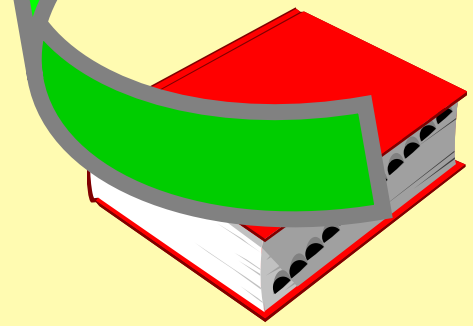


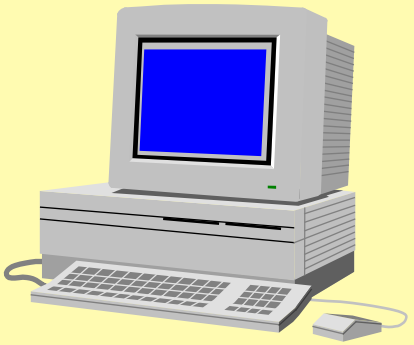
January Check


Cleanest Zone
+
Positive pressure
Negative pressure
Best Air Flow Direction
-
Dirtiest Zone









Faulty school shop exhausts

Adequate Ventilation

Specified in

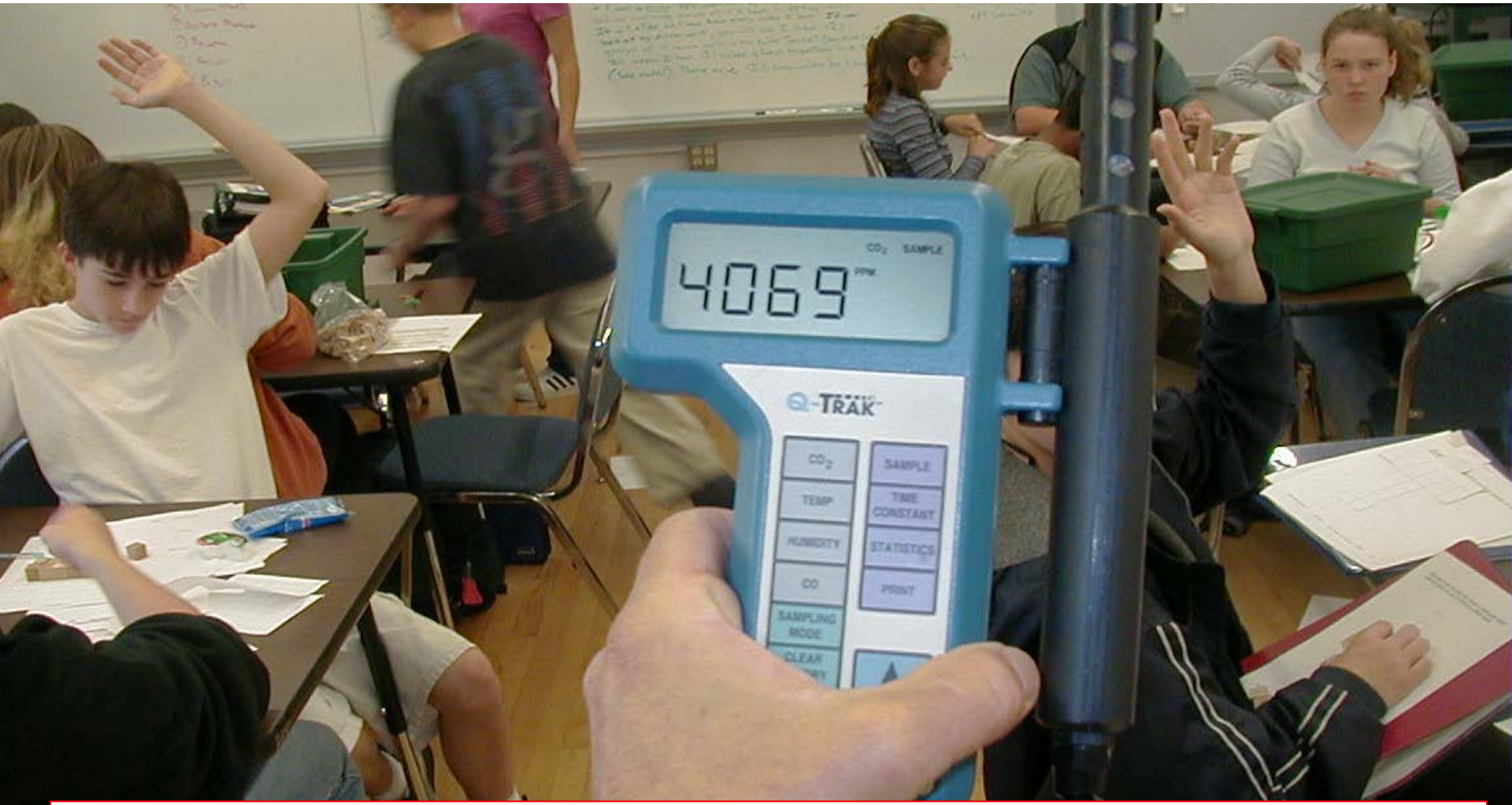
Cubic Feet Per Minute (CFM)

fresh air

per Person

Carbon Dioxide (CO_2)

Easy method to check fresh air exchange

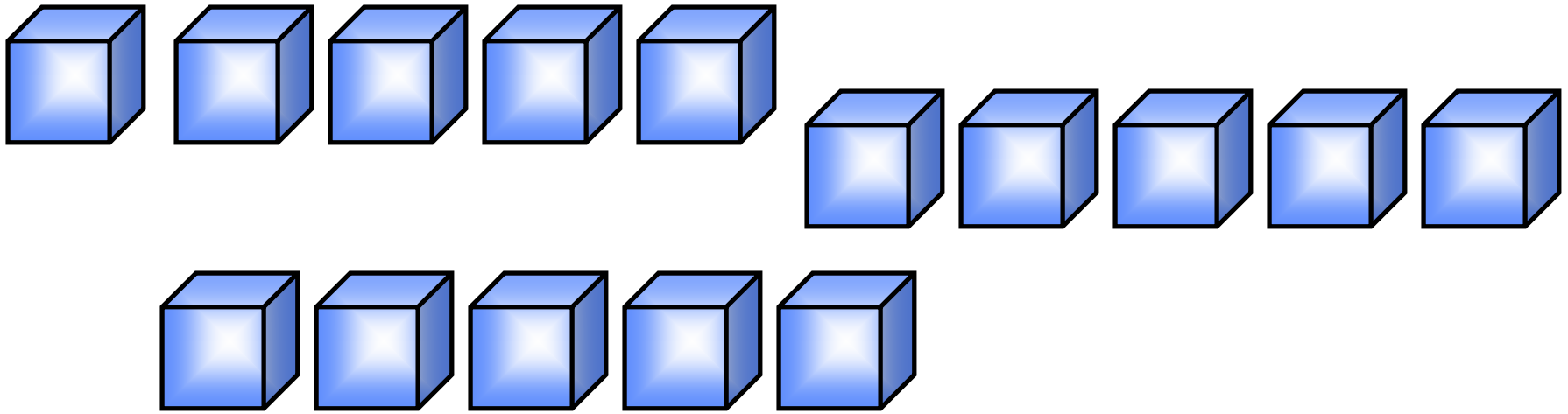


Should be maintained below about 1,000 ppm

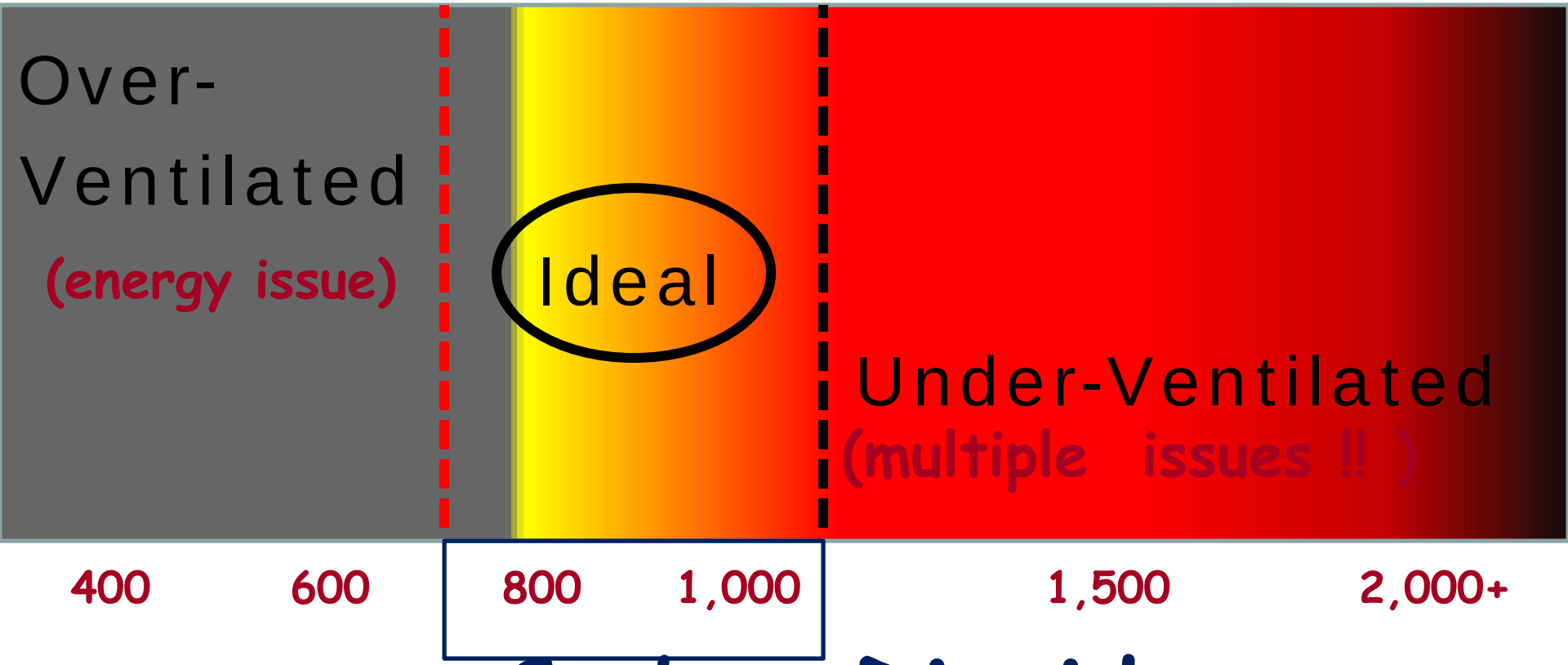
Cubic Feet per Minute (CFM)

~ 15 cubic feet fresh air per minute *each person*

for classrooms (cfm/p)

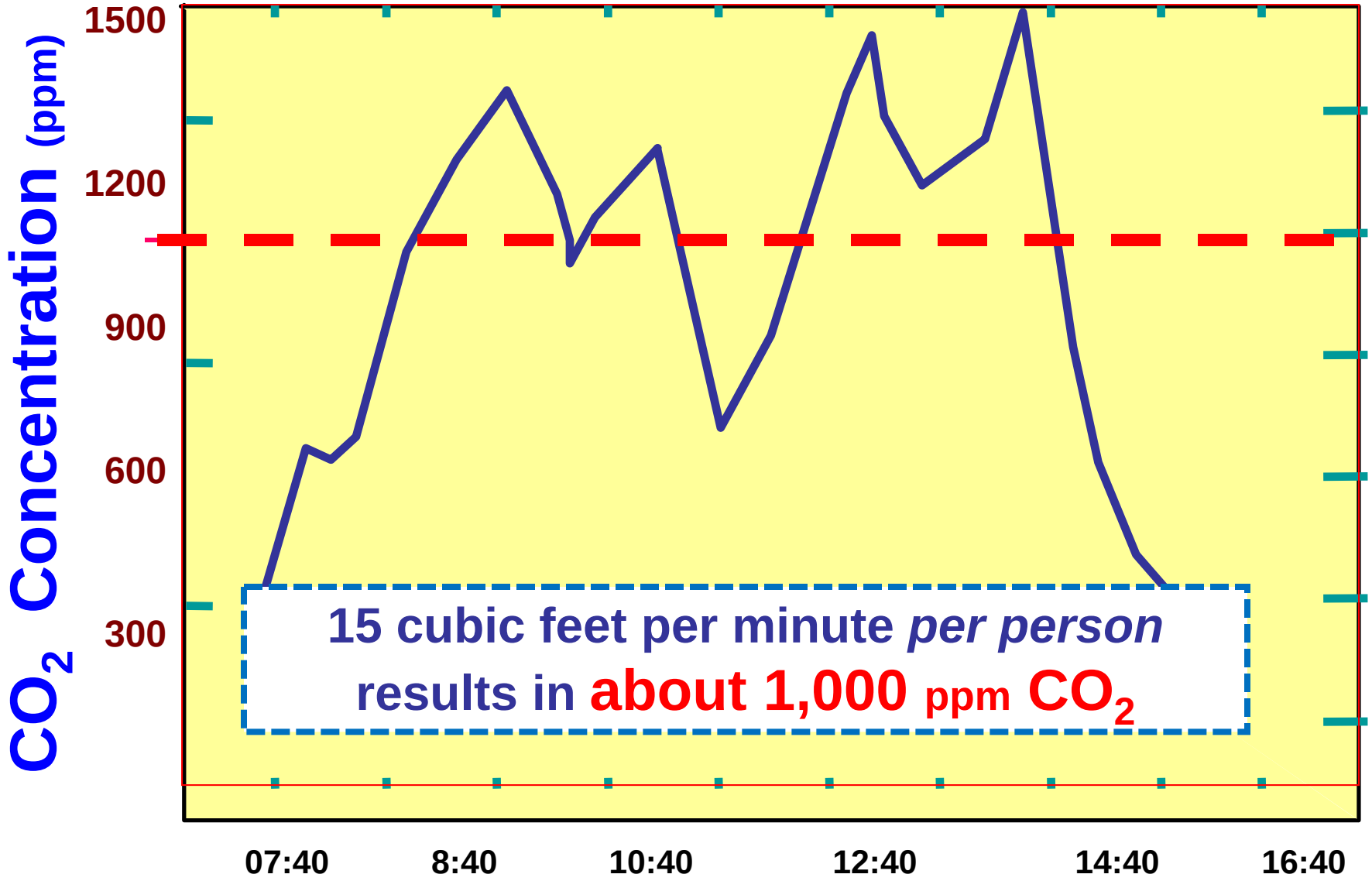


CO_2 Estimate of Ventilation



Elementary School Classroom

Continuous CO_2 Measurements



IAQ *Pro-Tip*

As CO_2 builds up,
so does "everything else"…

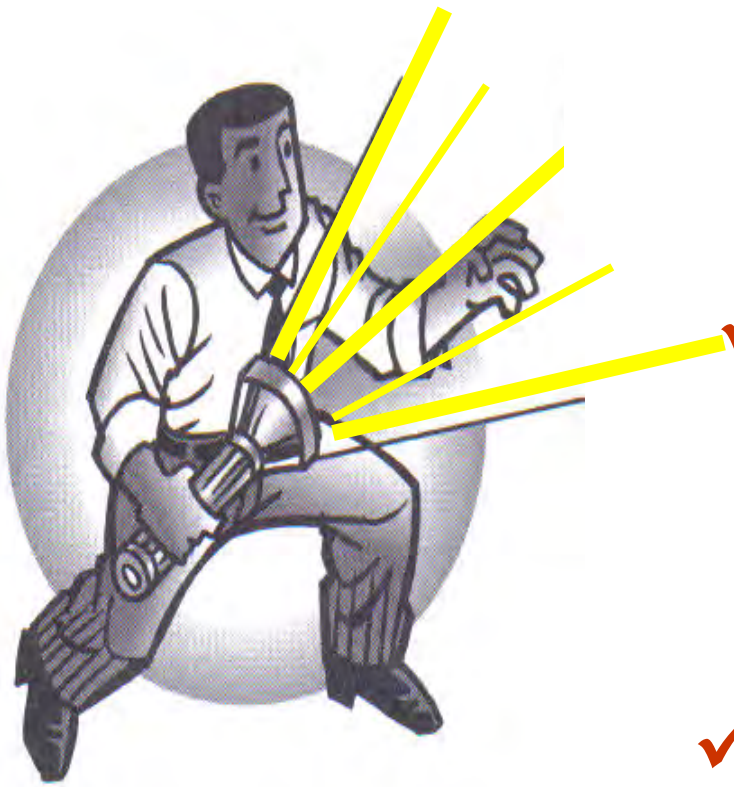
"Everything else" is
too difficult to measure
and interpret

Occupants appreciate the CO_2 numbers:
Non-threatening and meaningful

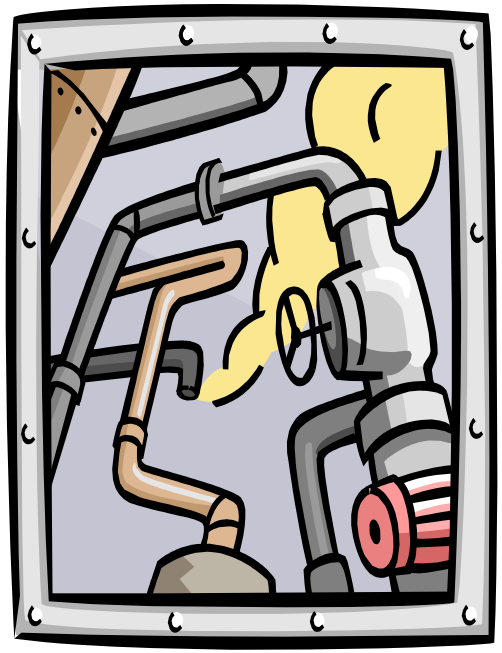
Elevated CO_2 *may* impact performance

6th Graders "left behind"
high CO_2 affected their achievement ?

