



Indoor Air Quality Problems and the Rebates Available to Address Them

Fixing Air Quality Problems Saves Energy & Money

By Bruce Severance, Energy Analyst, CK Builders Energy Division Manager

Bio-toxin Illnesses and Remedial Case Studies

By Cindy Edwards, Energy Analyst, General Contractor, Bio-Toxin Consultant

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Are Indoor Air Quality Problems Real?

- A 2013 EPA Study found that 30 million homes in the US have indoor air quality issues.
- That's a quarter of US households.
- Most problems are mold related.
- Many of these occupants are experiencing symptoms and are not always connecting the illness with the house.

– Advancing Healthy Homes – A Strategy for Action, by HUD & EPA

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Stats on Indoor Air Quality:

- People in the U.S. spend about 90% of their time indoors.

US EPA, (1987). The Total Exposure Assessment Methodology (TEAM) Study

- EPA studies indicate indoor levels of pollutants are up to ten times higher than outdoor levels.

Environmental Protection Agency (2008). An Introduction to Indoor Air Quality.

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75% Increase in Respiratory Problems Since 1980's

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Asthma Statistics

NATIONAL INSTITUTES OF HEALTH
National Heart, Lung, and Blood Institute

Data Fact Sheet Asthma Statistics



Introduction

The prevalence of asthma has been increasing since the early 1980s for all age, sex, and racial groups. The overall age-adjusted prevalence of asthma rose from 30.7 per 1,000 population in 1980 to a 2-year average of 53.8 per 1,000 in 1993-94. This represents an increase of 75 percent. The prevalence among children ages 5 to 14 increased 74 percent.

others to become more involved in asthma education, the NAEPP has developed this *Data Fact Sheet on Asthma Statistics* to indicate the magnitude of the problem.

Prevalence

In 1995, the prevalence of self-reported asthma was 56.8 per 1,000 persons. The prevalence was higher among children than adults and higher among blacks than whites. Among the general population, the prevalence of asthma was higher among females than males (Figure 1); however, among children, the prevalence was higher among males.

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Why do Widespread Indoor Air Quality Problems Go Unidentified?

- Causes are complex.
- No “warning light” for many issues
- CO detectors are inadequate
- “People spend more time looking at kitchen counter tops rather than the issues that can cause serious health problems”.
 - Nancy Harvey Steorts, Realtor, Author of Your Home Safe Home

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Benefits of Making Your Home Healthier:

- Monthly savings on utility bills
- Up to 15% return on investment
- Reduced environmental impact
- Increased resale value (8% to 30%)
- Lower medical bills, reduce symptoms

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Does Your House Have Issues?

- Any allergies?
- Dusty?
- Mold?
- Windows leak air or condense water?
- Crawlspace damp?
- Drafty, too hot or too cold?

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Reasons for High Indoor Pollutants

- Duct leakage and air leakage draws in toxins
- Unbalanced ventilation
- Inadequate ventilation
- Moisture accumulation fostering mold
- Radon: 2nd leading cause of lung cancer.
- Toxins outgassing from building materials.

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Home Air Infiltration

The single biggest factor affecting
comfort, indoor air quality,
and energy efficiency

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Typical Heating System Problems

- Average home has 30% duct leakage!!!
- Causes toxin infiltration
- All homes before 2004 have issues.
- Use anything but “duct tape”.



See [Anything But Duct Tape](#), by Lawrence Berkeley Labs for the DOE

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Open Stud Wall HVAC Return

Pulls dust from attic
through stud bays –
Really bad air!!



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New HVAC & Energy Code!

