# MOLD RELATED INDOOR IRRITATION FROM CONTAMINATED AC DUCTING


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# National Lead & Healthy Housing Conference Orlando 2015

Presentation by Gary Rosen, Ph.D. at the HUD Healthy Housing Conference 2015

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Further information at his web sites:

- www.Mold-Toxins.com
- www.Mold-Free.org
- www.Free-Mold-Training.org

# Dirty AC & Ducting Can Be the Devil

- This presentation focuses on homes with low to moderate levels of mold and mold contaminants that are always present in the indoor air when a moldy / dirty AC and / or ducting is running.
- These homes are not noticeably moldy or water damaged; although they may have had mold / water damage in the past that was cleaned up or remediated.
- Mold-sensitive individuals don't feel quite right in these homes. They wake up with clogged sinuses, red eyes, don't sleep well, or worse.
- But homes test fine with standard mold testing.

# Always a Problem for Mold-Sensitive People

- Normal moisture from the AC system turns accumulated dust /dirt in the AC and ducting into food for mold, resulting in the spread of mold-related irritants, causing allergy-like symptoms when the AC is running.
- Susceptible populations are **always** affected even by low levels of contaminants from the AC system, especially the young; immune compromised; and the elderly.
- And all AC systems (AC + ducting) except brand new have some level of mold contamination.

# Clean AC & Ducting Can Be an Angel

- On the positive side, the AC and ducting can be cleaned / refurbished to “as new”.
- And a quality (MERV 11 or better rated) air filter can be put in place.
- Then, the clean AC system can dramatically improve the indoor air quality so that mold-sensitive occupants are not irritated even if homes have significant problems with mold, dust, old carpets or dust mites.

# Very Young Always Sensitive

Formula-fed infants tend to be more susceptible to dysbiosis (disrupted gut microflora) from exposure to mold toxins in contrast to breast fed infants.

And just as with allergy-like symptoms from mold, who is susceptible to dysbiosis from indoor mold toxins is, to a large degree, a function of individual susceptibility / sensitivity.

Even very low levels of indoor mold contaminants released by the AC and constantly airborne can negatively affect sensitive individuals, especially the very young during developmental stages.

# A Clean AC Can Fix Many Problems

- In many cases when there are mold-sensitive individuals (especially children) in an older home, the **only practical way** to have a healthy indoor environment is for the AC system to be cleaned/ renovated to "as new" with a quality air filter in place to **continually** filter the indoor air.
- Running the (clean) AC with FAN=ON 24/7 is not expensive and can very efficiently remove not only mold contaminants from the indoor air but also **mites, insecticide or lead-contaminated dusts, pollen, and insect part allergens.**
- Running AC FAN=ON (24/7) may require adding a dehumidifier to keep humidity under control.

# Presentation Focus

- **Our presentation focus is on practical considerations**:

How to assess AC-related irritation problems.

How to fix the problems without breaking the bank.

How to fix the problems so they don't come back.

How to fix the AC-related irritation problems and guarantee that the sensitive occupant has no mold-related irritation in the home.

# Mold Toxins: More Than Allergic

- Note that many molds, and not just so-called Toxic Mold, produce mold toxins (mycotoxins.)
- Molds that commonly grow in contaminated ACs and ducting are often toxin producers.
- Mold mycotoxins found in AC systems can cause not only well-studied, allergy-like symptoms / irritation but also the disruption of gut micro-flora (dysbiosis*) from inhaled mycotoxins. Why?
    - Most of the inhaled toxins are eventually cleared from the lungs and wind up in your gut.

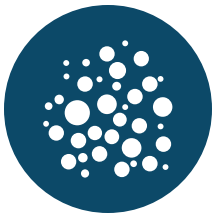
*http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3448089/

Diet-Induced Dysbiosis of the Intestinal Microbiota and the Effects on Immunity and Disease

# Presentation Audience

- Environmental specialists
- Health and housing officials
- Facility managers
- Health advocates
- Environmental companies and consultants.
- Mold / chemically-sensitive individuals being treated for Chronic Inflammatory Response Syndrome (CIRS) but don't seem to get better. Because it’s impossible to get better if you are constantly exposed to mold-related inflammagens in your home.

# Questions Addressed



The air test showed no elevated mold relative to the outside air. So why does the home smell musty?

The air test showed no elevated mold. Why is the occupant still irritated when home but fine outside?

We are run down and tired – we keep getting sick. Can this be from mold? I thought mold only affected the respiratory system.

I live in an older home and there's mold in several of the walls from earlier leaks. Can the home ever be irritation-free without tearing down walls and breaking the bank?

# Caution

- Many physicians that specialize in environmental illness are recommending DNA-based mold testing of house dust.
- This is a red herring!
- Keep in mind that exposure is from breathing mold typically as a result of mold contaminated AC and ducting.
- Exposure is not from moderate amounts of mold in settled house dust in a relatively clean home.
- There is always mold in house dust … So clean the dust and there will be no dust to collect mold.

# GUIDE TO AC COMPONENTS & DUCTING

# Air Handler & Components

*(Typical in Florida)*

Fiberglass-lined supply plenum made from duct board goes through AC closet ceiling and connects AC (Air Handler) to ducting in attic. Air comes out from here.