While CO2 is building up in classrooms . . .



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



Start Outside

IAQ Pro-Tip

what's outside
gets inside

what's inside
builds up

Neighborhood sources


• Dirt Control
• Plants
• Vehicle Exhaust
• Pests


" Look High "

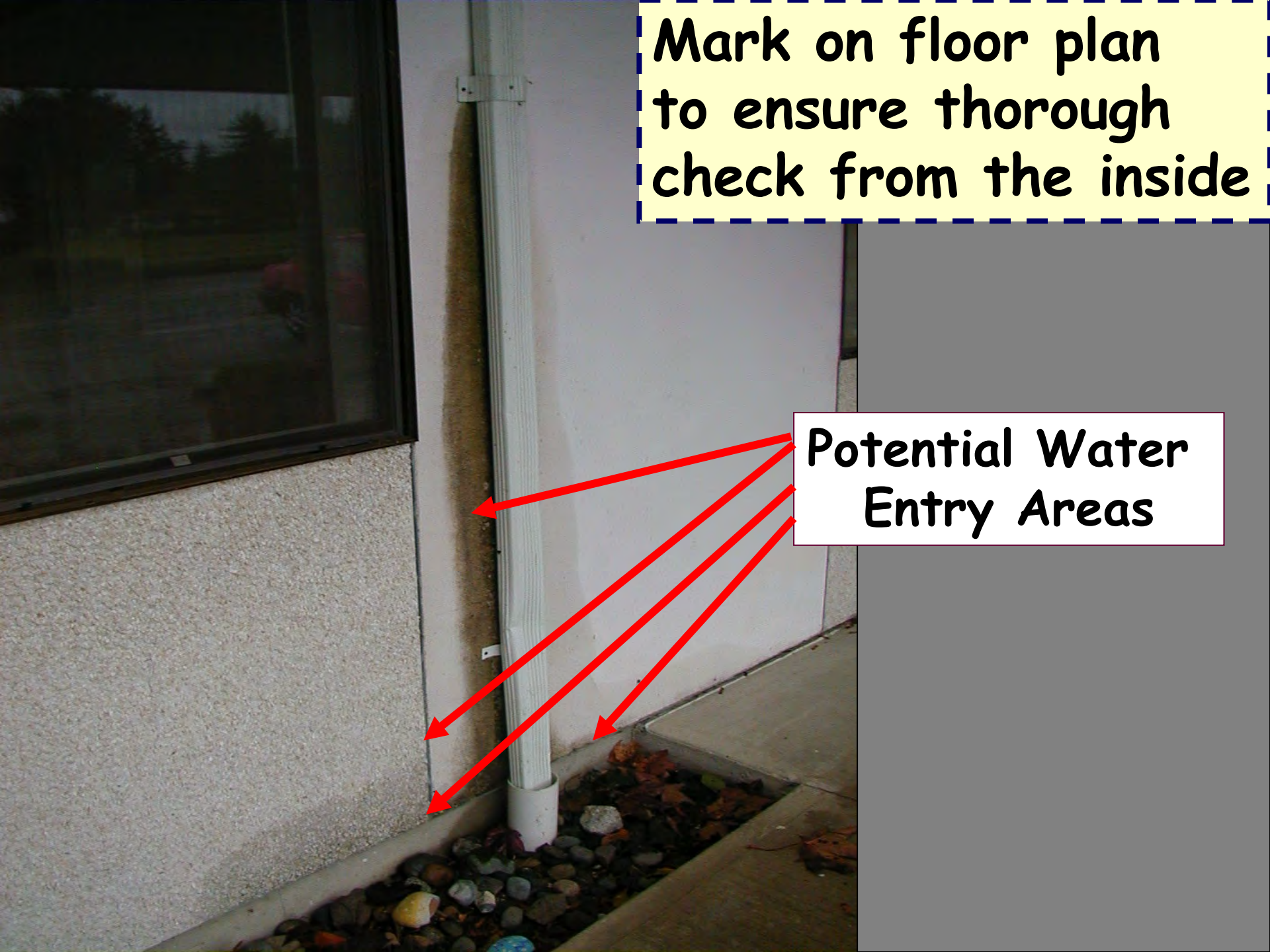

" Look Low "


PESTS WELCOME

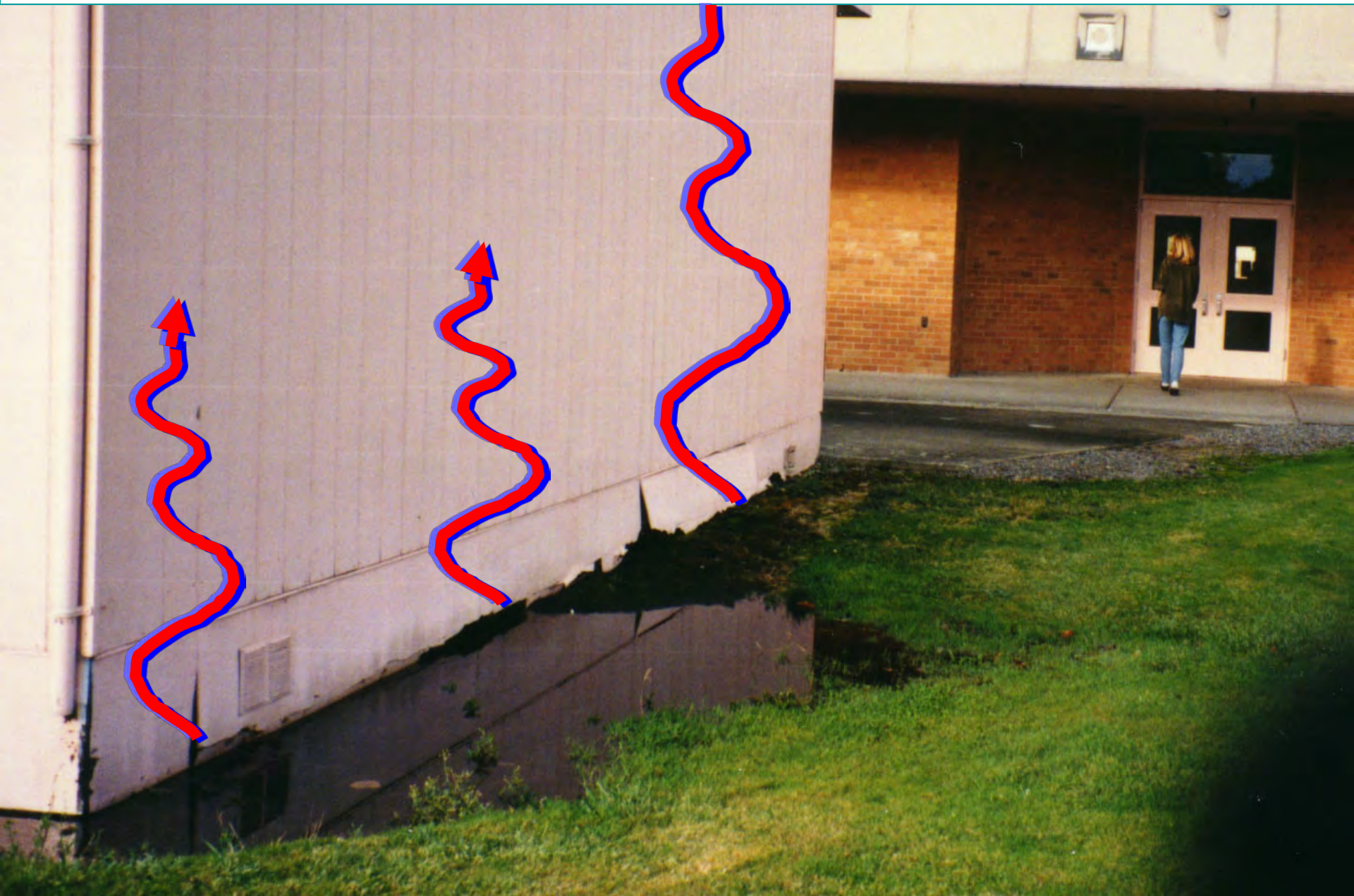

Air Intake

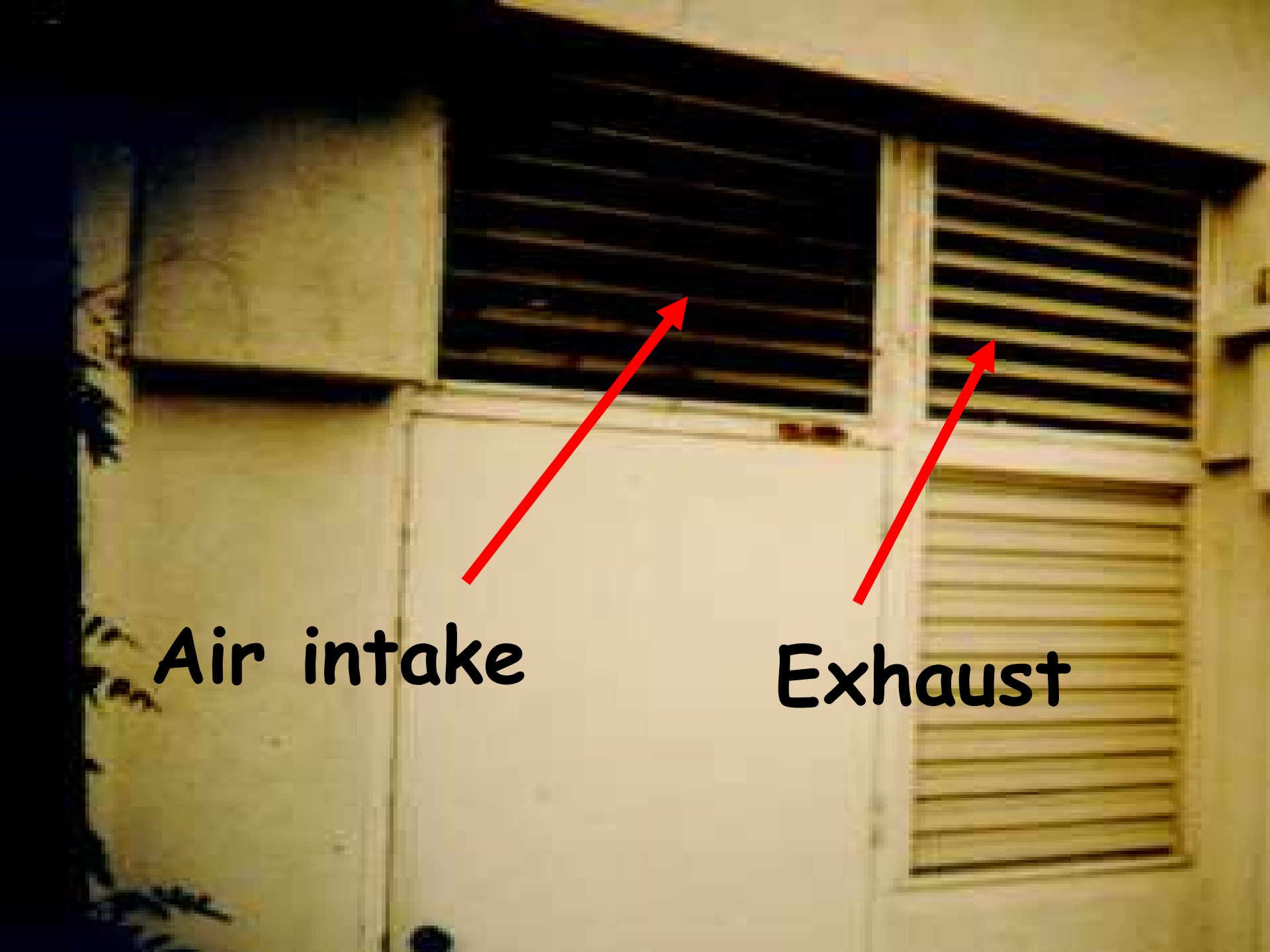

SCHOOL BUS
EMERGENCY EXIT
UNLAWFUL TO PASS
WHEN
RED LIGHTS FLASH
ILLEGAL PASSING
FINE
Air Intakes


" Look High "
Note outside issues on floor plan
Check inside for consequences


Mark on floor plan to ensure thorough check from the inside
Potential Water Entry Areas

Portable is damp & smells moldy




Air intake
Exhaust

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

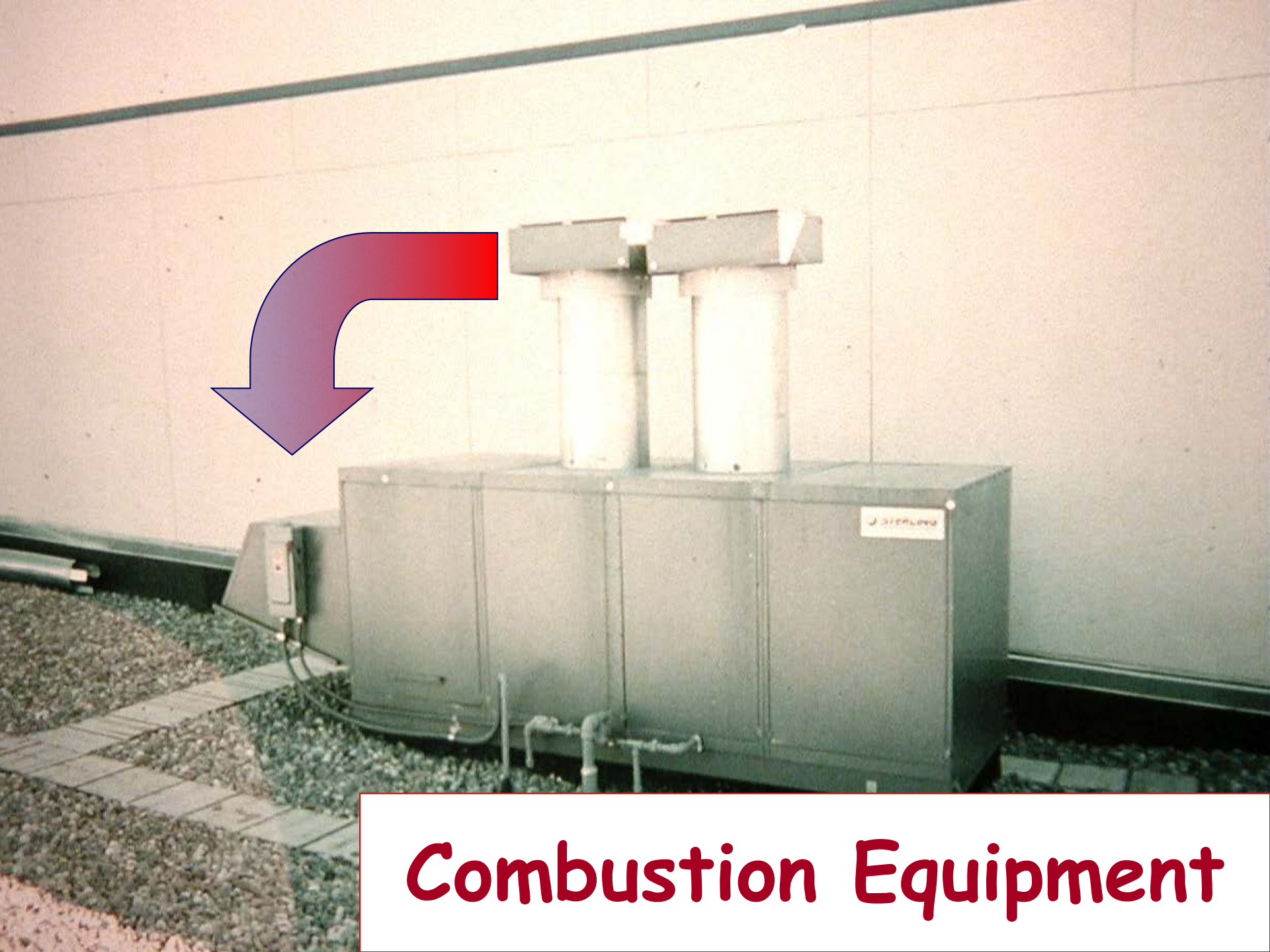

Air intake

Up on the Roof

Learn about mechanical equipment on the roof


Note conditions
Ask questions
"Show Me"