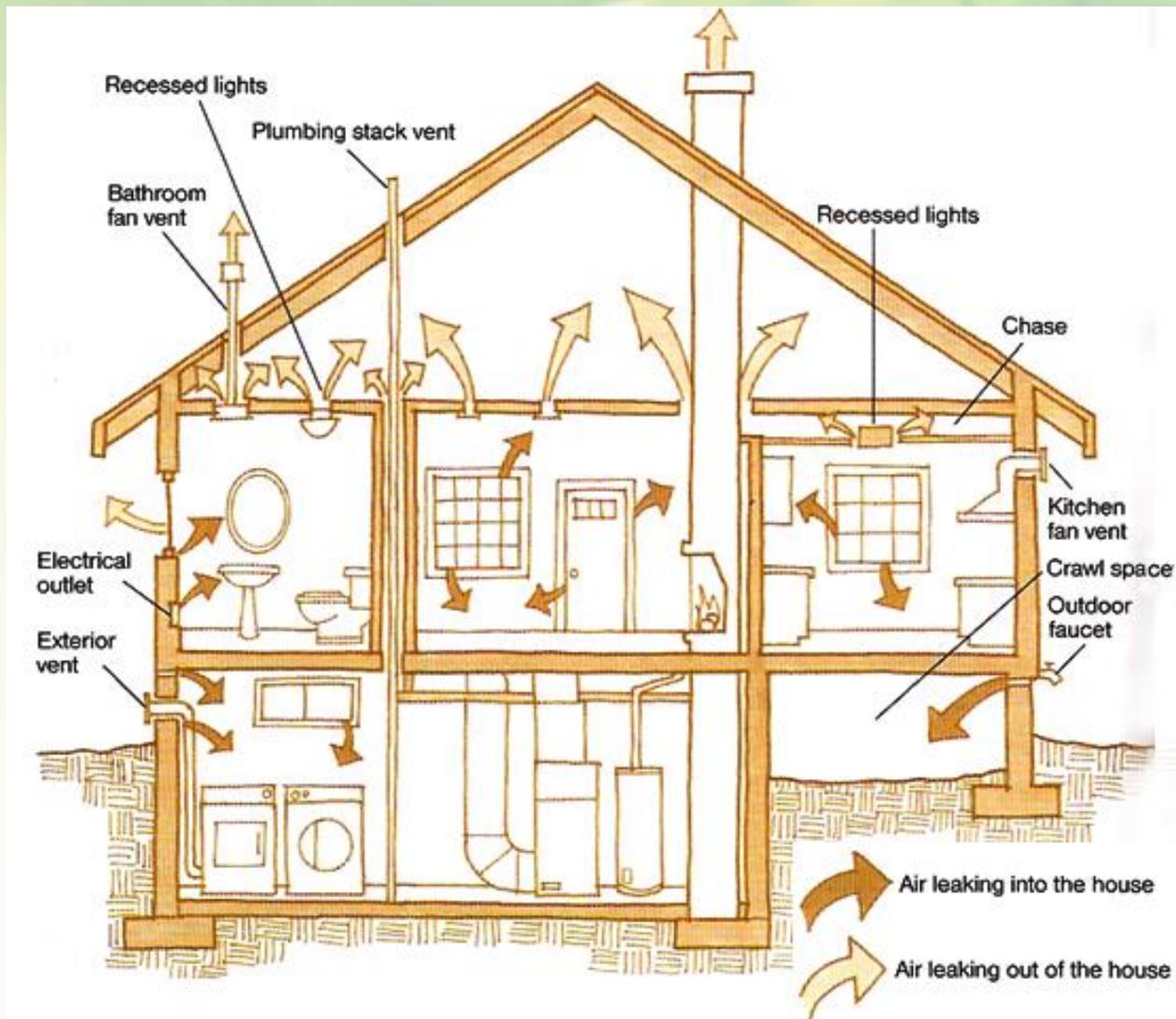
- **If HVAC contractor is not filing for permits, they are ripping you off!**
- 95% of furnace replacements in county don't meet code, have combustion safety issues and increase air quality issues.
- Most systems are oversized for house.
- Most systems oversized for ducts = stressed heat exchanger=CO danger!

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Where Does Your Home Leak?

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How Do We Measure Leakage?

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Blower
Door
Test





Where Does Your Air Come From?

Every cubic foot of air that leaves is replaced by a cubic foot from outside.

Is your “make up air” coming from a healthy source?

Lawrence Berkeley Lab says 40% of of your “fresh” air comes from the crawlspace.

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Where are the leaks?

- Electrical and plumbing holes
- Tub access panels in sub floor
- Unsealed sub floor
- Duct leaks in crawlspace



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Old Style Can Lights Leak a Lot!

Replace
with
ICAT
rated!



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Are You Breathing CO from Combustion Appliances?

- **25% of SLO County homes tested have combustion appliance safety issues.**
- 85% of homes have “depressurization” due to duct leakage and large fans.
- Can cause standard water heaters to draw flue gasses and CO into home.