Air handler

Insulated coolant line

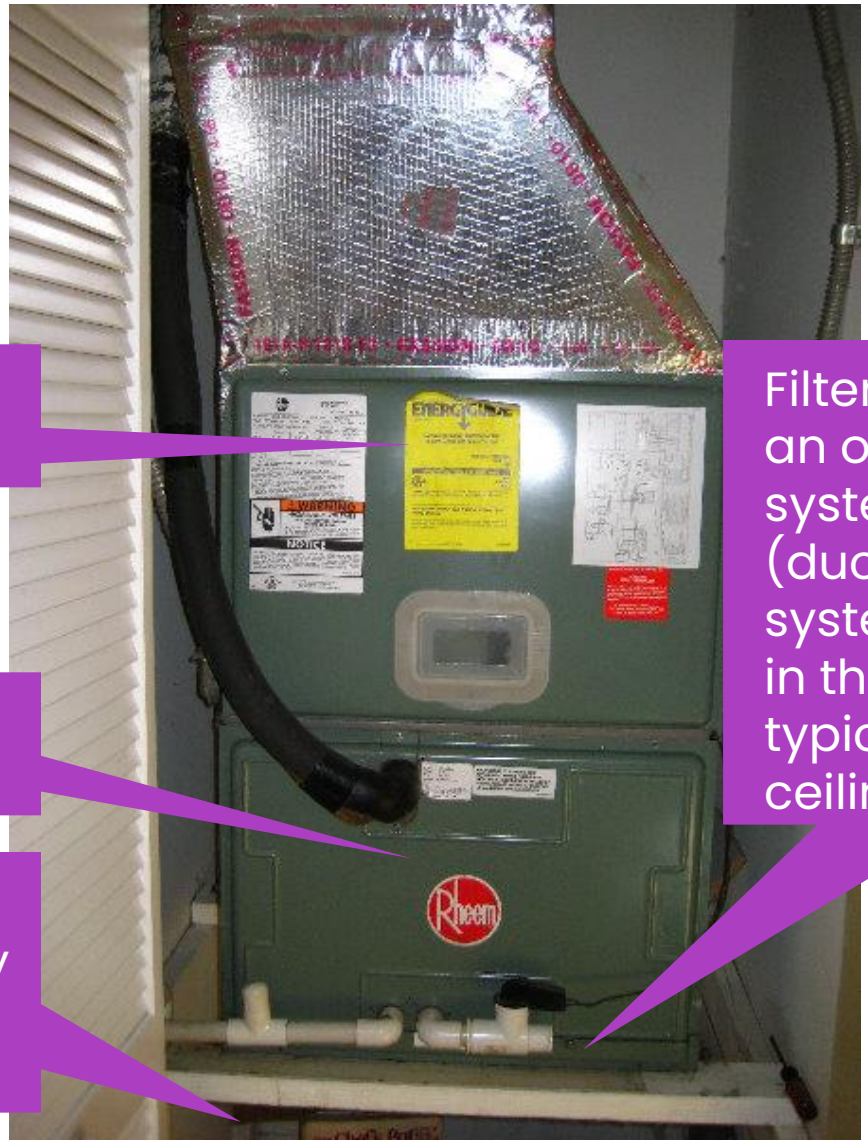
Drain line

# Air Handler Components

Blower is inside here above coils

AC coils are down here above drain line.

Air returns here under the unit. This area may be open or may be ducted or closed with a return air grill.




Filter goes here in an open return air system. In a closed (ducted) return air system the filter is in the return air grill typically in the ceiling.

# Dirty AC Coils

- Dirty AC coils. Dirt, mold, dog hair. All being spread throughout the home. Even if there is a good air filter used, it does no good as the problem is on the other side (downstream) of the filter.

# Cleaning the AC Coils

- Steps:
  1. Remove AC coils from unit.
  2. Clean them outside at the curb.
  3. Rinse off cleaning chemicals after cleaning.
- But blower, AC lining along with supply plenum and ducting will also need cleaning.
- Not cleaned with standard AC coil cleaning.

# Dirty Blower

- Dirty blower wheel. Blower should be removed to be cleaned outside.
- When AC coils are cleaned, rarely if ever is the blower cleaned. **But it should be.**