Note conditions and ask questions



Combustion Equipment

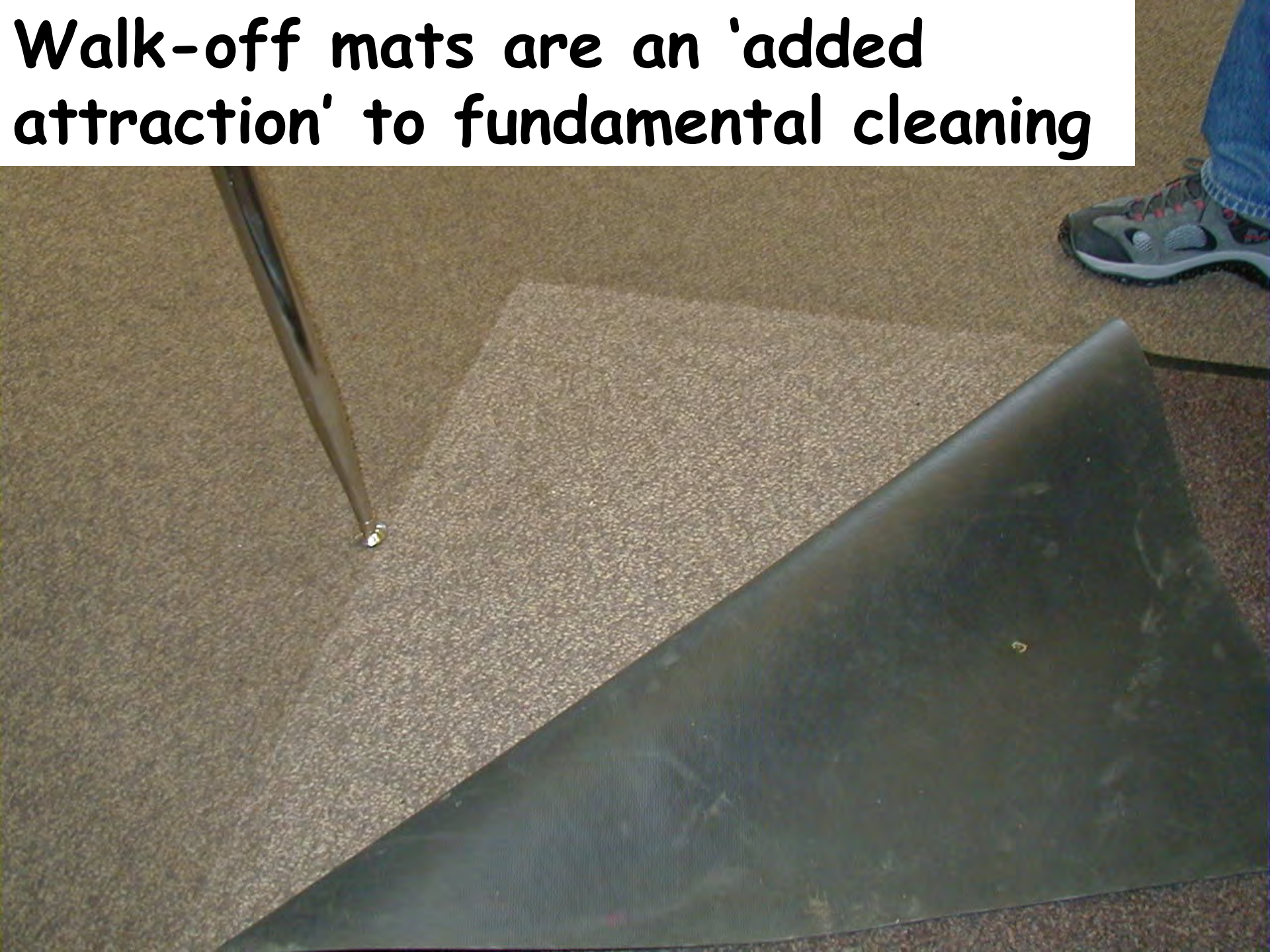
Check Inside: top to bottom

First: Entrance defense

Stop the dirt at the door

3-stage dirt control at entry

Walk-off mats are an 'added attraction' to fundamental cleaning



"Stop the dirt at the door"
but with mats that can be cleaned


"Composting carpet"

"composting carpet"

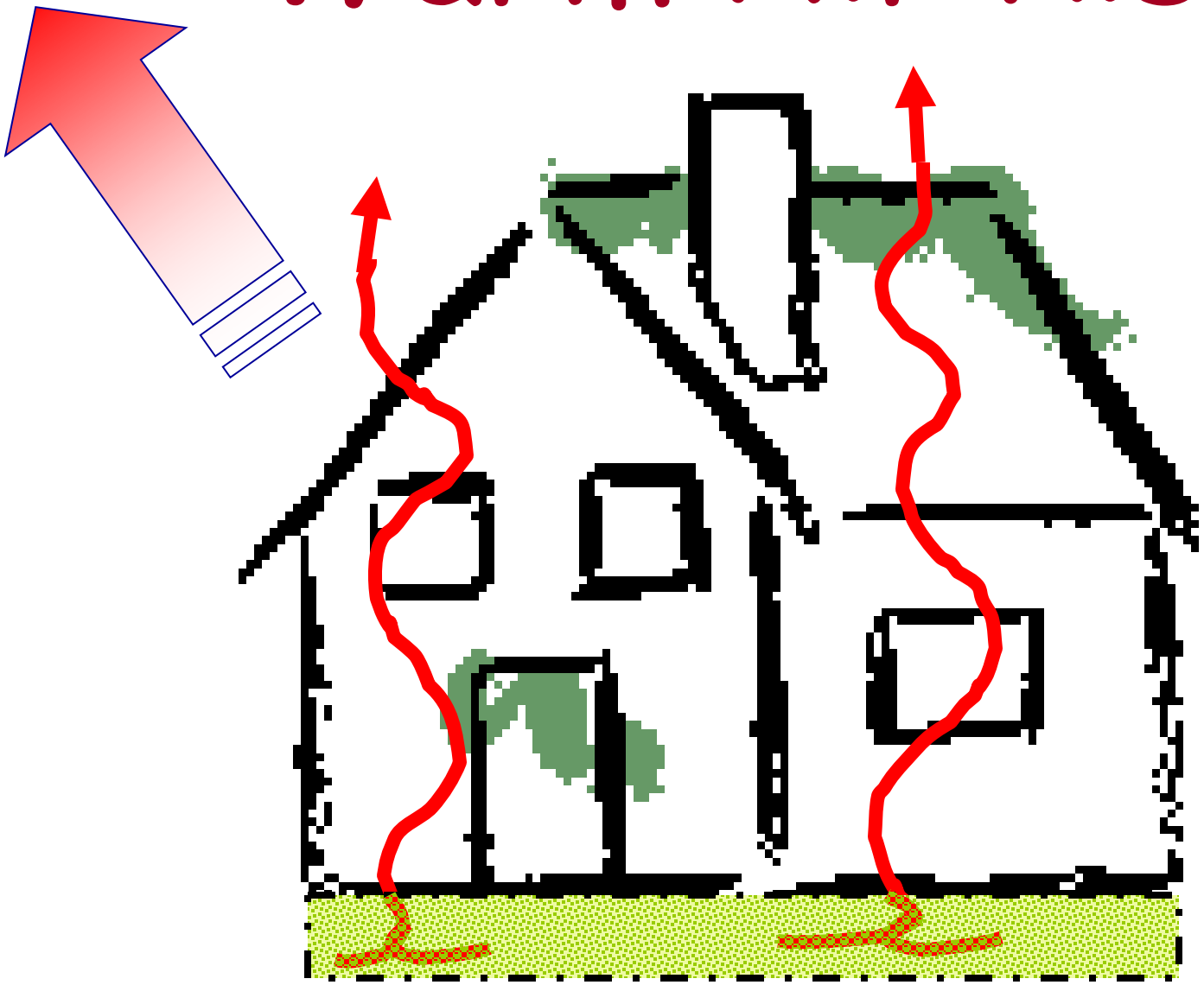
Inspect everywhere

Check out attic spaces

Bat Guano over a 3rd grade classroom

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

Warm Air Rises

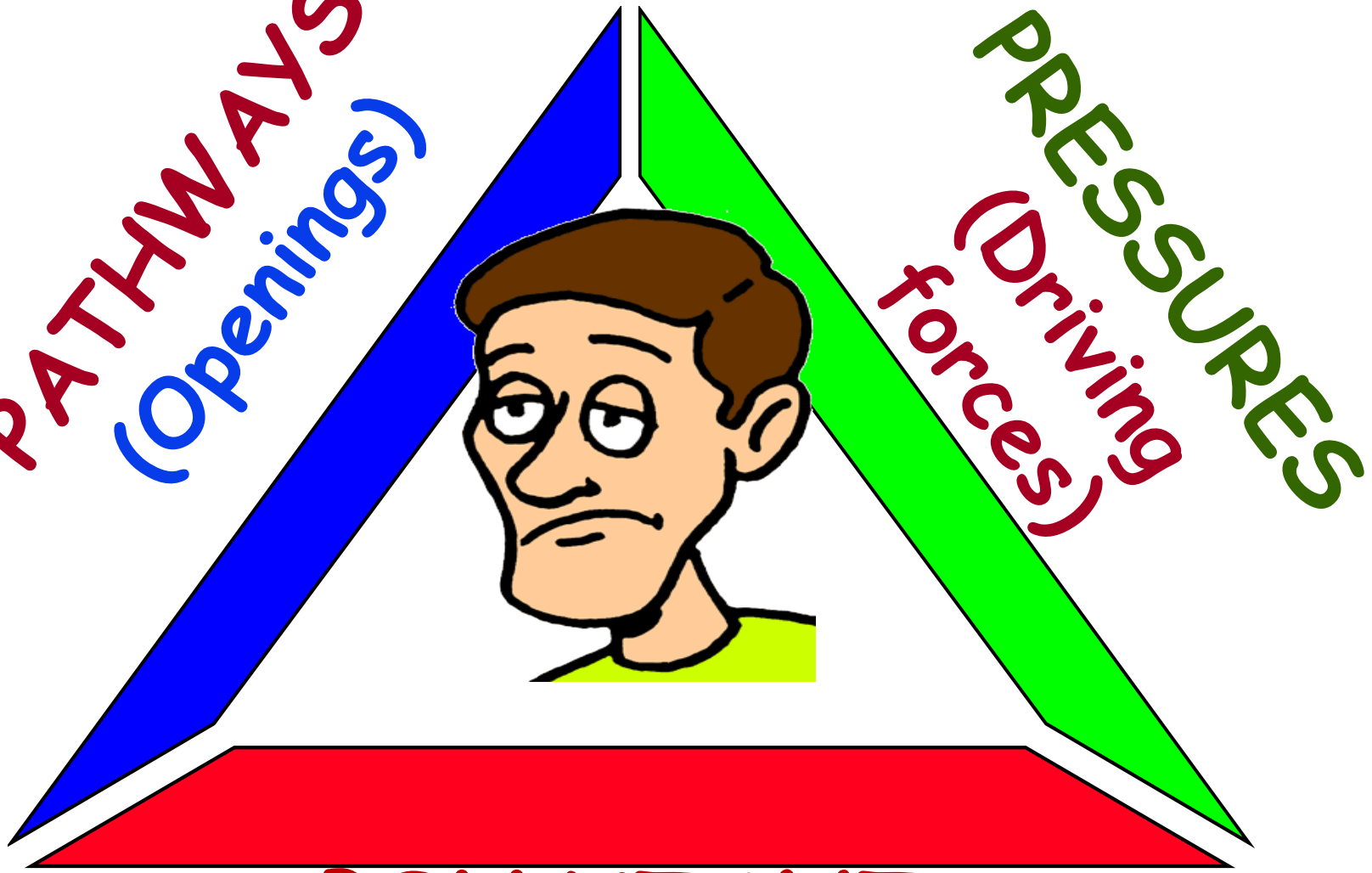


Crawlspaces, Tunnels, Etc.

Contaminated air enters occupied areas through *unplanned pathways*

Check air flow direction at access covers or other penetrations and note on map

Investigating & Solving IAQ Issues




"Unplanned" air pathway

Remove Sources

Contaminated crawlspace under a school

Remove Sources

Close Pathway

Remove Sources

Close Pathway

Pressure Control with Exhaust Fan


Wet crawlspace

Tunnel is air duct for school


Tunnel is air duct for school


Underground air ducts
Radon entry & asbestos

Check CO_2 outside for reference

Offices
Work rooms
Staff room

Office: gather school facts and get the "inside information"


Un-vented mega-copier

Un-vented laminators

Foul odor from staff lounge 'fridge

Storage
Custodial
Mechanical Areas

Gas cooking equipment ?


CAUTION
SBESTOS HAZARD
OT DISTURB WITHOUT PROPER
RAINING AND EQUIPMENT


Use Personal Protection
where needed


Check pressures in
"combustion zones"


CO Alarm?
SYSCO
52747
FOAM PLATES
LAMINATED - VANILLA
6" (15.2 cm)
8/125 CT. (1000/CS)
spillage !