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Combustion Safety: This is Dangerous!!!

Dryer in small laundry room depressurizes room and causes water heater flue to “backdraft”

Carbon Monoxide and other combustion gasses commonly enter the living space!



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Combustion Safety: Dangerous Conditions

Water heater flue
terminates in attic
or is broken in
attic.



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Does Your CO Monitor Keep You Safe?

- **UL approved monitors are triggered if:**
 - 1) exposed to 30ppm for 30 days, or**
 - 2) 70 ppm for four hours, or**
 - 3) 150 ppm for under 50 minutes.**
- Harmful effects such as headaches and dizziness flue symptoms are felt at 35 ppm in 6 to 8 hours.
- OSHA allows 50 ppm for 8 hours.

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What is a Safe Level of Carbon Monoxide?

- **UCLA study indicates only 5 ppm is linked to pregnant women having underweight children with smaller heads.**

Concentration	Symptoms
35 ppm (0.0035%)	Headache and dizziness within six to eight hours of constant exposure
100 ppm (0.01%)	Slight headache in two to three hours
200 ppm (0.02%)	Slight headache within two to three hours; loss of judgment
400 ppm (0.04%)	Frontal headache within one to two hours
800 ppm (0.08%)	Dizziness, nausea, and convulsions within 45 min; insensible within 2 hours
1,600 ppm (0.16%)	Headache, tachycardia , dizziness, and nausea within 20 min; death in less than 2 hours
3,200 ppm (0.32%)	Headache, dizziness and nausea in five to ten minutes. Death within 30 minutes.
6,400 ppm (0.64%)	Headache and dizziness in one to two minutes. Convulsions, respiratory arrest, and death in less than 20 minutes.
12,800 ppm (1.28%)	Unconsciousness after 2–3 breaths. Death in less than three minutes.

Chart from Wikipedia.org

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How Dangerous is Radon?

- Naturally occurring odorless gas
- Second leading cause of lung cancer.
- 5.9% of SLO County residents live in homes with radon over EPA action level.
- Radon exposure produces no symptoms.
- Test kits are only about \$25
- There are ways to mitigate

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Radon Problems in SLO

- In Templeton, 27.3% of homes are exposed to levels that exceed EPA action level

(4 picocuries/liter)

- 18.8% in Atascadero
- In Paso: 8.9%

-Based on 2008 Department of Public Health Indoor Radon Program survey of 918 homes in SLO County. Radon Potential in San Luis Obispo County.