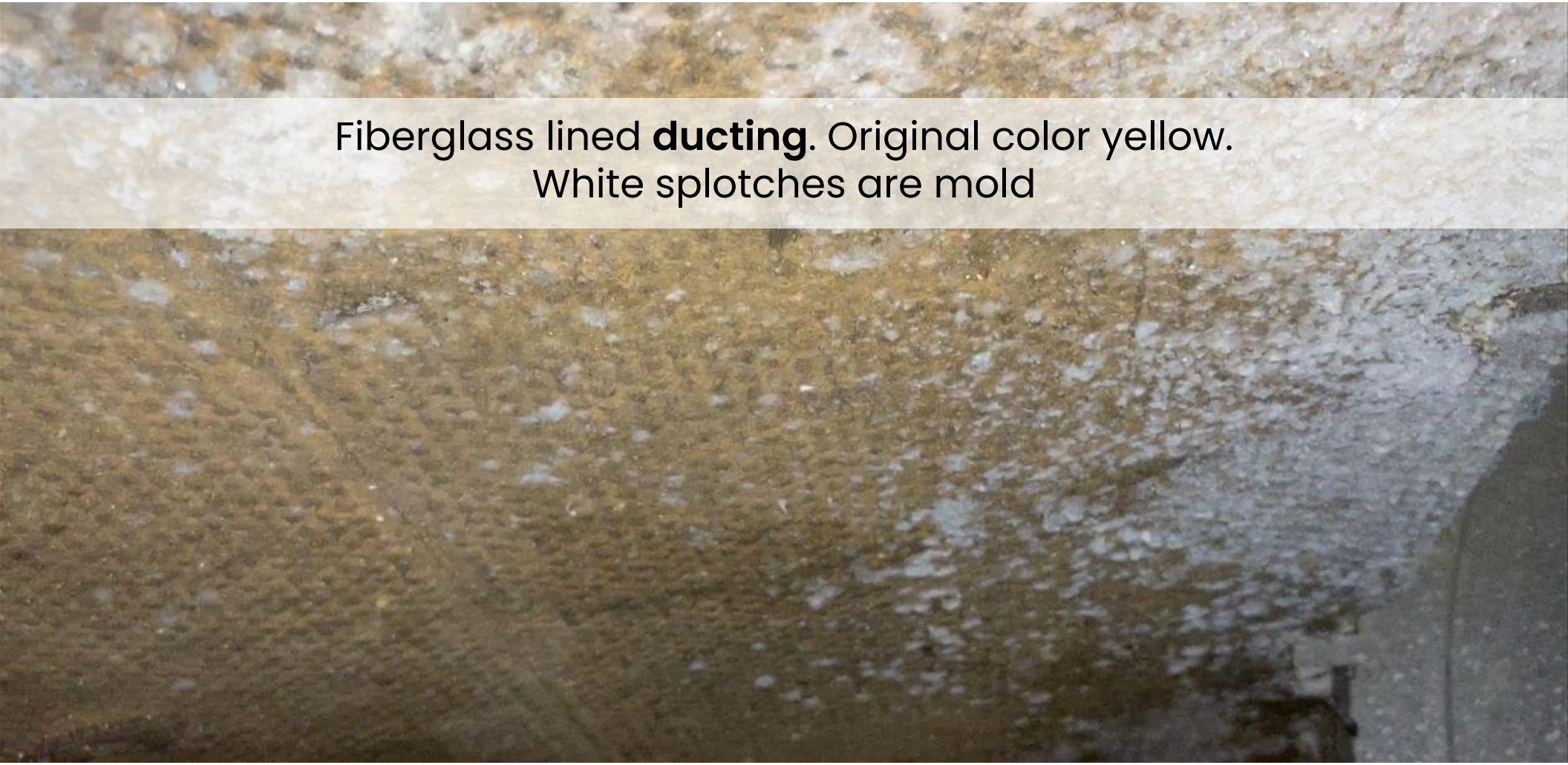
# Fiberglass Lined Supply Plenum


- The AC supply plenum (inside yellow box) sits on top of the air handler, goes thru the AC closet ceiling, and connects the air handler to the duct work.
- It is made (in Florida and other hot climates) from fiberglass duct board and has a rough internal lining that captures dirt and dust. (Interior surface has nooks and crannies like an English muffin.)

# Fiberglass-Lined Supply Plenum

- Dust + Moisture from the blower = Mold Growth.
- When the AC is cleaned or replaced, the supply plenum is never cleaned or replaced.
- Yellow arrows on right point to white mold growing just above the air handler.
- **This area is never cleaned by duct cleaners.**

# Fiberglass-Lined Ducting



Fiberglass lined **ducting**. Original color yellow.
White splotches are mold

- In many homes the ducting is also made of fiberglass lined duct board.
- It collects dust and grows mold. White spots are mold. **Never cleaned by duct cleaners.**

# Flex Duct: Smooth Lining. But Fragile.

Many newer homes have Flex duct — lined with smooth, thin plastic film. Fragile.

Ducts made from Flex ducting generally get less dirty than ducts made from fiberboard due to the smooth lining of Flex duct versus rough (sticky) interior lining of the fiberglass duct board.

But care must be taken to **not damage** fragile Flex ducting when cleaning.