Official Rat Count

||

Jonah I

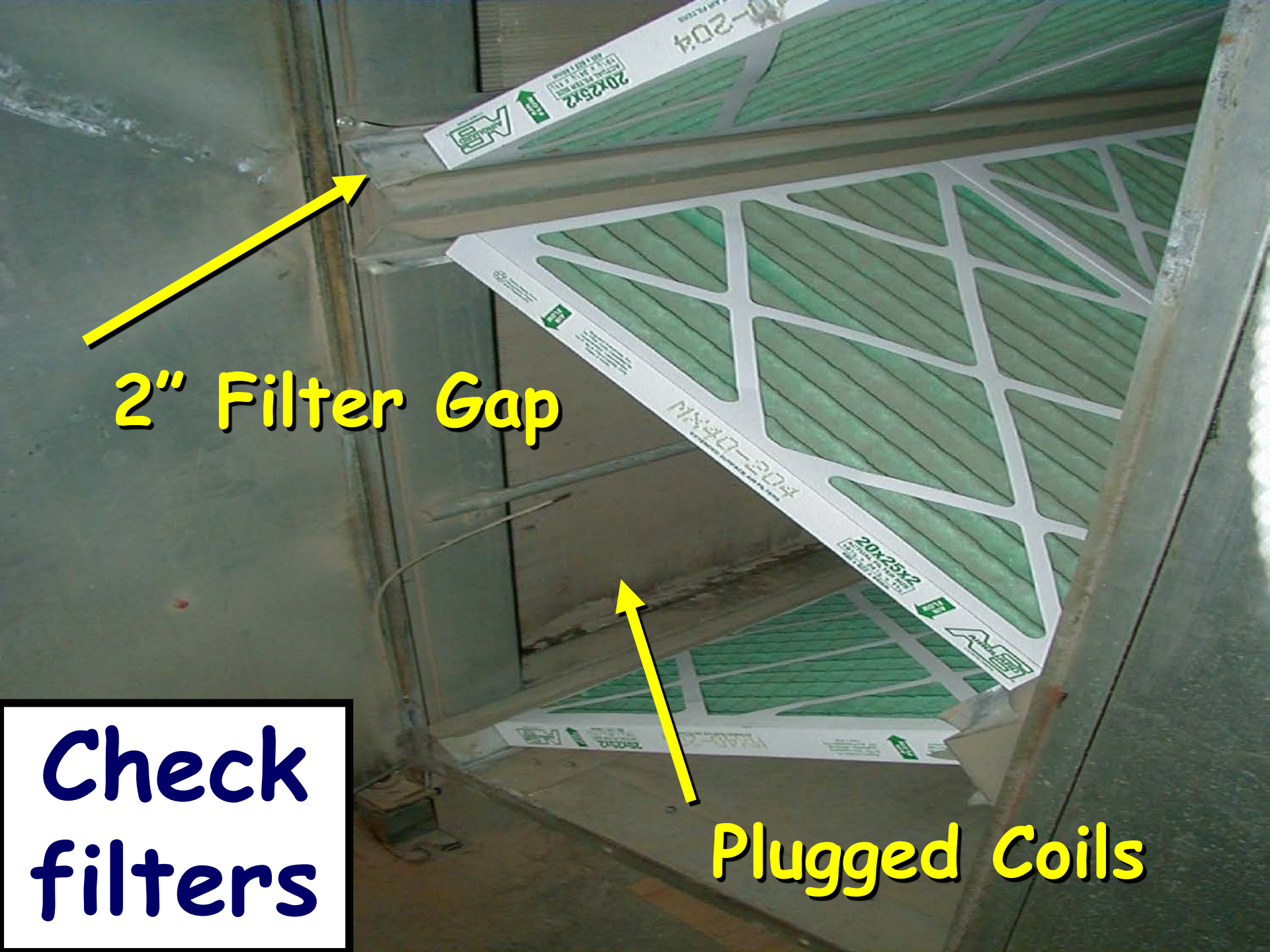
Jonah II

Jonah III


VICTOR
VICTOR

You don't know unless you look

Check filters


2" Filter Gap
Plugged Coils
Check filters

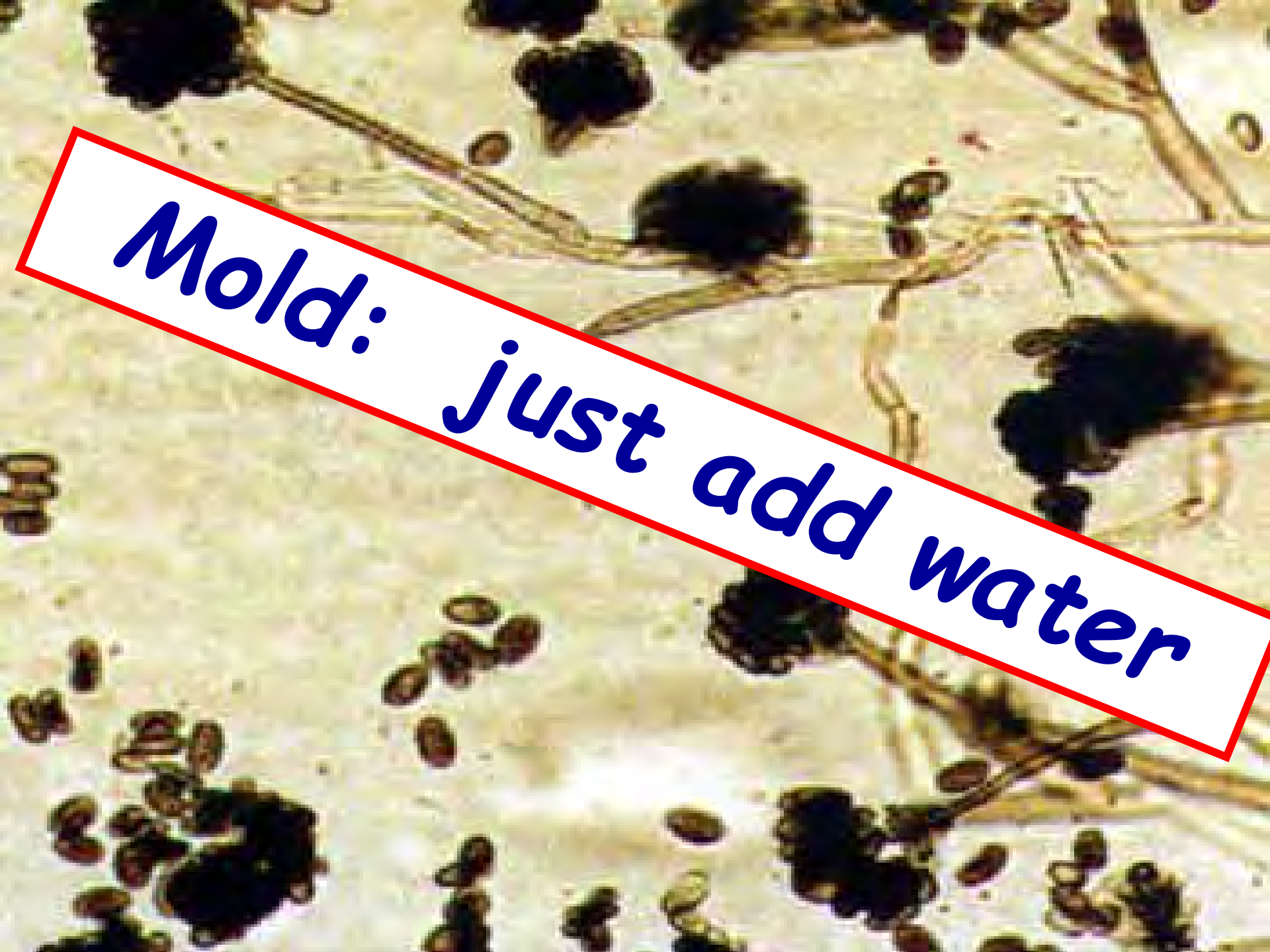
Immediate Improvement

Discovered orphaned filter

Fix it on the spot

Time clock out of synch

Slimy drip pans under HVAC equipment contribute biological pollutants


Mold: just add water


DUAL WAVE

Remove the mold food

Note flammables, harsh chemicals, solvents, etc. – consider substitutes

Note cleaning techniques and equipment


Note cleaning techniques and equipment

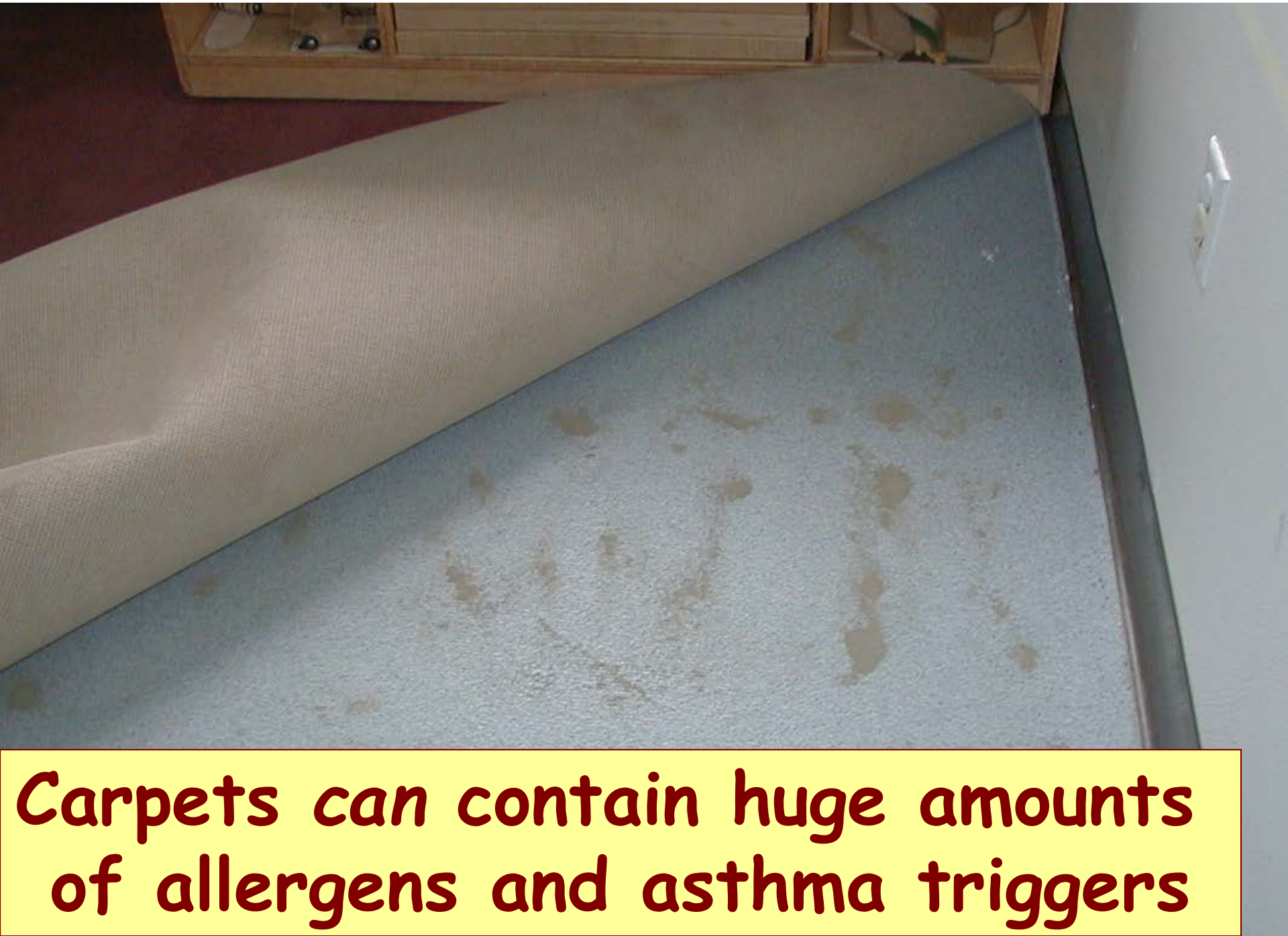
Green Cleaning:

Reduced chemical exposures

Reduced number of products used

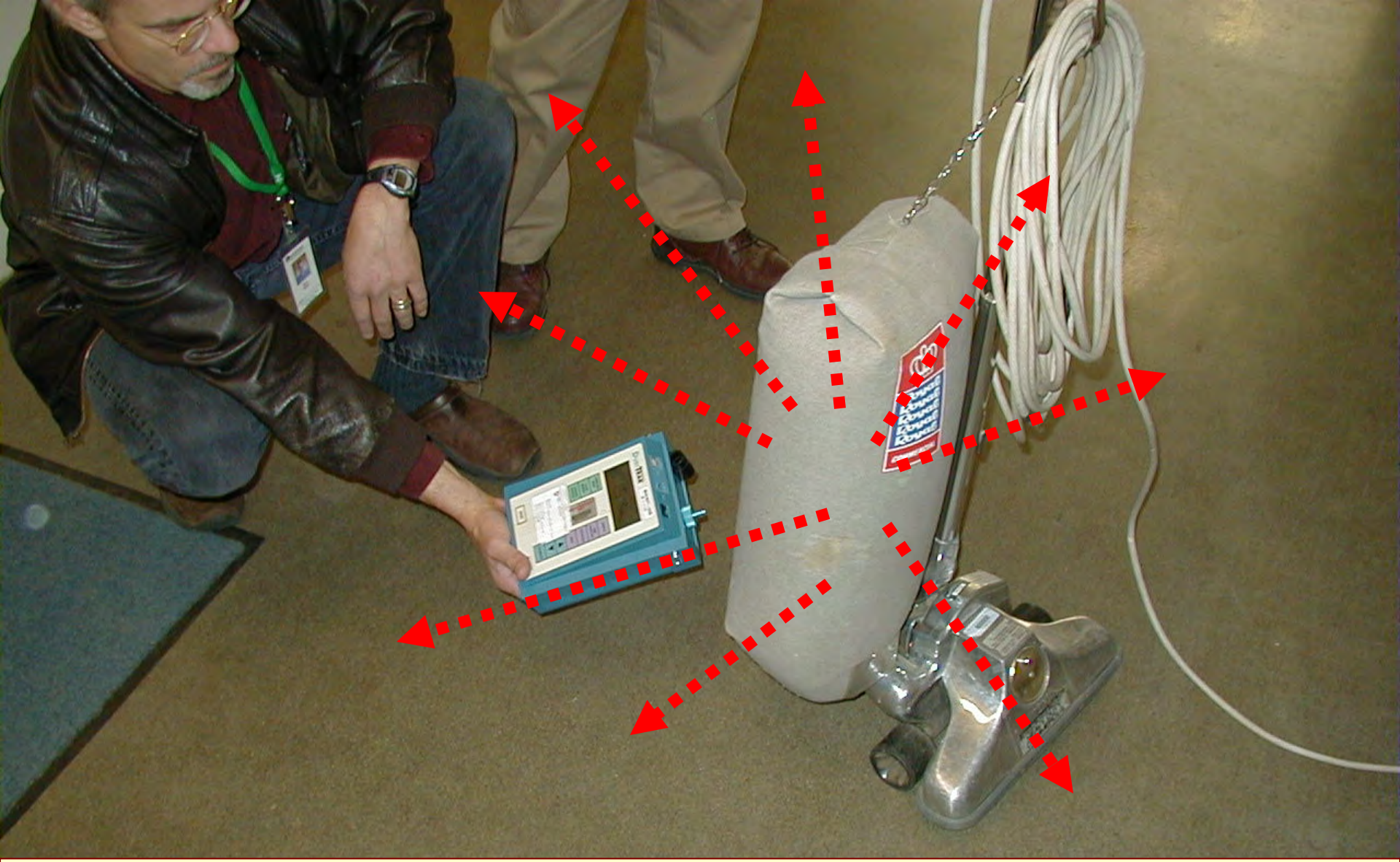
Clean Smarter Not Harder

Micro Fiber Products Recommended



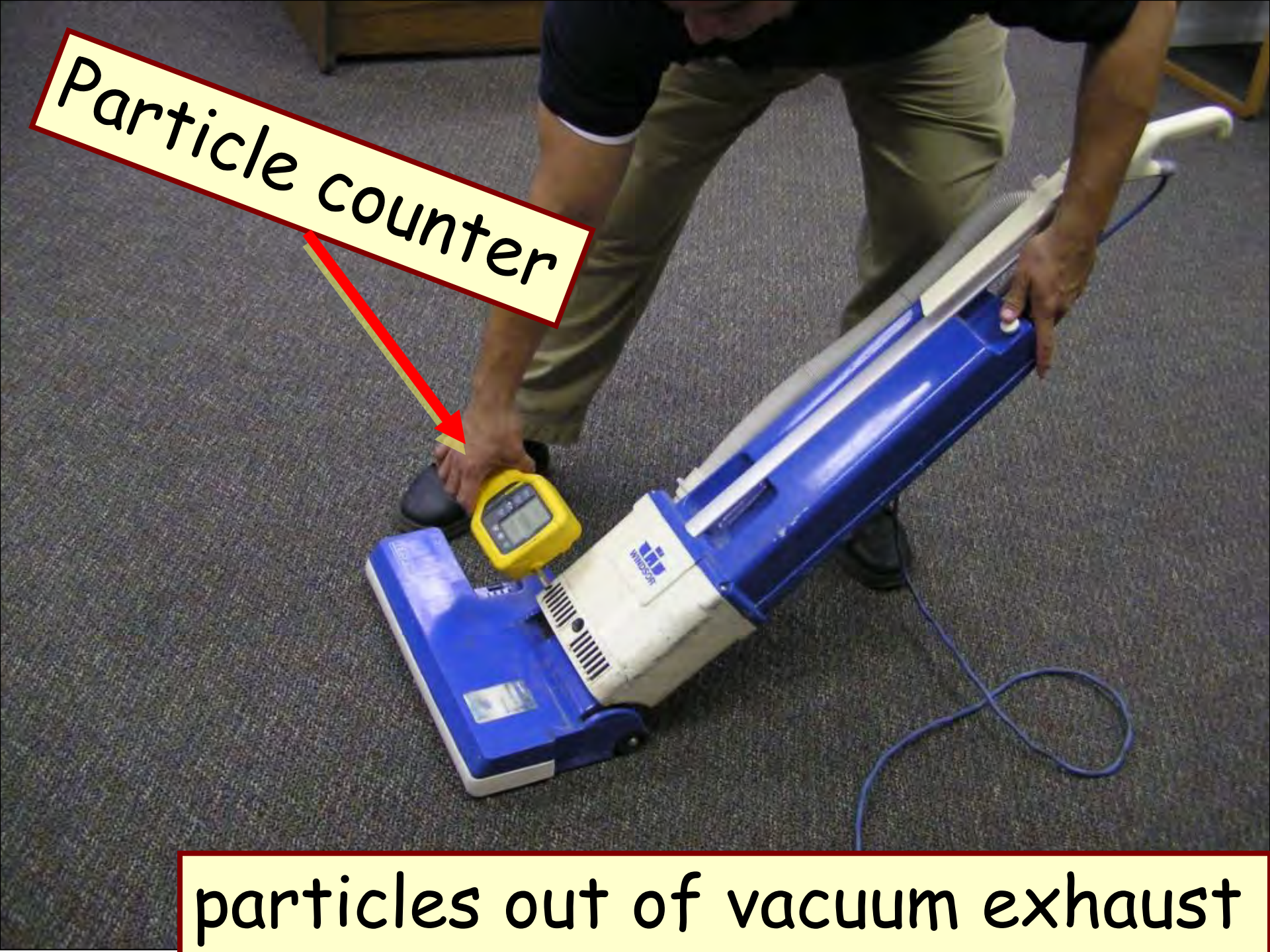
Carpets *can* contain huge amounts of allergens and asthma triggers


Asbestos tile
removal required



Vacuums can be part of a problem:
settling of smallest particles takes ***days***

1st Step: use a filter bag !