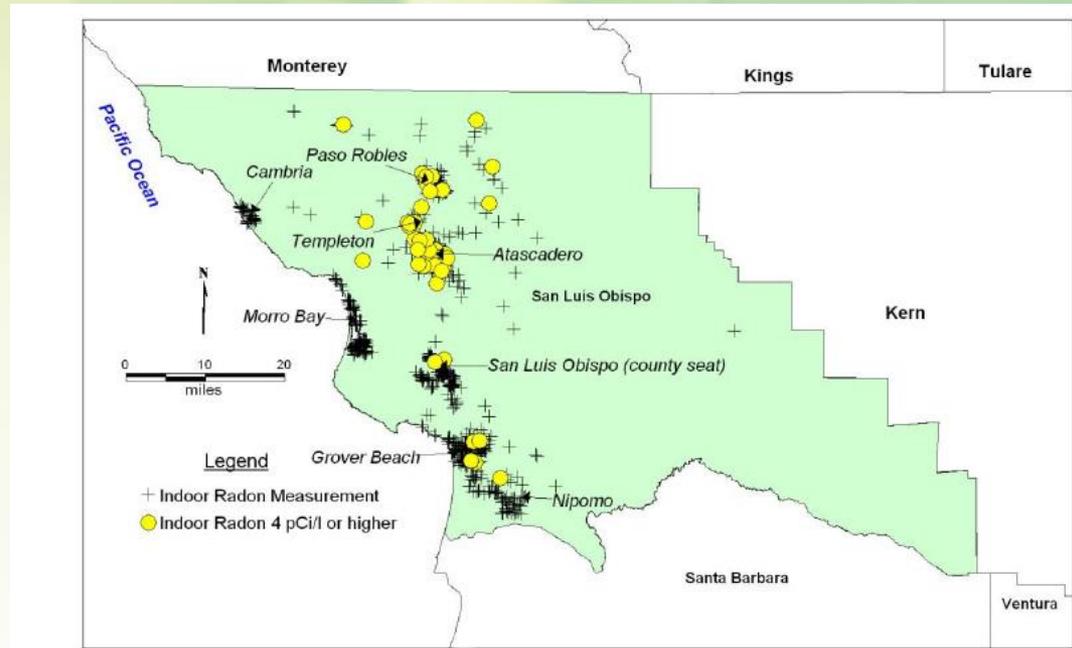


Figure 2. All CDPH Short-Term Radon Test Results for San Luis Obispo County—with 4.0 pCi/l or Greater Sites Shown as Yellow Circles

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Why Have Dedicated Source of Fresh Air?

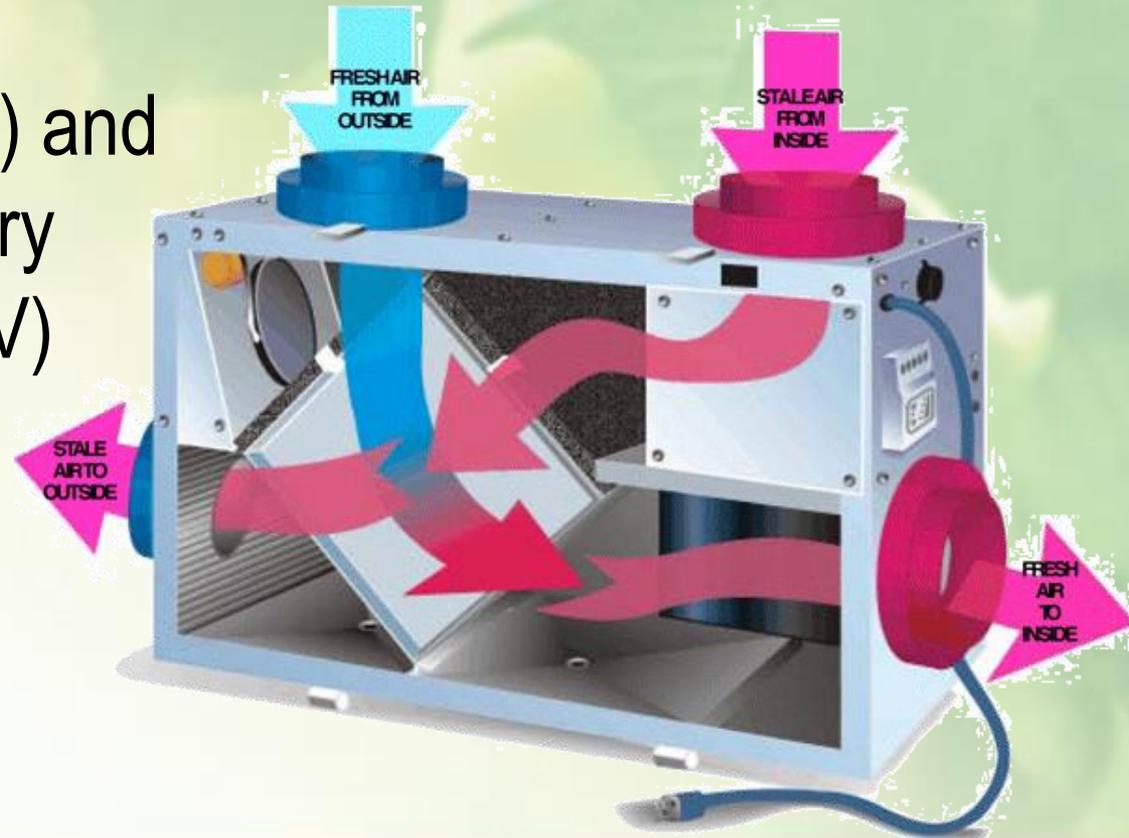
- Most homes don't have controlled source of fresh air (required in commercial building).
- HVAC can be designed to continuously draw air from outdoors, but this is not efficient.
- An ERV allows you to bring in fresh air without losing heat and also prevents depressurization.

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ERV's: Fresh Air without Heat Loss!

Heat Recovery Ventilator (HRV) and Energy Recovery Ventilators (ERV)



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Rebates Available for Energy Upgrades!