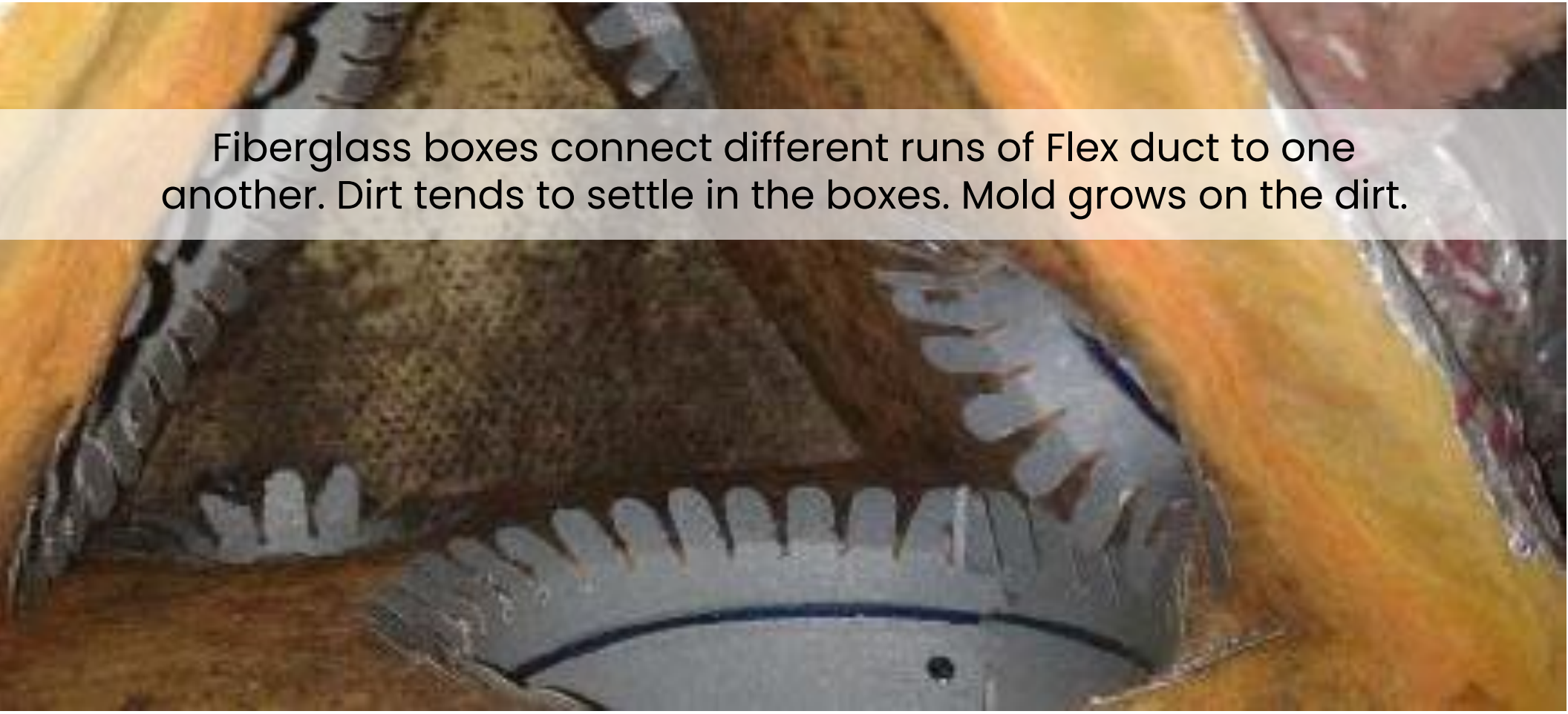
# Flex Duct: Fragile & Hard to Clean

- Even though Flex generally gets less dirty than ducts made from fiberboard, Flex duct will still need to be cleaned when sensitive people are involved.
- The rotating brushes used by duct cleaners to clean metal duct found in commercial buildings tear the fragile lining and cannot be used.
- Chemicals that keep on killing are generally sprayed inside Flex by duct cleaners. This is not an acceptable practice as sensitive occupants can become ill from these chemicals.
- THERE ARE NO CHEMICALS EPA-APPROVED FOR USE IN DUCTING.

# No Biocides Are EPA-Approved for Use Inside AC Ducting

- "The EPA is concerned that sanitizer, disinfectant and other antimicrobial products are being used to treat the surfaces of HVAC systems including, but not limited to, use as part of air duct cleaning." http://www2.epa.gov/pesticide-registration/prn-2006-draft-useantimicrobial-pesticide-products-heating-ventilation-air
- Duct cleaning companies commonly state that they are using EPA-registered products. But this has absolutely no meaning. Registered for what?
- There are **no biocides** (sanitizers, disinfectants, or other antimicrobial products) that are **EPA-approved** for use in air duct systems.

# Fiberglass Connection Boxes



Fiberglass boxes connect different runs of Flex duct to one another. Dirt tends to settle in the boxes. Mold grows on the dirt.

- Flex duct is connected by fiberglass connection boxes (triangle box here).
- Dirt and mold collect on the rough surfaces (interior sides/ bottom) of these boxes. **Never cleaned by duct cleaners.**

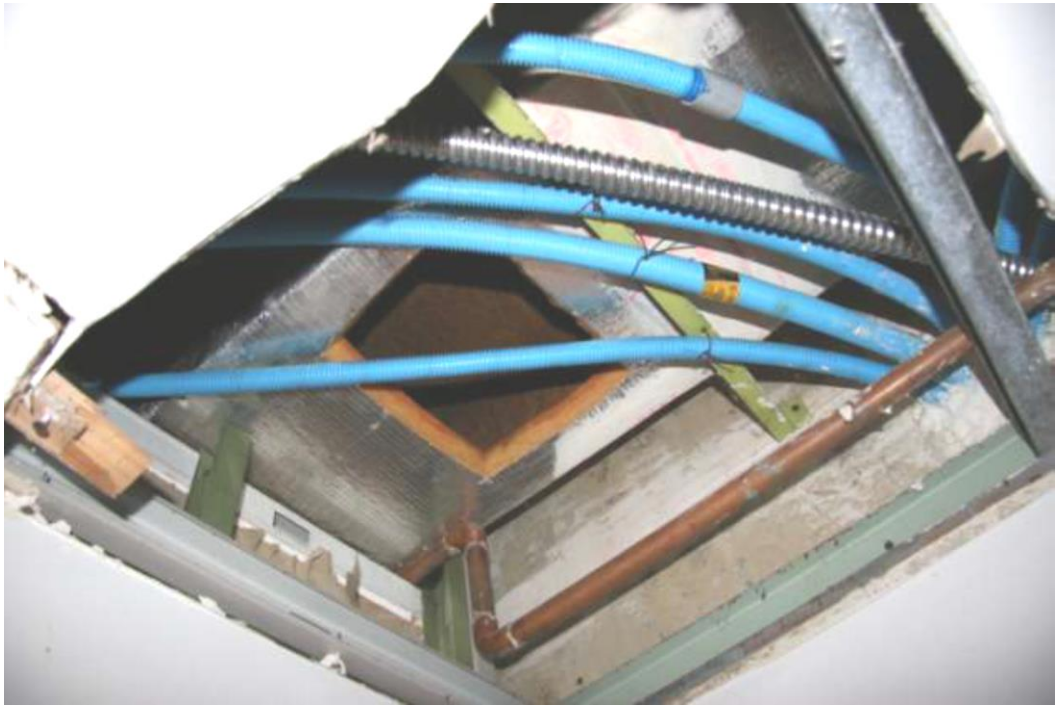
# Fiberglass Connection Boxes Can Be Hidden

- Different lengths of flex duct are connected by fiberglass connection boxes.
- In 2-story homes, one must **cut open the flooring on the 2nd floor** so ducting can be cleaned and sealed to "as new."
- **Never cleaned by duct cleaners.**

# Fiberglass Connection Boxes Can Be Hidden

- Or … in 2-story homes, one must **cut open the 1st floor ceiling** to get at the fiberglass connection boxes so they can be cleaned and sealed to "as new".
- **Never cleaned by duct cleaners.**

# Fiberglass Connection Boxes

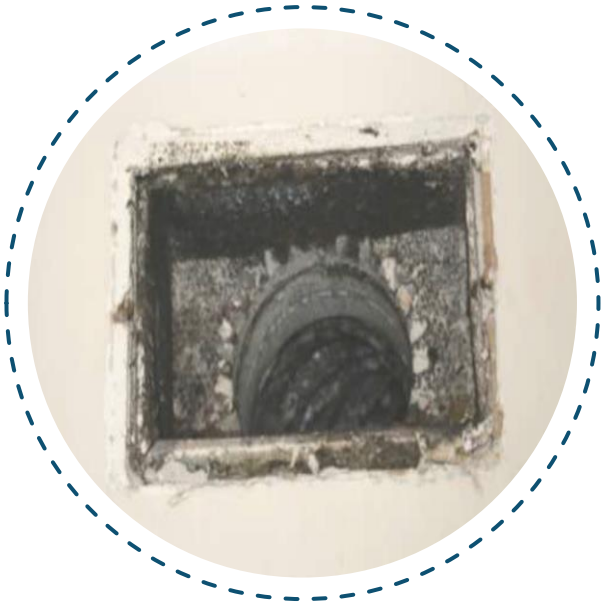


- In condos and apartments, ducting and connection boxes are hidden inside of drop ceilings and soffits that must be cut open to refurbish ducting.
- **Never cleaned by duct cleaners.**