Particle counter
particles out of vacuum exhaust

Particle Counts from School Vacuums

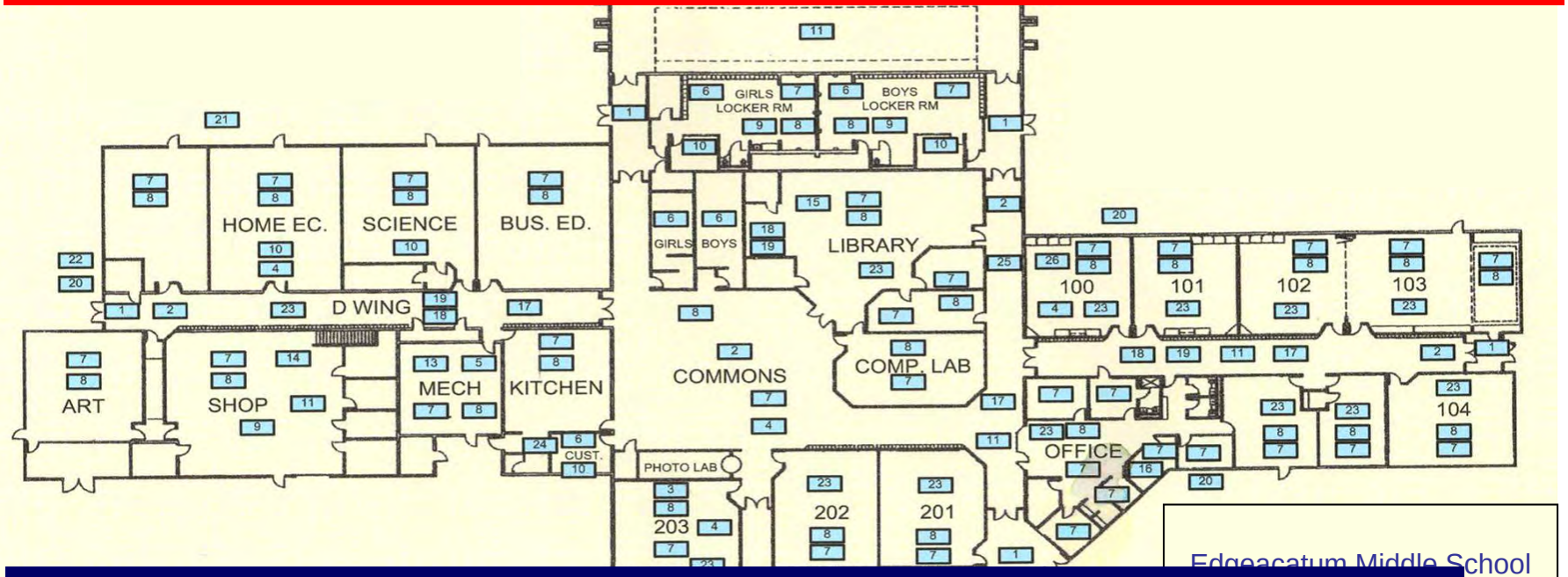
Fluke 983 Differential Mode 1 Liter Samples	SIZE ym 0.3	0.5	1.0	2.0	5.0	10.0
Back-pack 12579 (Dirty filters)	103,501	23539	5736	3230	506	109
Back-pack 12579 (Clean filters including hepa)	85,948	13948	2528	1493	401	120
Back-pack vacuum ID: 0116891 FXR "with dirty filter"	99,886	15819	1746	932	30	14
Back-pack vacuum ID: 0116891 FXR "with a clean hepa filter"	77,284	20902	3649	3278	651	196
Back-pack vacuum ID: 0117640 FXR "with dirty filter"	117,061	22666	1900	1026	71	16
Back-pack vacuum ID: 0117640 FXR "with a clean hepa filter"	93,133	13755	868	417	41	6
Back-pack vacuum cleaner #0116890 FXR dirty filter	281,750	67464	12918	6472	1707	995
Back-pack vacuum cleaner #0116890 FXR new filter	248,656	54535	13063	7259	1205	182
Back-pack 0116789 FXR (Dirty filters)	54,124	10971	1538	632	39	6
Back-pack 0116789 FXR (Clean filters)	40,701	8009	1247	571	73	16
Back-pack 0116788 FXR (Dirty filters)	24,482	3768	651	337	53	8
Back-pack 130822 (Dirty filters)	50,725	17418	4888	2491	316	69
Back-pack 130822 (Clean filters)	35,820	9391	2590	1290	171	29
Old Royal Vacuum Cleaner (rarely used)	19,518	4085	2580	2141	889	261
Back-pack 62-074935 (Dirty filters)	48,963	12401	3386	1996	662	223
Back-pack 62-074935 (Clean filters)	57,299	13846	3816	2317	661	167
Back-pack 62-034055 (Dirty filters)	53,213	14326	4016	2435	596	111
Back-pack 62-034055 (Clean filters)	58,022	15043	4281	2619	611	133
Back-pack #184163 (dirty filters)	149,427	23263	4385	2053	330	65
Back-pack #184163 (new filters)	88,125	15372	3655	1985	257	37
Up-right Windsor #131146 (very clean filter)	90,437	11513	1329	682	176	72
Up-right (dirty filter)	74,000	24,000	4,700	4,500	267	55
Up-right (dirty filter)	143,000	23,000	1,700	2,000	600	300
Back-pack (dirty filter)	101,000	25,000	2,200	736	0	0
Up-right (dirty filter)	29,000	4,200	480	460	40	15
Up-right (dirty filter)	42,000	9,500	1,000	589	250	345
Back-pack (dirty filter)	70,690	20,600	2,900	2,000	393	230
Up-right (old) (dirty filter)	45,000	20,000	5,000	6,000	1,000	400
"Pig" (dirty filter)	1,800	300	100	375	550	590
Up-right Windsor (dirty filter)	120,000	38,000	3,300	1,000	160	110
Hoover Wind-Tunnel Up-Right (residential model)	4,900	170	0	6	6	0
Up-right Windsor (dirty filter)	81,000	20,000	1,500	530	52	68
Back-pack (dirty filter)	47,000	10,000	1,000	700	160	160

Note 1: some rounding of values was peformed

Note 2: "dirty filter" means the unit was operated as-found with the used filter/bag in place


Exhaust Fans:
restrooms
locker rooms
boilers
clean to dirty

✓ Check the Classrooms

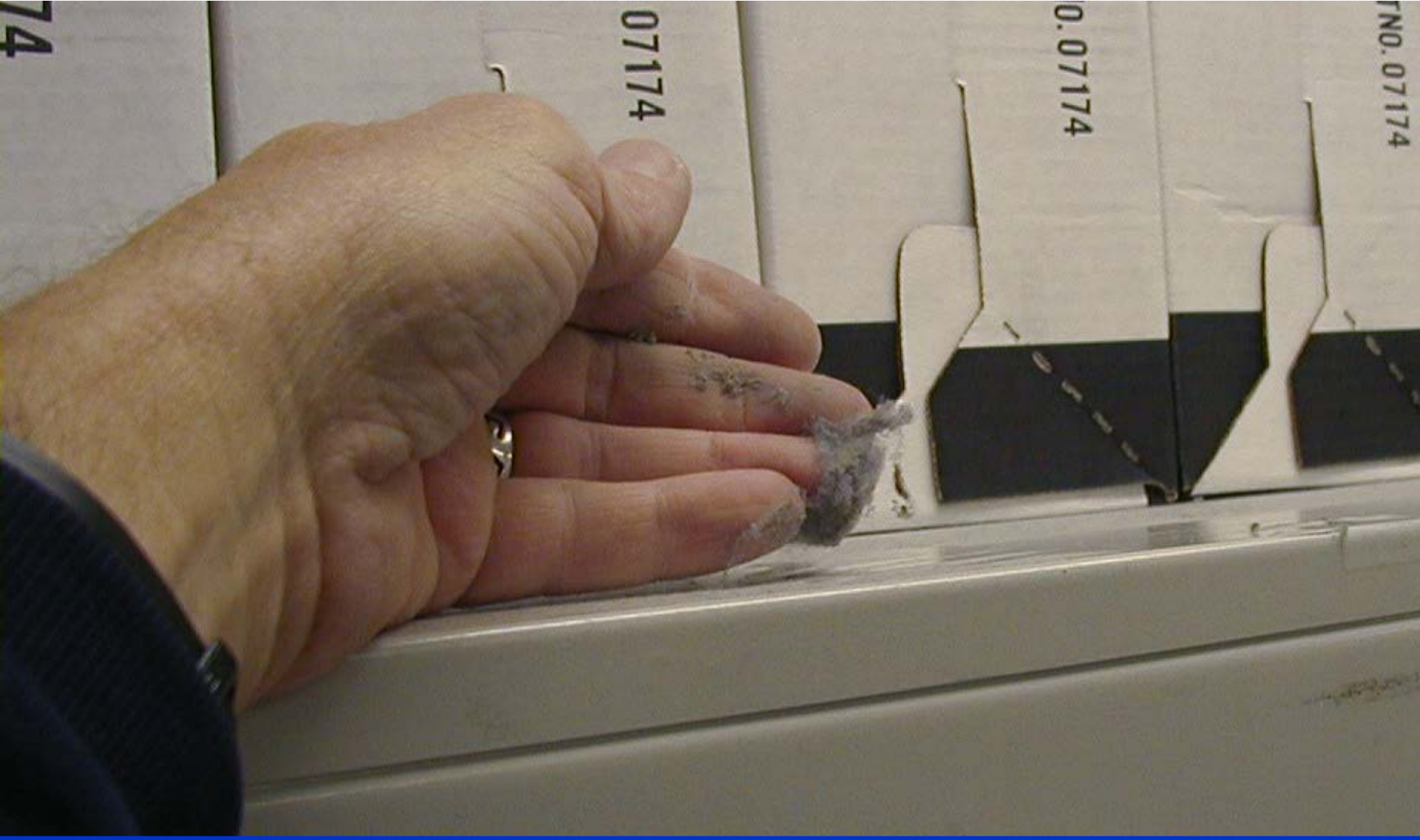


Edgeacatum Middle School

CO_2 built up by now…


Custodian's nightmare


Clean Enough ?



HVAC filters *cannot* clean dirty buildings

Asthma Trigger Reservoirs

non-district furniture, rugs, blankets, pillows

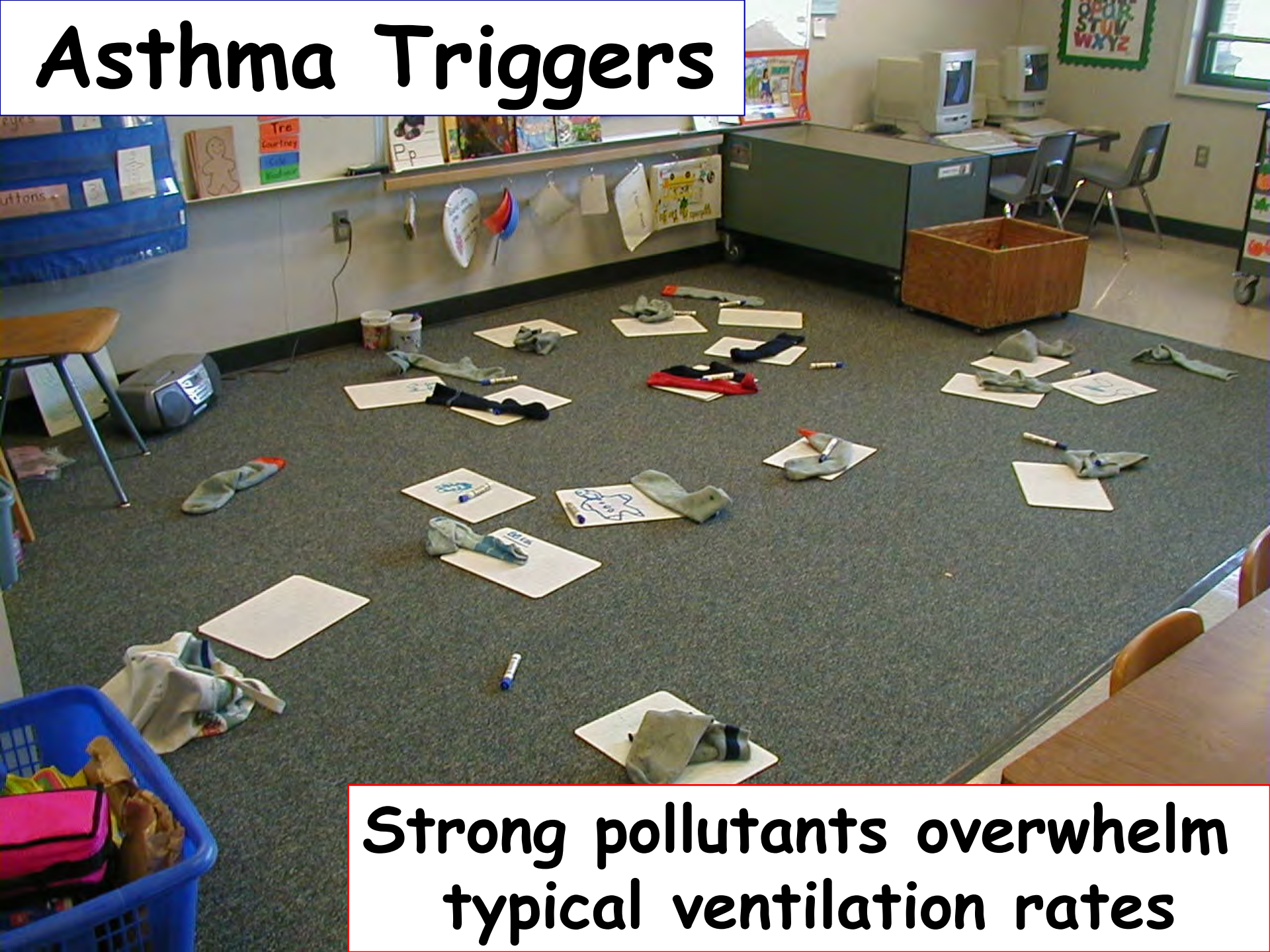
What's outside gets inside . . .

What's inside piles up …

High Performance Cleaning Adopted


ANACORTES

Asthma Triggers

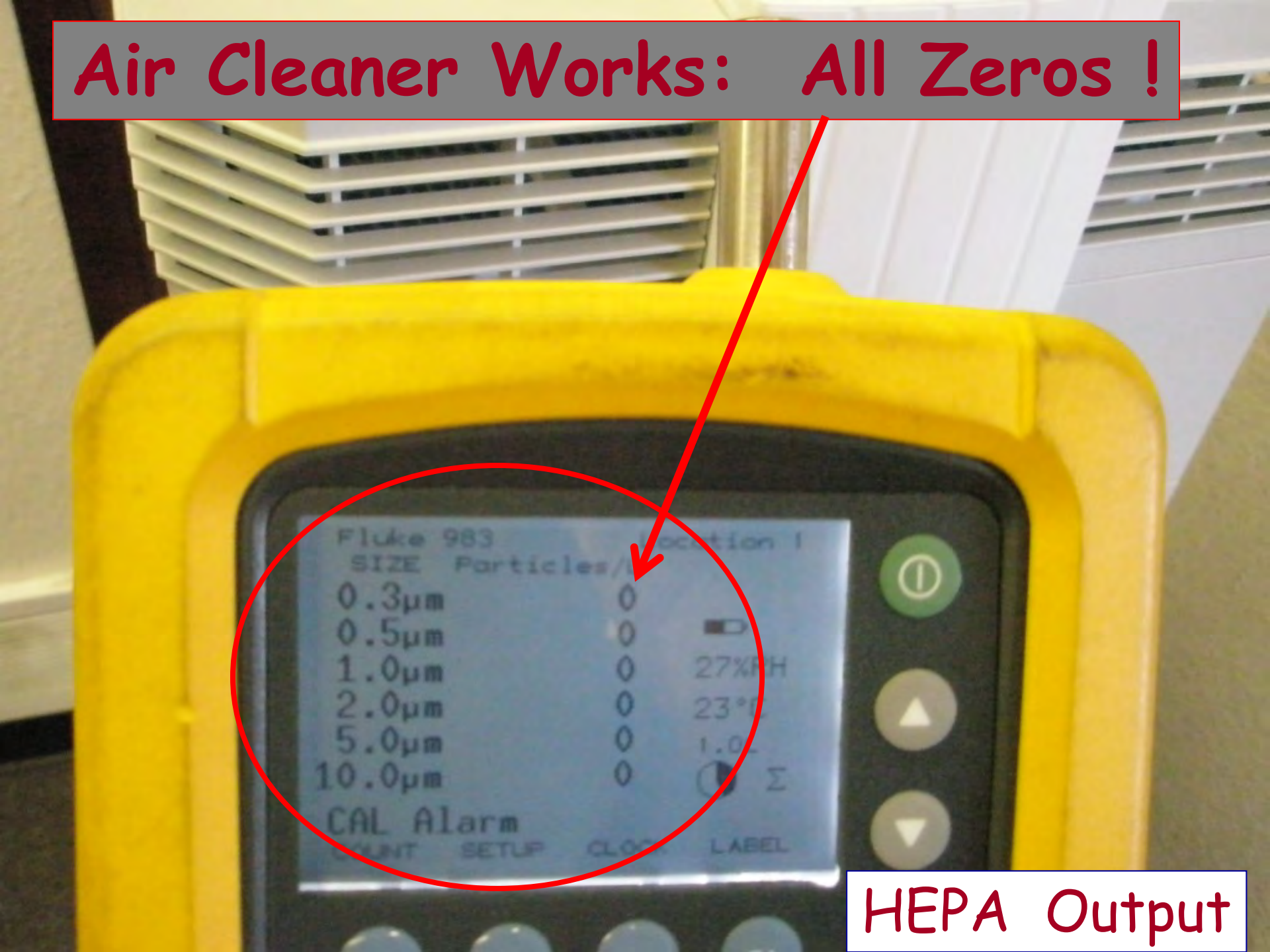


Strong pollutants overwhelm typical ventilation rates

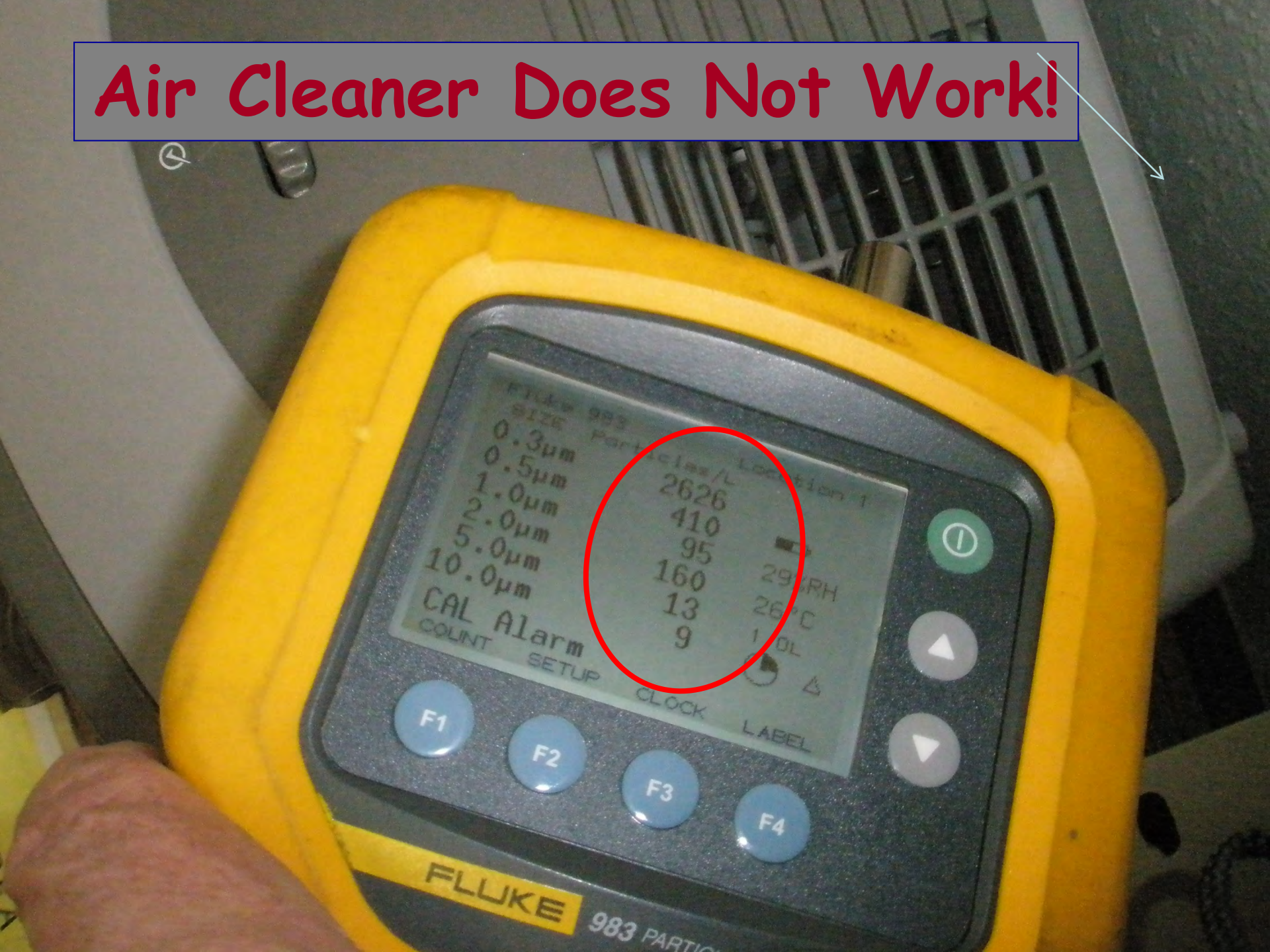
Note any IAQ concerns

Note HEPA air cleaners

Does the air cleaner work?