- Energy Upgrade California has rebates for \$1000 to \$6500.
- Rebates usually cover 15% to 25% of the cost of repairs
- Energy upgrades always address indoor air quality

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But Will it Add Market Value?

Market Trends

- 91% of U.S. home buyers would prefer to buy a home with energy-efficient features over a less-efficient home that is 3 percent cheaper.

National Assoc. of Home Builders Consumer Preference Survey, 2009

- 81% of U.S. home buyers prefer green homes. - McGraw Hill Survey, 2011

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Bio-Toxin Illnesses and Remedial Case Studies

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What Causes Mold?

- Moisture: people cause 3 quarts of water vapor per day.
- Most houses are depressurized due to duct leakage and fans, causing bio-toxin infiltration.
- Inadequate and unbalanced ventilation



Moisture + Food = Mold

- Mold spores are everywhere
- Outdoor levels usually not an issue.
- Indoor levels can overwhelm sensitive individuals.



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Typical Bio-Toxin Related Illness

- 24% of population has bio-toxin sensitivity gene
- CIRS: Chronic Inflammatory Response Syndrome
- Neurotoxicity (brain toxicity)
- Cytotoxicity (cell toxicity)
- Immune toxicity, cell depression & damage
(*Gray et al 2003; Thrasher and Crawley, 2009*)
- Molds linked to cancers, reduced blood flow to brain, damage to organs, soft tissue and bone
(*Dangers in Our Home Mold, Steven Gilbert, 2009, Toxipedia.org*)

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Typical CIRS Symptoms

- Respiratory infections
- Flu-like symptoms
- Arthritis
- Neurological dysfunction
- Rashes and hives
- Swelling, edema
- Heart conditions

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Dr. Shoemaker's Diagnostic Protocol

- 37-point diagnostic protocol
- Complicated interactions make causal links difficult.
- Differentiates CIRS from Lyme disease and Alzheimer's.
- Same gene causes higher sensitivity to Lyme
- **SEE SURVIVINGMOLD.COM**

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CK Builders Case Study One

- Ice maker leaked onto wood floors. First contractor “remediated via disposal of flooring”.
- Containment was used during remediation.
- Their air testing showed insignificant spore levels.
- Previous consultant recommendations:
“improve air filtration, possible duct cleaning, and check for sources.”
- Symptoms persisted & CK Builders was called.

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CK Case#1 Visual Findings



CK removed toe-kick vent (about four feet from ice-maker) revealing mold growing in cabinet supplying air.

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CK Case#1 Visual Findings

CK removed
drywall to reveal
water damage
under adjoining
stairs.

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CK Case#1 Visual Findings

Stair cavity
used as a
return duct,
pulled spores
into the HVAC
system.



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CK Case#1 Visual Findings

Visible duct leakage at HVAC plenum contributes to bio-toxin infiltration.

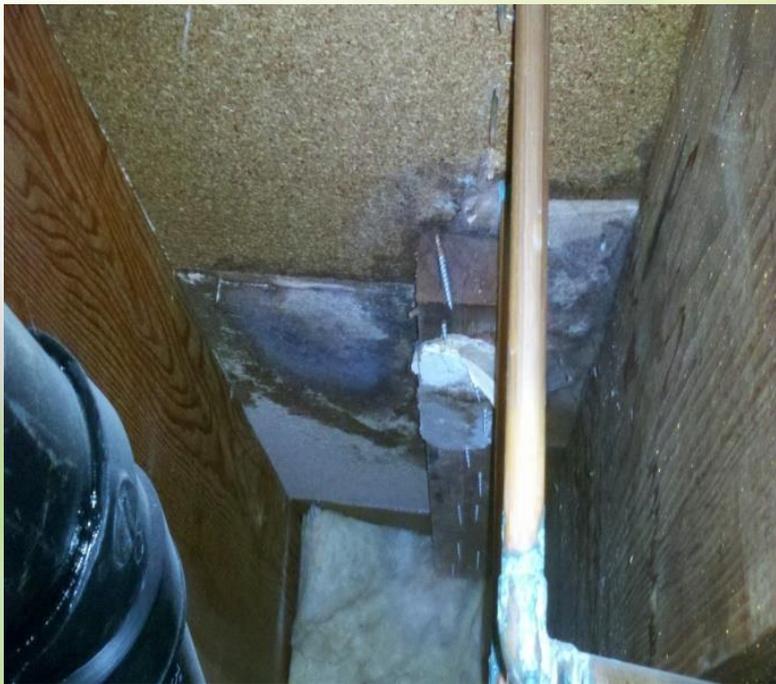


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CK Case#1 Visual Findings

Shower pan leak under second floor.