**In Condos, ducting inside of soffits and drop ceilings is owned by and the responsibility of the Condo Association. But they will never actually properly clean.**

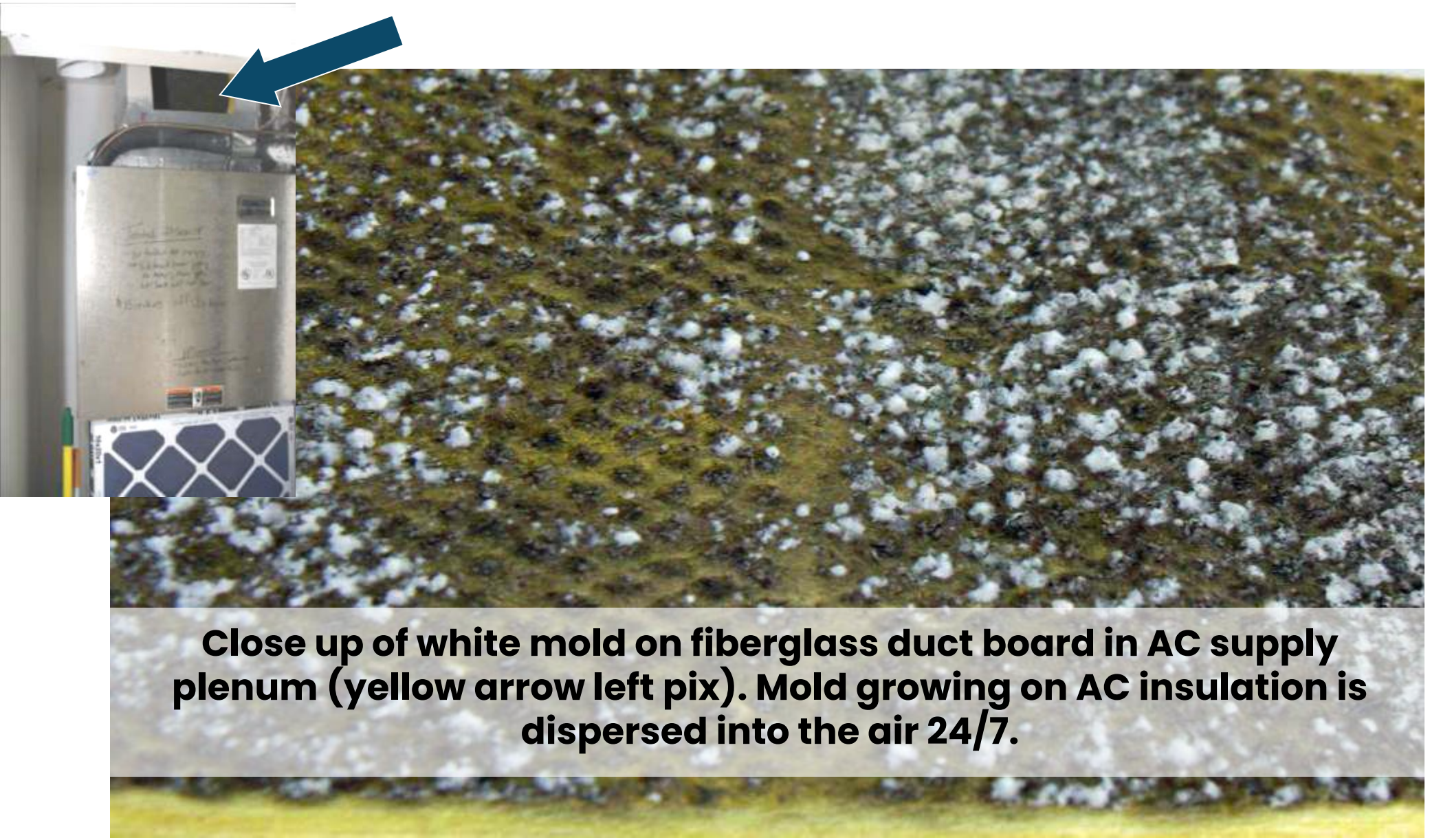
# Fiberglass Cans & Flex

***(Ducting Behind AC Supply Grills)***



- Generally, the box that the metal AC supply grills are connected to are also fiberglass-lined (whether ducting is duct board or Flex.)
- Generally, duct cleaners clean and paint this area, but that will leave ducting full of dirt & mold.

# Mold on Fiberglass-Lined Supply Plenum



**Close up of white mold on fiberglass duct board in AC supply plenum (yellow arrow left pix). Mold growing on AC insulation is dispersed into the air 24/7.**

# Open Return: Mold Under AC

Open Return: When the AC drain line clogs and the drain pan overflows mold will always result under the air handler unless quickly dried. Remove AC and water heater. Replace walls. Must use containment.
**Duct cleaners no use here.**

# Closed Return: Mold Hidden in Return Air Box

- For many AC units, the return air passes through the Return Air Box.
- When the AC leaks, there will always be mold hidden inside the Return Air Box.
- Remove return air box. Cannot be cleaned. Must use containment. Rebuild.