Air Cleaner Works: All Zeros !
Fluke 983
SIZE Particles/
0.3µm 0
0.5µm 0
1.0µm 0
2.0µm 0
5.0µm 0
10.0µm 0
CAL Alarm
SETUP
LABEL
HEPA Output

Air Cleaner Does Not Work!



What is the airborne particle count in the room?

Compare to OUTSIDE and look for 50 percent reduction

Ozone generators

Not

recommended

Avoid odor "masking" with chemicals

"Unintentional" Asthma Triggers


Pollutants ?
Hazards ?

No chemicals "from home"


LEMON SCENTED
Aerosol
ntolene
ust mop
eatment
• gathers dust
ay on dust mop or cloth
revents germfilled dust
from scattering
CHEMSEARCH
DROP DEAD™
A Combination of Insecticides
Offering Quick Knockdown and
Residual Kill of Crawling Insects
for up to Four Weeks.
KEEP OUT OF REACH OF
CHILDREN
BANI
Advanc
Urinal Mai
• Quickly removes
scale and buildup
salts
• Eliminates offensiv
• Use for
prevent
e maint

Old photo chemicals

Stained ceiling tile

Wet ?
Moldy ?

or just Ugly ?


Vinyl wallpaper can trap moisture

Evidence of moisture

and/or

molds

may not be obvious


"Blank" switch plate
easily covers inspection hole

Measure Moisture

Drywall over 18 percent moisture content? Mold will grow…

Over 28 % = Sopping Wet

Damp carpet under chair mat?

Concrete wicking moisture

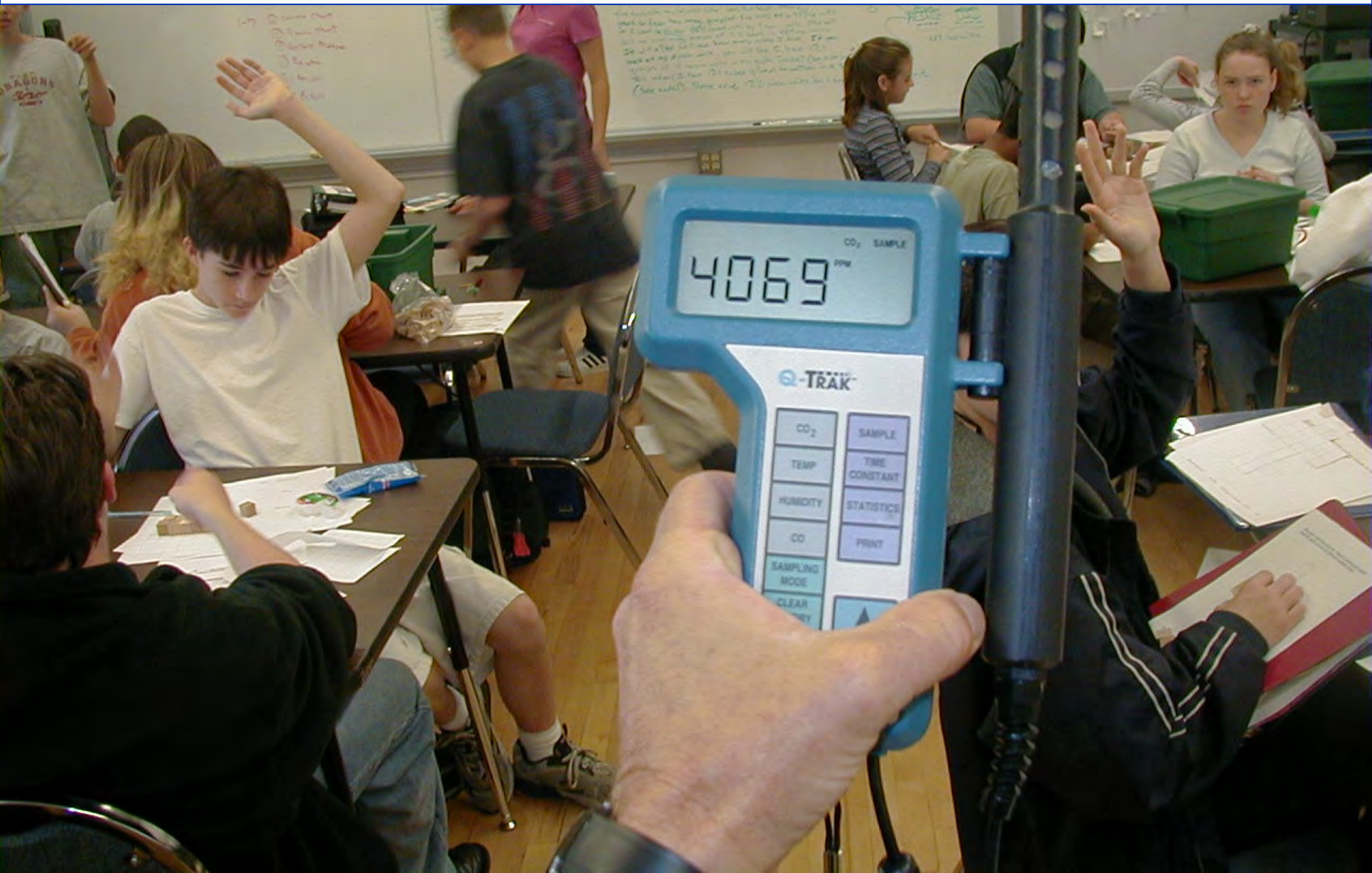
Concrete moisture test kit

Look Above Suspended Ceilings


Gravity Always Wins !

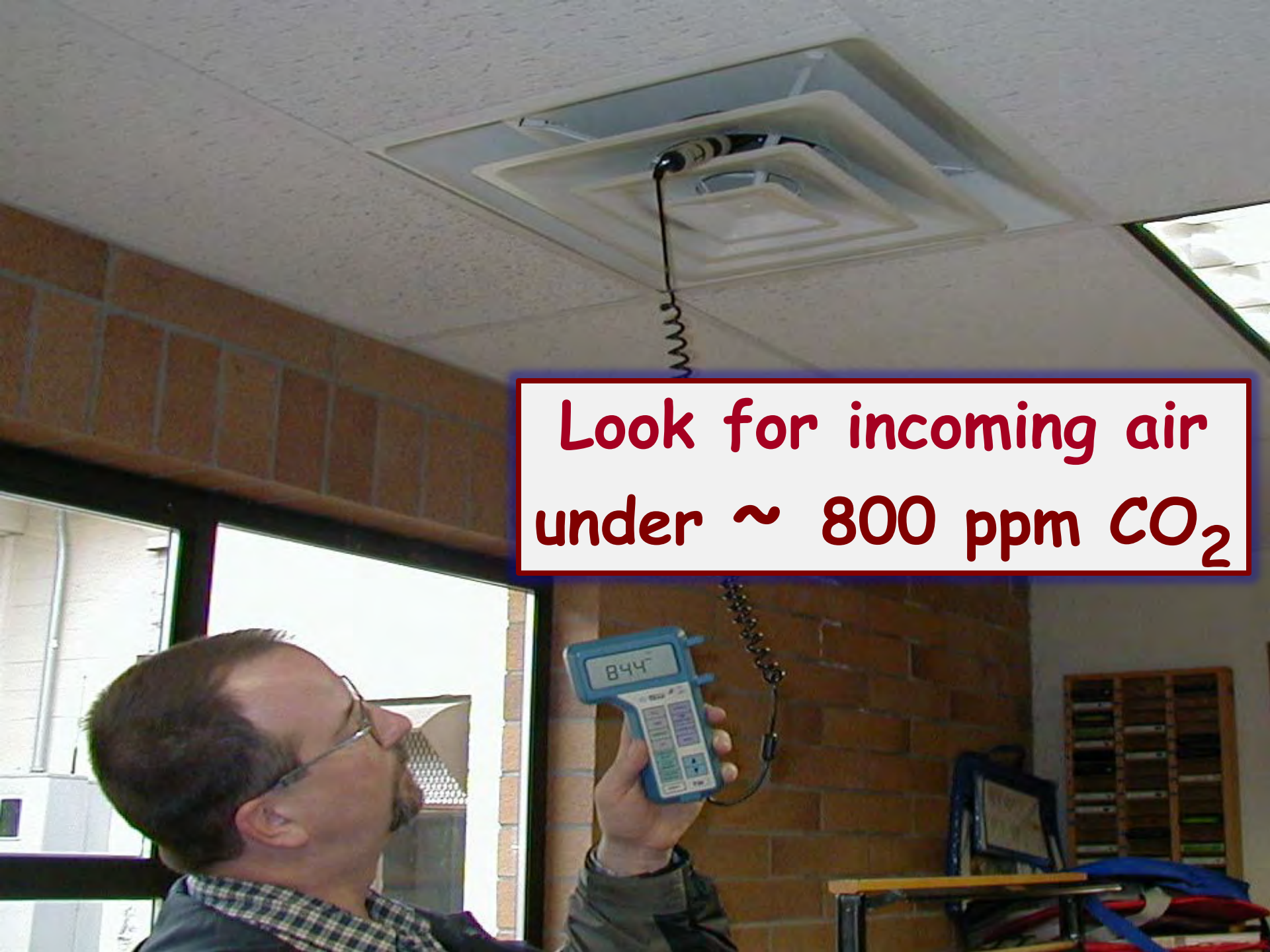
Can fiberglass reach the occupants?

Measure Room CO_2



Measure CO2 at supply air


Check CO_2
at supply registers
844

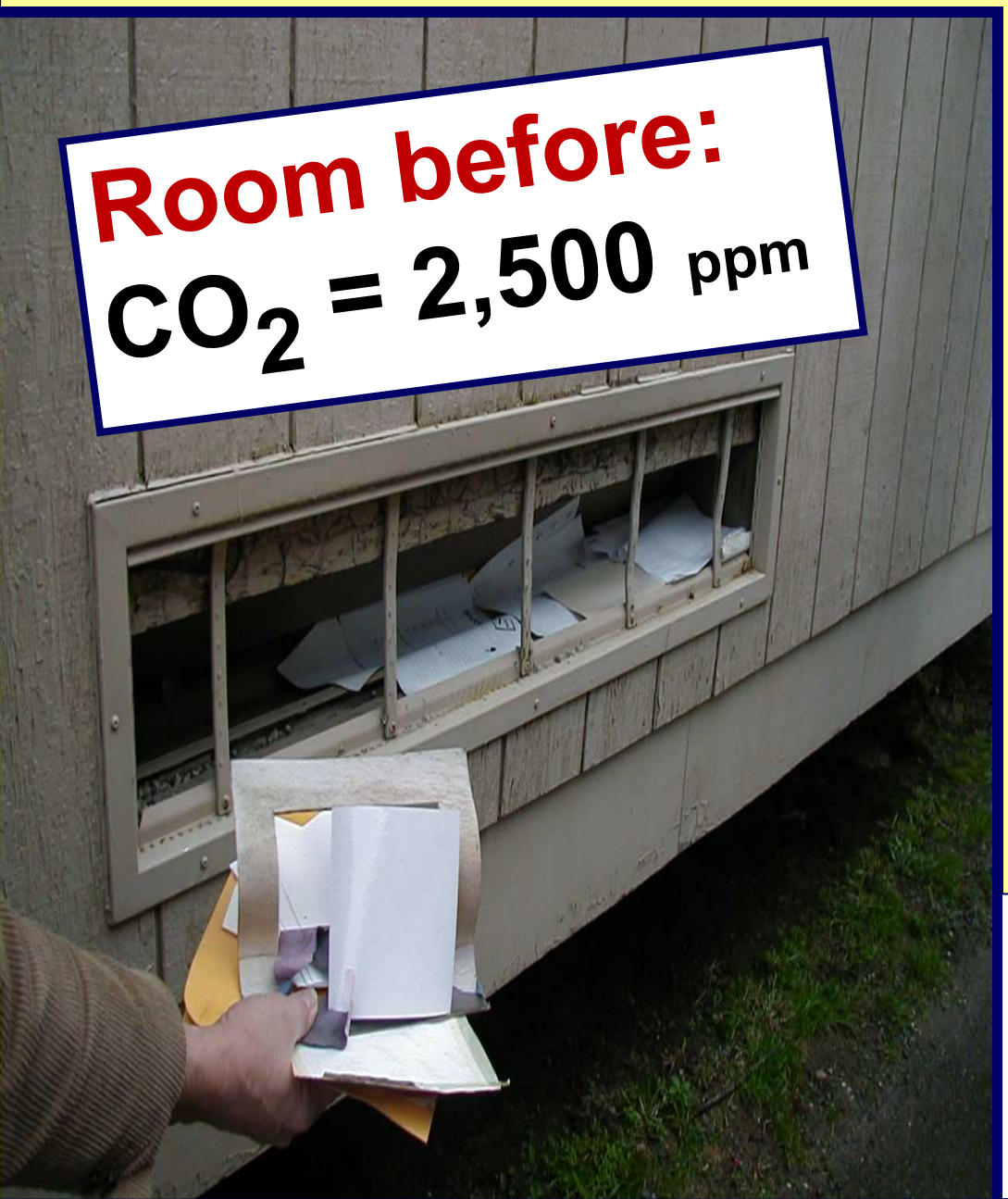

Look for incoming air
under ~ 800 ppm CO_2
844

Measure CO2 at supply air

fresh air intakes covered for the "season"

Installed brackets:
Covered only during "cold snaps"

Outside Air Intake Cleaned



Room before:

CO_2 = 2,500 ppm

Room after:

CO_2 = 998 ppm

Where is the fresh air supply ?