Exhaust fan access revealed hidden mold.

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CK Case#1 Visual Findings



Moldy bath fan duct terminated in the attic causing more contamination.

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CK Case Study One Summary

- Mold levels found by testing hidden sources reveals “black mold”. (Stachybotrys)
- Finding the hidden sources validates the CIRS patient. (No they are not crazy)
- Assessment by mold testing alone is unreliable.
- Invasive procedures (opening walls, etc.) are usually necessary but must be done correctly.

CK Builders Case Study #2

- Patient moved into a “newly remodeled” apartment. ERMI mold test (by others??) “passed”.
- Visual inspection revealed significant cross contamination.
- Inner wall cavity tested positive for mold in bathroom.
- Client able to break their lease to relocate.

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CK Builders Case Study #2



This client was told that this was a newly remodeled building.

Contaminants
and mold visible
in attic.



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CK Builders Case Study #2

- Water damaged roof sheathing reinstalled in the attic.(uncommon practice to put roof sheathing here)
- Leaky light fixture allows cross contamination.



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Case Study #2 Summary

- Mold testing revealed toxic molds.
- Patient was able to validate their environment was causing their symptoms.
- Assessment findings prompted relocation without lease “early termination” fees.

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CK Builders Case Study #3

- High water table allowed 1/4" of water in the basement.
- Previous Contractor's recommendations:
 1. Remove water source
 2. Remediate the basement
 3. Rebuild and move back in.
 - But it didn't work...

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CK Builders Case Study #3

- Patient bio markers spiked higher after remediation.
- They moved into a (clean)camper to detox during the remediation/rebuild. The family member improved! 😊
- When the rebuild “by others” was completed they moved back into the home before performing a whole house cleaning. ☹️

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CK Builders Case Study #3

- They got sicker after first remediation and rebuild. Why?
- The home had not been cleaned after the rebuild.
- The home was not air sealed to reduce cross contamination.
- The home did not have enough ventilation.
- Cross contamination occurred from agriculture business, school age children.

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CK Builders Case Study #3

- CK's Solution: Build a permanent decontamination room that could be used to remove contaminants before entering the home. Contaminates from (Ag/school).
- To make the home safe: air seal and install two heat recovery ventilators (HRVs).
- HEPA sandwich clean the whole house and contents.

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CK Case Study #3

- Bio marker results after moving into the clean camper levels improved by 28%.
- Post HP/Decon chamber after 60 days bio marker levels improved by 71%.
- Client's husband commented that "she's the best she's been in over four years". 😊

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CK Case Study #3

- HP techniques are vital to reduce cross contamination. (HP= home performance=air sealing, duct sealing??)
- Using a clean, sealed air source is vital.
- There is a direct correlation between the implementation of HP techniques and patient bio markers.
- Using a decon chamber reduces cross contamination from outside source.

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What Causes Mold to Grow?

- Plumbing leaks
- Plumbing back-ups
- Roof leaks
- Window leaks
- Wind Driven Rain
- Plants
- Washer Hose leaks
- Ice Maker Leaks
- Reverse Osmosis Leak
- Grading and Drainage
- Shower pans
- Shower vapor
- Lack of Exhaust Fans

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Mold Mitigation Strategies:

- Eliminate water leaks!!
- Open the windows!
- **PREVENTATIVE MEASURE:** Heat Recovery Ventilation: HRV's offer balanced ventilation that draws in fresh air and pumps out excess moisture without losing all the heat.



Repairs that Improve Air Quality also Save Energy

- Air sealing (the building envelope)
- Duct sealing
- Changing out leaking recessed can lights
- Installing sealed combustion appliances
- Installing ERV ventilators
- Installing CO monitors
- Eliminating asbestos hazards

All of these repairs qualify for energy grants

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Thank You for Coming!

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Green Remodels
Zero Energy Custom Homes
Energy Upgrades**

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