**Air duct cleaners are no use here.**

# AC System: Multi-Function

- When the AC coils aredirty, the AC does not cool well. It does not dehumidify well and spews out mold, mold fragments, bacteria and dust mite feces (dust mites feed on mold.)
- But when clean with a good air filter, central AC systems:

Cool

Dehumidify

Circulate & filter the air

**A clean AC system has tremendous health benefits; however, cleaning to "as new" can be a challenge.**

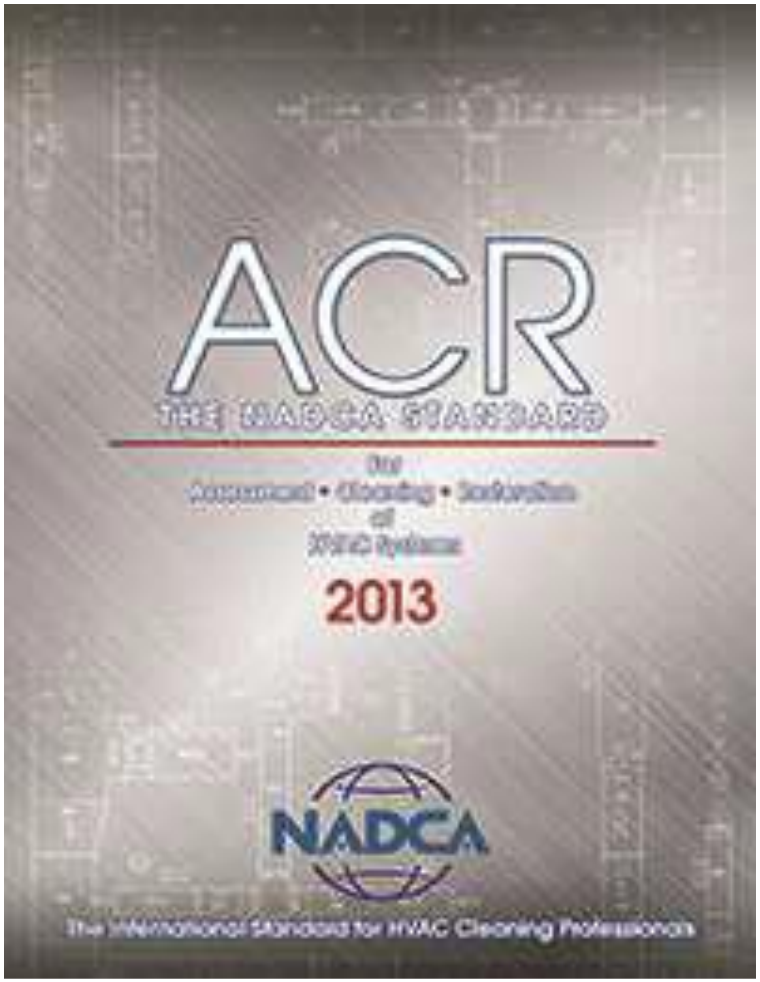
# AC System: Complex

- AC systems are complex. One must deal with the air handler, the oftentimes water-damaged AC closet, mold filled fiberglass plenums, and / or dirty ducting.
- The AC Supply plenum goes through the ceiling of the AC closet and is almost never replaced when new ACs are installed, as this requires drywall work which is never done by AC contractors.
- Ducting is often inaccessible in soffits, drop ceilings, or chases, and never properly cleaned or replaced, as this requires drywall work.
- Installing a new AC never fixes the problem as this does not deal with the ducting or plenums.

# NADCA

**National Association of Air Duct Cleaners.**

- NADCA has a specification as to how to properly clean ACs, ducting, and fiberglass connection boxes. It is called Assessment, Cleaning & Restoration of HVAC Systems.
- It states:
  - An air duct cleaner alone cannot clean an AC system. Requires a licensed AC contractor to disassemble the air handler.
  - If there is mold found, neither an air duct cleaner nor AC contractor can do the cleaning which is now called mold remediation. And there's always mold!




**Is it any wonder why there are so many mold-contaminated AC systems?**

# Florida Subcontracting Law

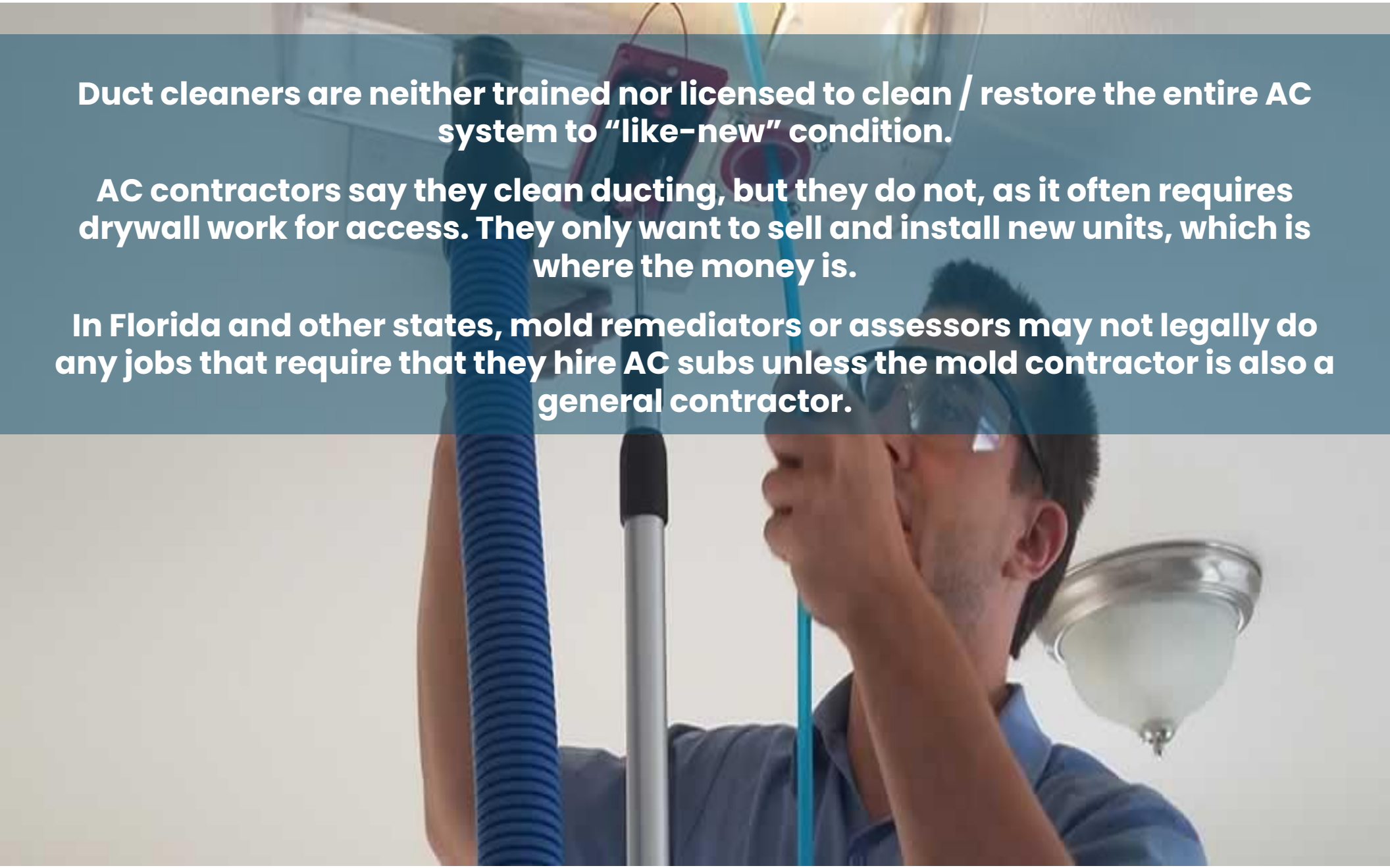
In Florida, a mold remediation contractor, unless they are also a general contractor, may not legally quote (or do a job) that requires any state-licensed subcontractor such as an AC contractor. To employ or quote jobs that require subs, one must be a general contractor.