STREGA
Cross-Trekkers


DO NOT COVER VENTS

Why high CO_2? Teacher turned off HVAC fan noise (and the fresh air)

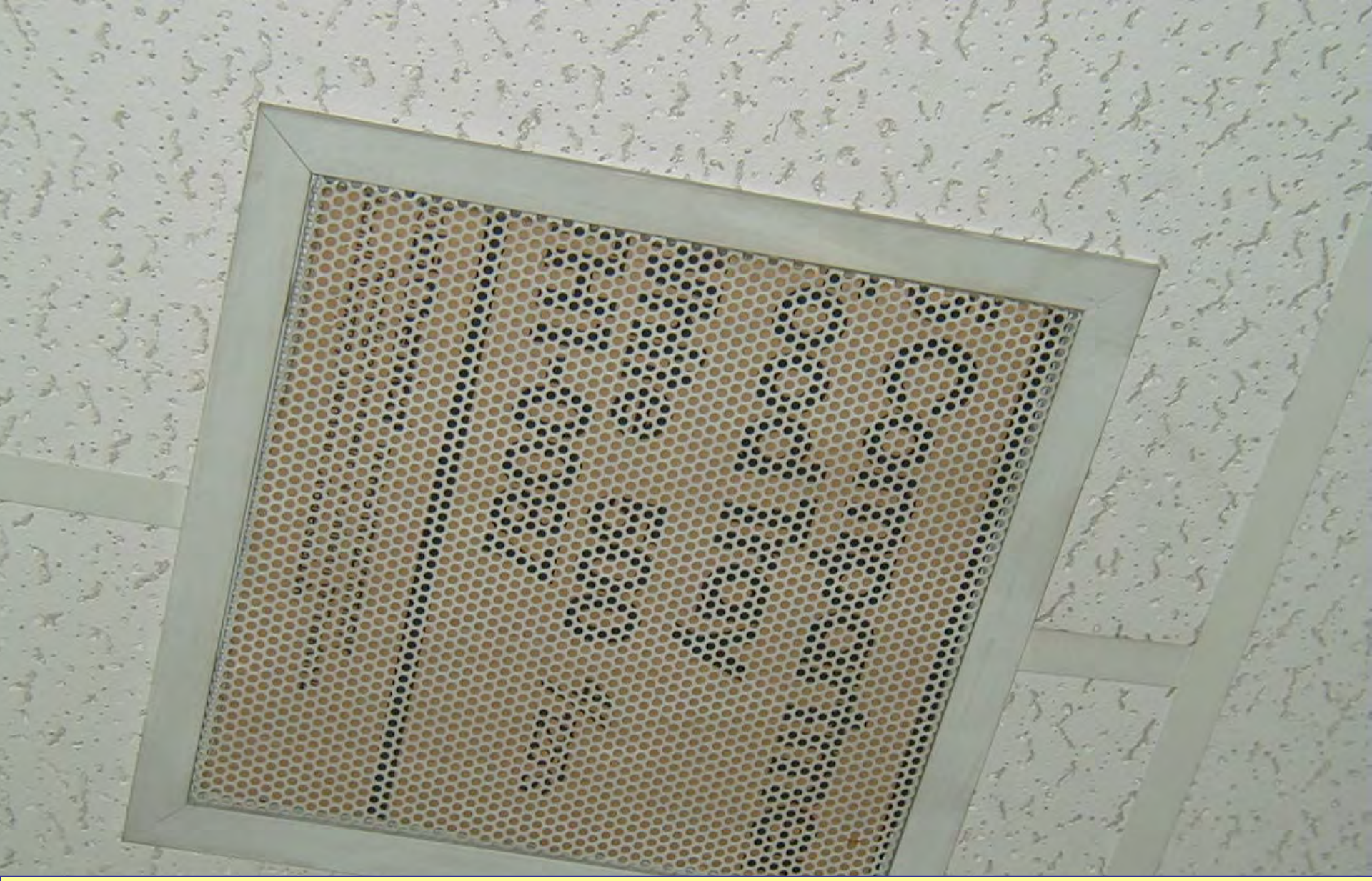
Return Air Blocked

Spot check room air filters


16"x 25"x1"

Tunnel open to "unit-ventilator"
Unplanned pathway


A "message" from occupants



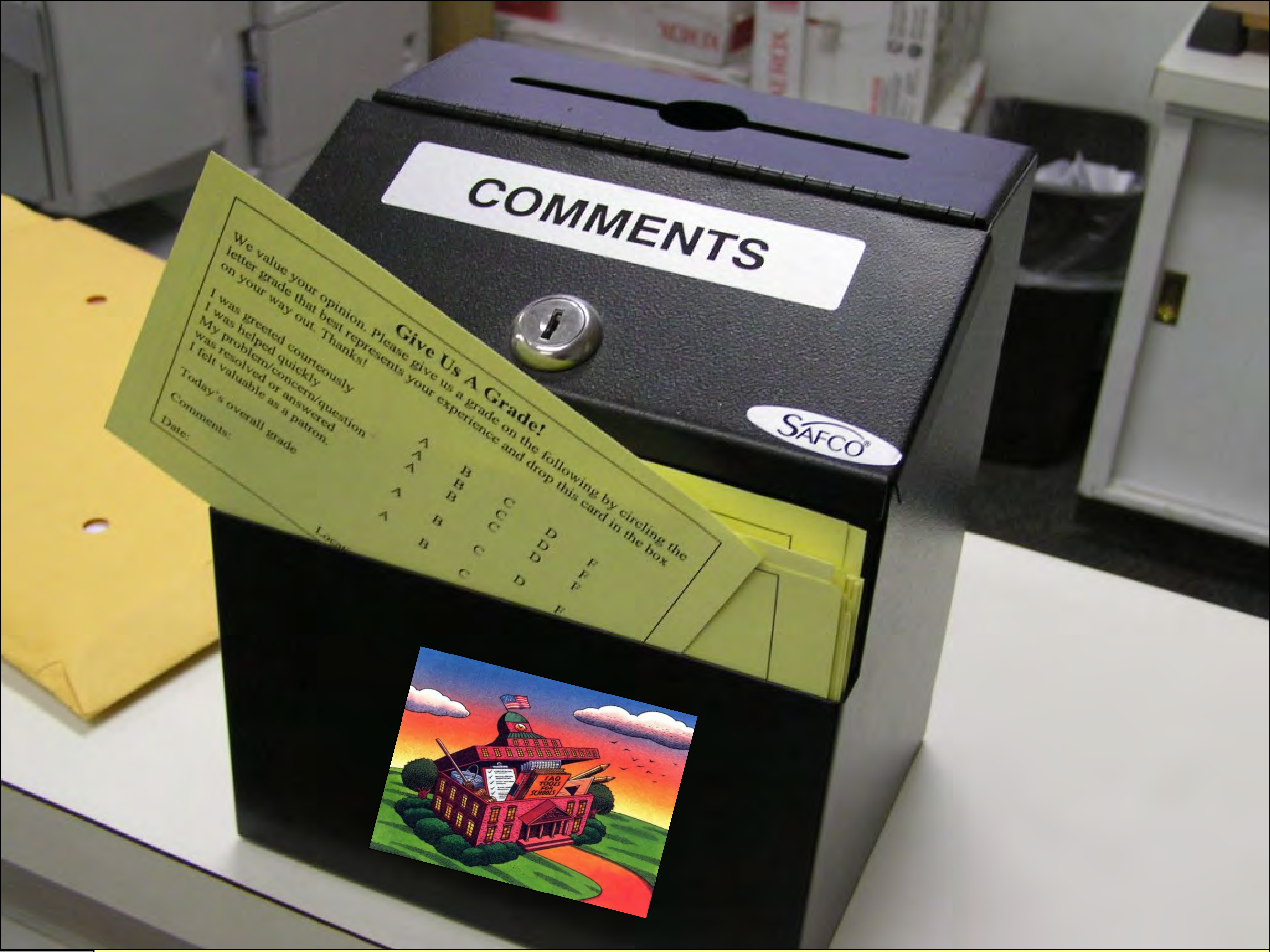
message from occupants

message from occupants

"Message" from occupants


COMPLAINT
FORMS
WA!
Fill out in triplicate.
Each request will be carefully considered.


COMPLAINT
DEPARTMENT
TAKE
A
NUMBER
1
U.S. IMPORTS & PROM.
EXPRESSIVE DESIGNS 33312


COMMENTS
SAFCO
Give Us A Grade!
We value your opinion. Please give us a grade on the following by circling the letter grade that best represents your experience and drop this card in the box on your way out. Thanks!
I was greeted courteously
I was helped quickly
My problem/concern/question was resolved or answered
I felt valuable as a patron.
Today's overall grade
Comments:
Date:
FAQ TOOLS FOR SCHOOLS