In Florida, unless one is also a general contractor, a mold assessment contractor may not legally quote (or do an inspection) that requires a state-licensed AC subcontractor to disassemble an AC which is required for a thorough inspection.

Only general contractors can employ subcontractors. Mold contractors cannot.

**Is it any wonder why there are so many contaminated AC systems?**

# Air Duct Cleaning Will Not Clean the HVAC System



**Duct cleaners are neither trained nor licensed to clean / restore the entire AC system to "like-new" condition.**

**AC contractors say they clean ducting, but they do not, as it often requires drywall work for access. They only want to sell and install new units, which is where the money is.**

**In Florida and other states, mold remediators or assessors may not legally do any jobs that require that they hire AC subs unless the mold contractor is also a general contractor.**

# Mold Contractors Focus on Mold in Walls & Ceilings

Mold remediators and mold assessors are rarely trained or knowledgeable in dealing with mold in the AC and ducting. Why?

Because the $$ is in remediating walls and not recommending an AC contractor to replace the ducting.

**So, mold contractors always attribute mold related health problem to mold hidden in walls or ceilings rather than the AC system (Sad but true.)**

# Assemble a Team

**Mold Remediators must assemble a TEAM to do the mold assessment, AC/ducting cleaning, and remediation if it is to be done right.**

**Free training on how to do it right is available at:**

**FREE-MOLD-TRAINING.ORG**

This free mold training is approved Continuing Education for Florida Mold Contractors and provided as a public service by Gary Rosen, Ph.D. and Certified Mold Free Corp.

# CDC ON MOLD-RELATED IRRITATION

# CDC on Mold

Some people are sensitive to molds. For these people, molds can cause:

Nasal stuffiness

Coughing or wheezing

Throat irritation

Skin irritation (less common)

Eye irritation

http://www.cdc.gov/mold/dampness_facts.htm

# CDC on Mold

- "People with mold allergies may have more severe reactions.
- "Immune-compromised people and people with chronic lung illnesses, such as obstructive lung disease, may get serious infections in their lungs when they are exposed to mold."

http://www.cdc.gov/mold/dampness_facts.htm

# You Can Control Mold

- "If mold is growing in your home, you need to **clean up the mold** and **fix the moisture problem."**
- "Mold growth can be removed from hard surfaces with commercial products, soap and water, or a dilute **bleach solution** …"
- "If the area to be cleaned is more than 10 square feet, consult the EPA guide titled Mold Remediation in Schools and Commercial Buildings." [This is useful information for homes and multi-family buildings as well.]

# Cleaning / Removing Mold

- In our experience, mold can be cleaned off / removed from most surfaces (walls / ceilings) with bleach or Tilex® (which is 50% bleach) or 10% Hydrogen Peroxide.
- Concentrated Bleach and Peroxide are strong oxidizers. They remove mold (and removes all mold toxins and allergens) by oxidation (disintegration.)
- Soap and water (laundering) or dry cleaning is effective in cleaning most fabrics that do not have excessive mold growth.
- Lysol® (in a spray can) cleans mold off of furniture when you cannot use bleach/peroxide.

# CDC: Testing for Mold

- Current evidence indicates that allergies are the type of diseases most often associated with molds.
- Since the susceptibility of individuals can vary greatly ….

**"Mold sampling and culturing are not reliable in determining your health risk. (CDC)"**

# But … More Than Allergies

While respiratory problems such as allergies or allergy-like symptoms are the most common health problems from mold exposure…

The latest evidence links mold exposure to gut-related problems as well as other possible serious problems such as:

ADHD and Obesity.

# Health Concerns Regarding Mold

- Just as with allergies, the susceptibility of individuals to the affect of mold and mold toxins including gut-related and other serious problems can vary greatly; therefore:

**Mold air sampling is not reliable in determining your health risk. (CDC)**

# Sampling Does Have Its Place

While we agree with the CDC (and EPA) that testing for mold is not generally useful and resources are often best spent removing the mold, there are situations that call for mold testing in the hands of a mold professional:

*In real estate transactions* because earlier mold and water damage are often covered up/ painted over by sellers. Air sampling required.

*For medical or legal situations,* air sampling and especially DNA-based air sampling is required.