'Critical' Air Flow zones

Labs

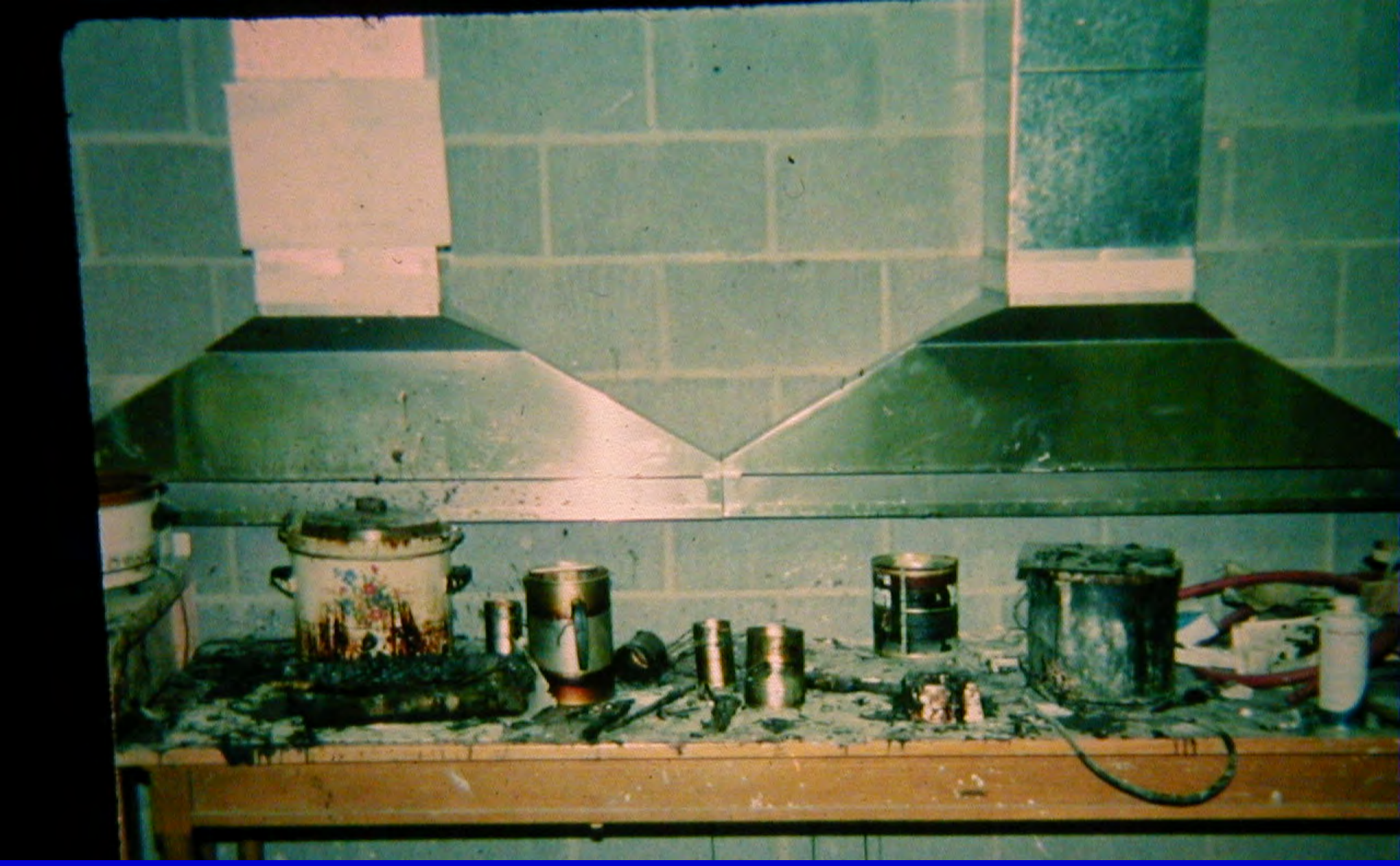
GYM

Shops

Home Science

ART

Capture and exhaust



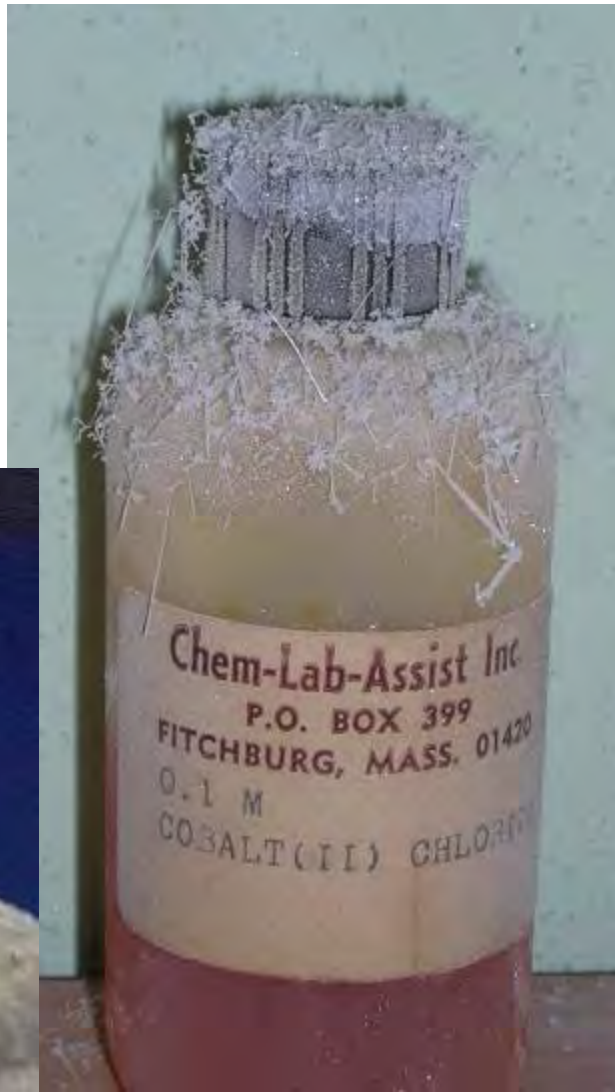
Capture and exhaust
= less exposure

Exhaust 24/7

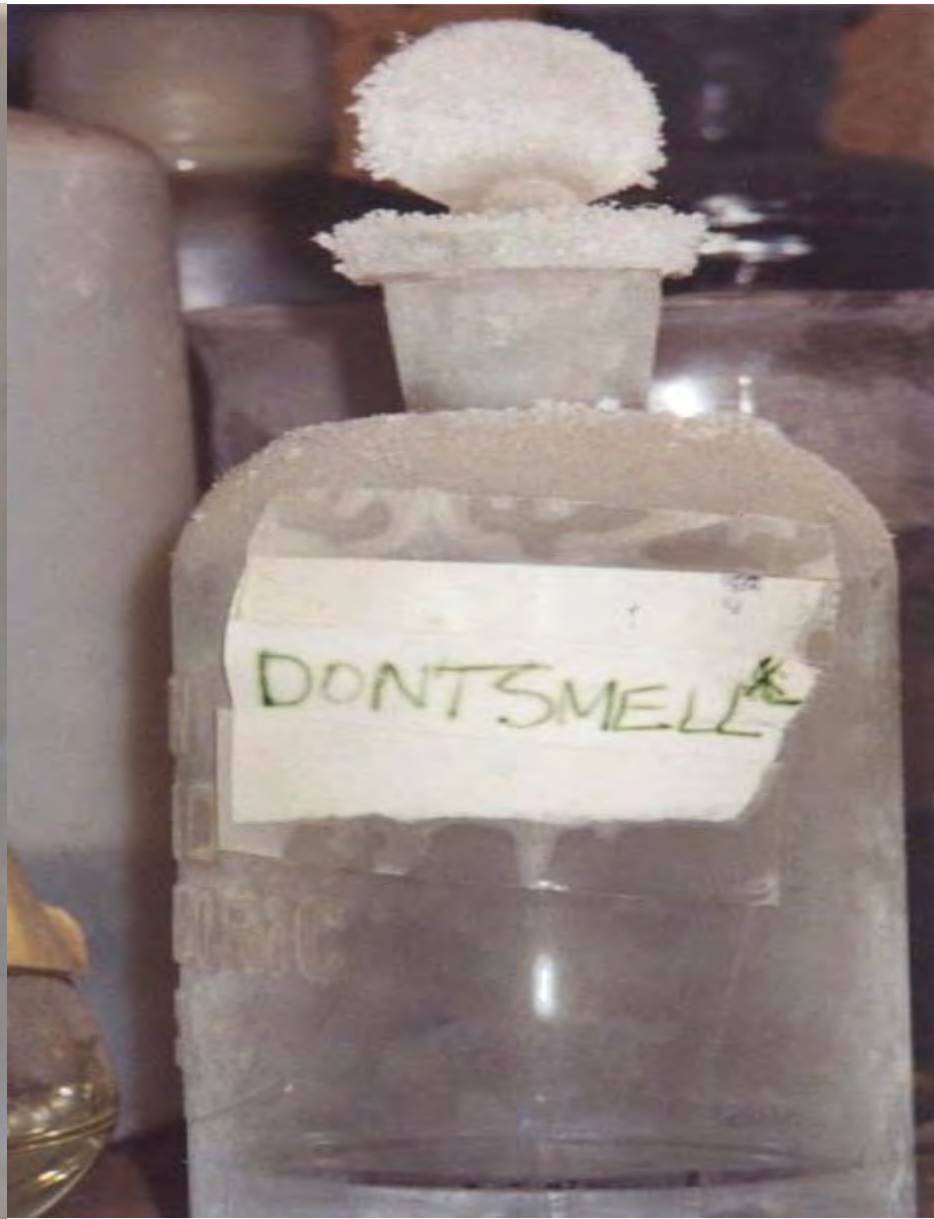
Contain and Exhaust

LABS and Chemical Storage

Note obviously unsafe conditions



Improper Labels



Vented kilns

'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

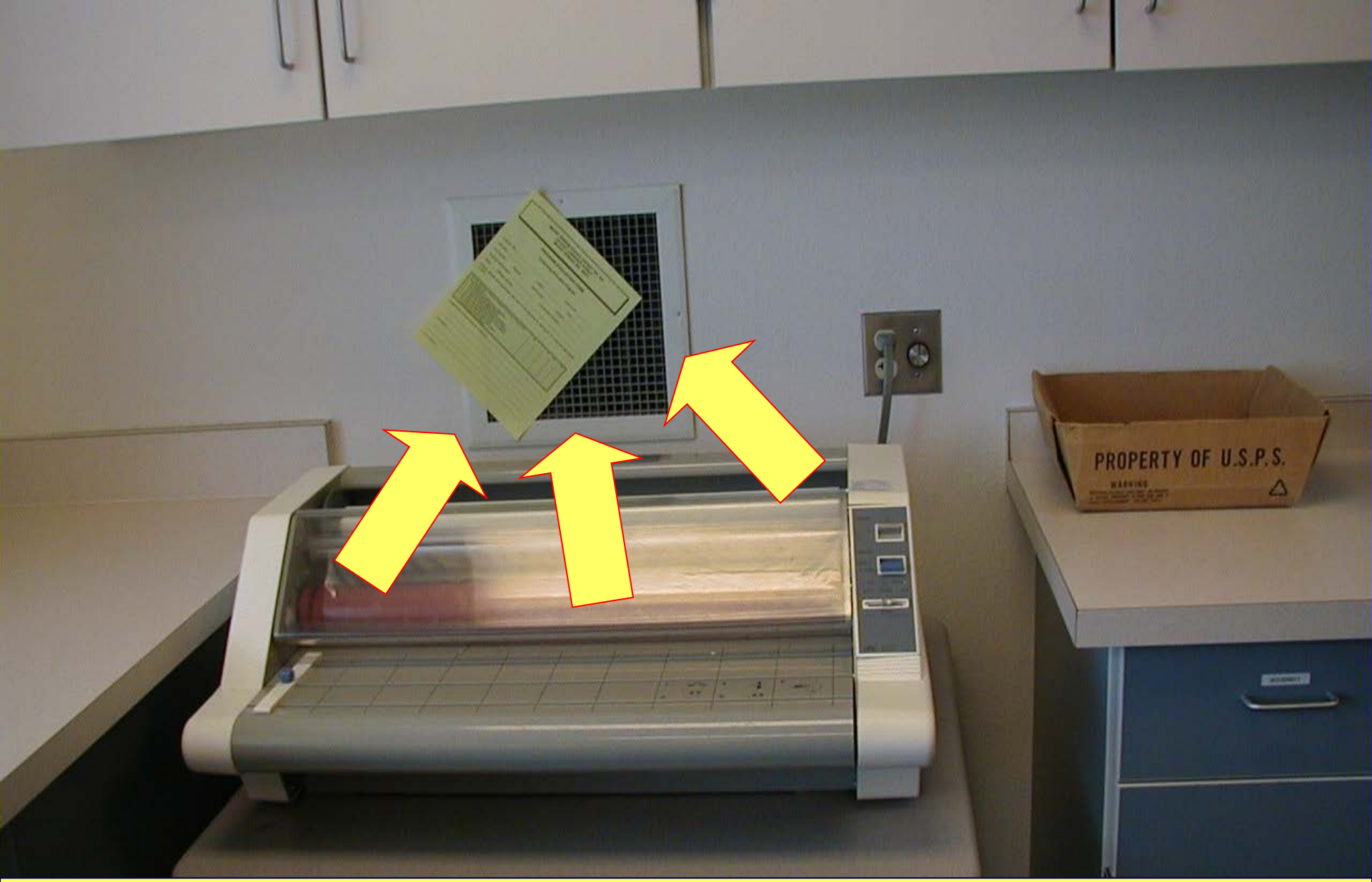
1) Rank Priorities
2) Set Timelines
3) Document Fixes

Ventilation & comfort

Fight Moisture

Send chemicals home

Ensure basic maintenance



Control Pollutants

Add exhaust for large

and/or high-use copiers


Install exhaust fan
Duct to outside


Improve
shop/art
exhaust


Adopt
effective
cleaning

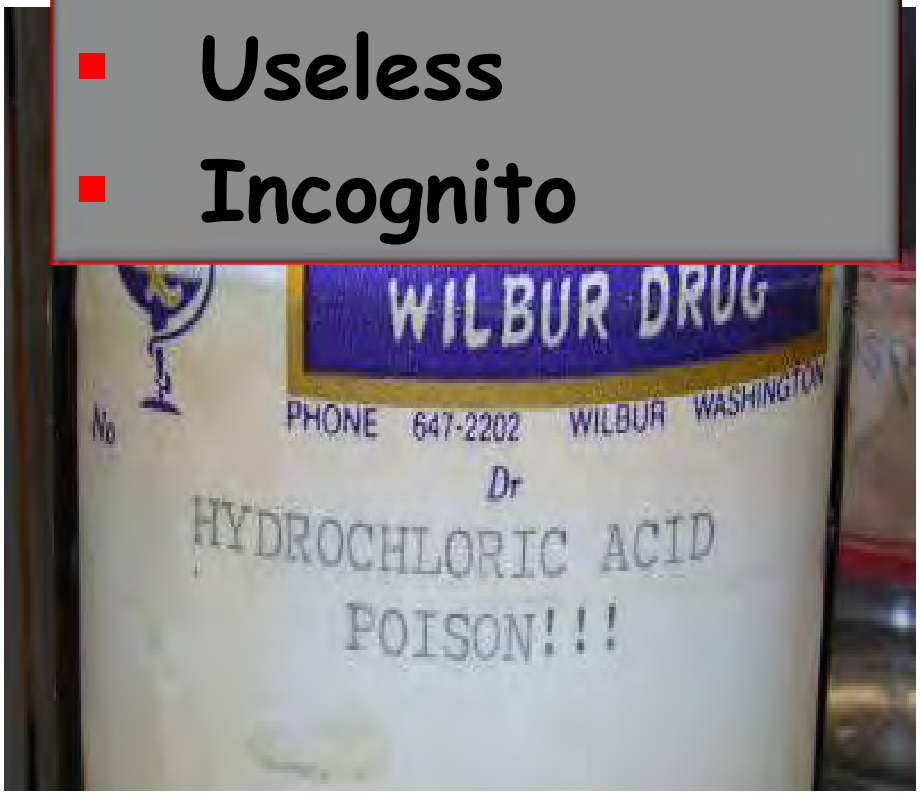
Respect sensitivities of others

Control and/or remove asthma triggers

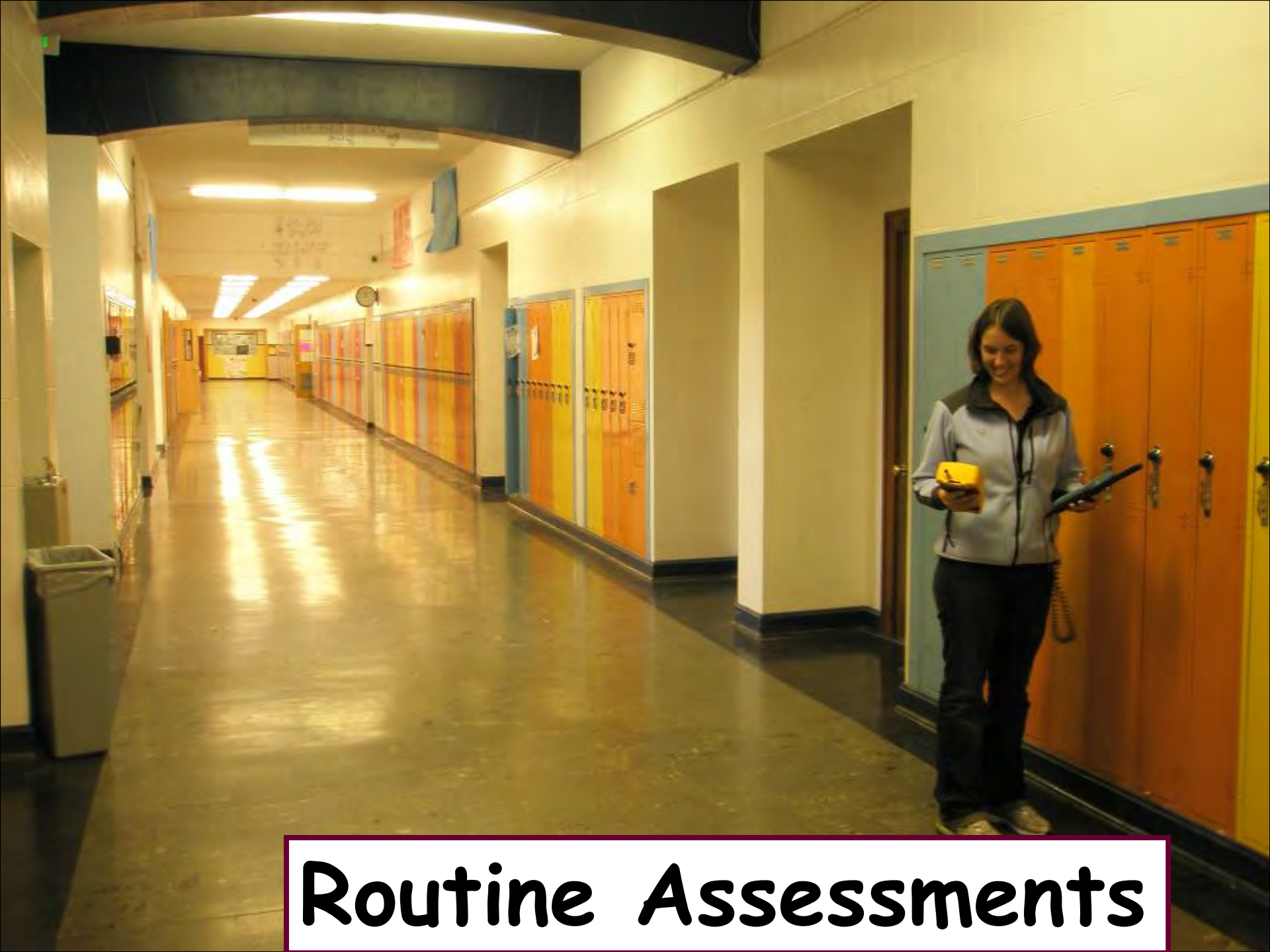

Find and correct exhaust
're-entrainment'

Dispose of Chemicals that are really:

- Dangerous
- Decrepit
- Excessive
- Useless
- Incognito



Formalize "good practices" into plan


Routine Assessments

Get Students Involved !

WASHINGTON STATE UNIVERSITY
EXTENSION ENERGY PROGRAM

"It's understood there is a large silent majority of individuals that strive d... environment. Consider taking credit for indoor air quality efforts in your school...."

Rich Prill

Indoor Air Quality in Northwest Schools

An electronic newsletter for school Ind...
(IAQ) exclusively for Nort...

Winter 2005

Continue to Provide Resources

...004 Tools for Schools Symposium

Washington, DC, December 2004

Article by Rich Prill,
Washington State University Extension Energy Program

More than 500 people attended the 5th Annual Tools for Schools symposium this year. To say the symposium is a great place for networking

School Indoor Air Quality Newsletter for Northwest Schools

A quarterly electronic newsletter exclusively for Northwest schools.

Please circulate this subscription opportunity throughout the Northwest to those who may be interested.

There are two ways to subscribe:

1) To view the newsletter, click here: *www.energy.wsu.edu/projects/building/iaq_nl.cfm*

The newsletter contains a link for subscription information.

BIRCHWOOD ELEMENTARY SCHOOL

INDOOR AIR QUALITY

APRIL 21, 2003

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, Implementation of "Tools for Schools"

1998, Started using Unbleached Paper Products

1998, BSD initiated Annual Building Cleanliness Inspections

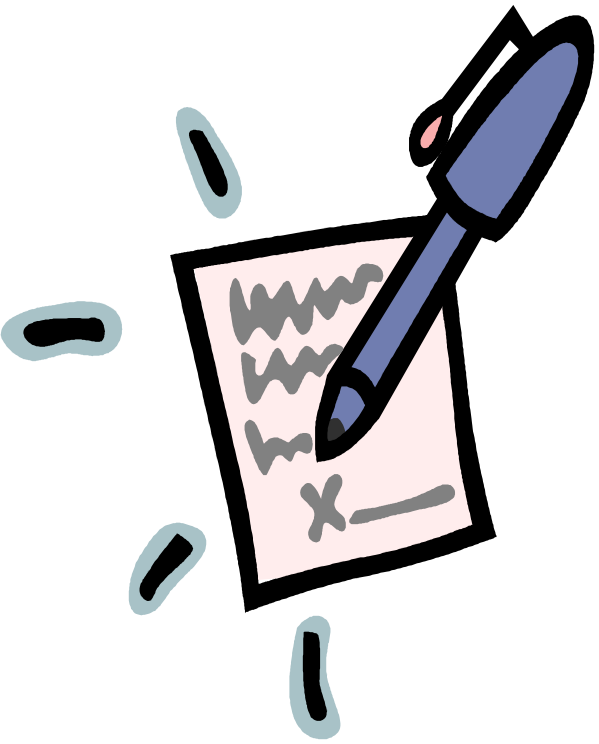
2000, Switched to using "Green" label products

2000, Replace windows in original building w/Insulated windows

for Health

Communicate!

Publicize your IAQ efforts



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

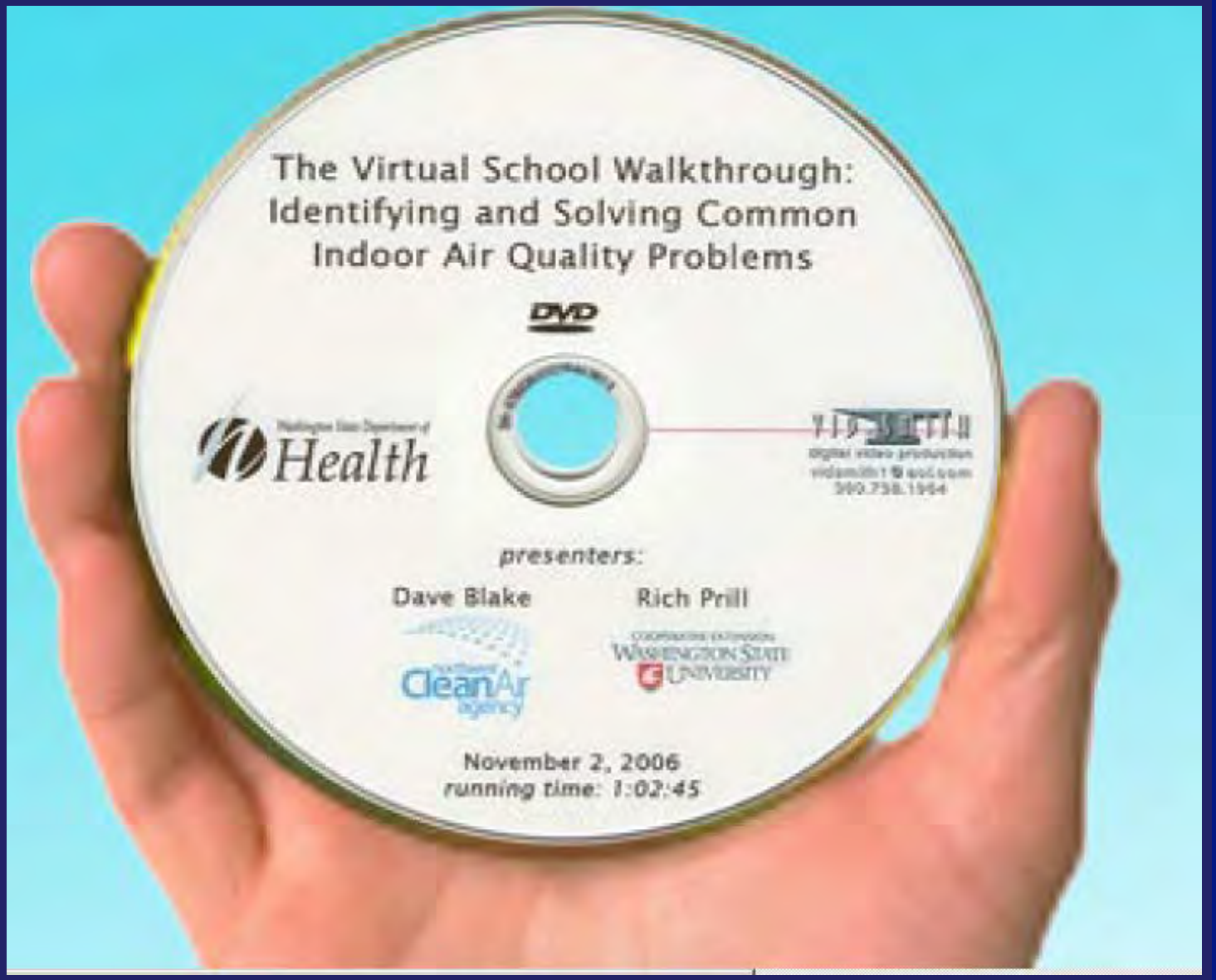
The Environmental Protection Agency Region 10

Awarded November 29, 2005

EPA Region 10
Air Program Director

Rich Prill
Indoor Air Quality Specialist
Washington State University

DVD available online



Thank you for your attention !