*Rental units.* Tenants may complain about mold-related illness or irritation. If there is visible mold problems, FIX. If not, it may be best to perform air sampling to rule out mold spores as the cause of illness / irritation.

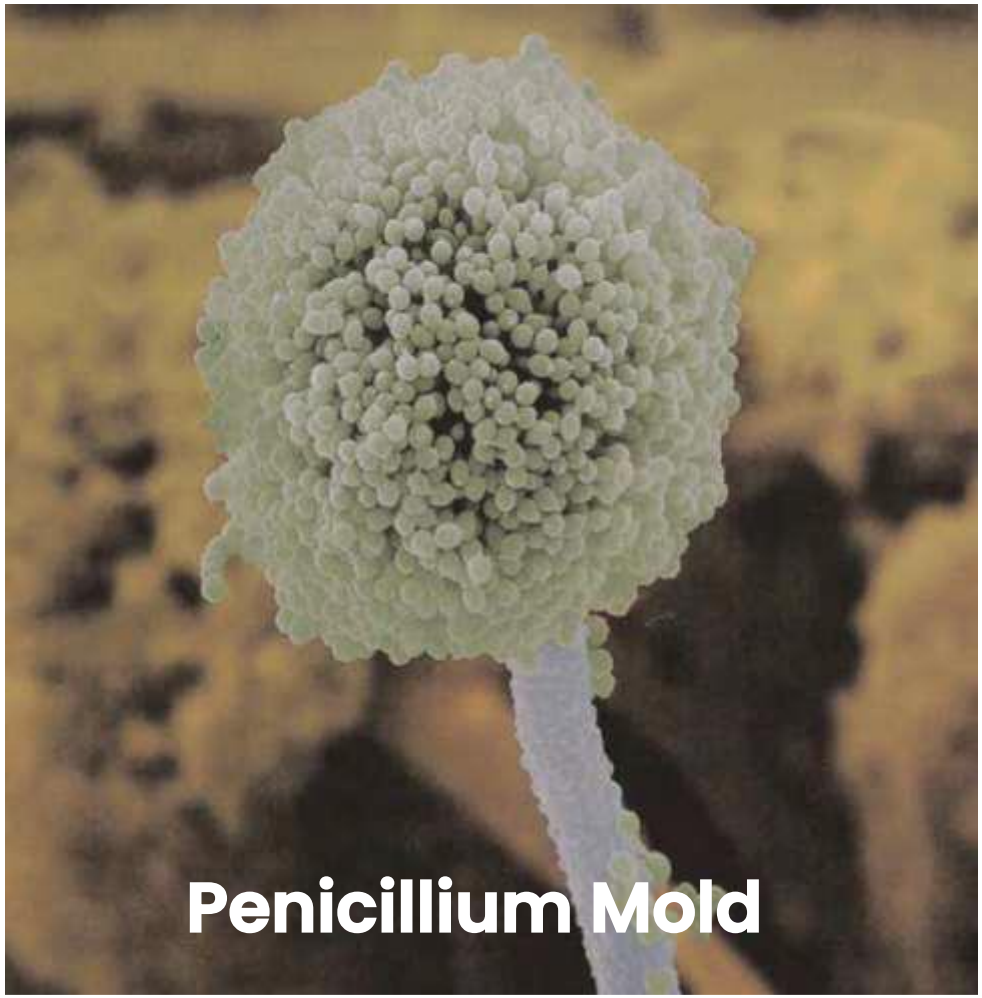
*Post remediation air sampling is always needed to document* that the environment has not been left contaminated as a result of improper use of environmental controls during mold remediation.

***Sampling Does Have Its Place but has Significant Limitations***


SEVERAL METHODS
FOR MOLD TESTING
ALL HAVE LIMITATIONS

# Viable Mold Spores

- Growing molds produce gases (moldy odors) and mold spores. Mold spores are the seeds molds produce so they can spread to new areas.
- Fresh spores are live /viable and when they land on a moist surface such as moist/ wet drywall, moist/wet fabric, or **sinus membrane** they attempt to germinate.

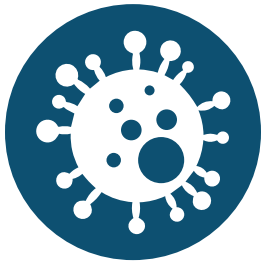


# Germination


- When the mold spore attempts to germinate it releases enzymes and other chemicals to digest the food source (sinus membrane, drywall etc.) so it can “put down roots”
- A healthy person fights off the mold and it does not germinate in their sinuses, but the process can result in a strong allergy-like reaction.

# Viable vs. Non-Viable

Mold spores when fresh are viable and capable of germinating but mold spores have a short life expectancy – they generally die (become non-viable) within a few weeks or months.



Mold spores found outside are generally dead. They cannot germinate in sinuses (or elsewhere). Mold spores found in the outside air are significantly less allergenic than fresh indoor spores.

All mold spores whether viable or non-viable can still cause adverse reactions when breathed in high quantities. Many mold spores contain toxins that are irritants whether the spore is dead or alive.

# The Most Common Forms of Mold Testing

- The most common forms of mold testing are spore trap air sampling and DNA (ERMI) testing. Neither distinguish viable from non-viable mold spores and as such will always over-estimate the allergenicity of mold counts.

- Spore trap air sampling uses a cartridge such as the Zefon Air-O-Cell on the right. The cartridge is attached to an air pump and air is pulled through the cartridge which contains a small microscope slide with a sticky gel on it.

- Mold spores (both dead and alive) are trapped in the gel and are categorized and counted by a lab technician using a high power (600X) microscope.

# Wall Cavity or Cabinet Checks

- In order to check inside of a wall or under a cabinet an extension is added to the spore trap cassette. These extensions can be purchased at: https://www.zefon.com/aoc-wall-sampling-adapter-starter-kit
- (We have no affiliation with Zefon.)

# Complex Spore Trap Results

## But what do you learn from such a complex report?

**Spore Trap ASSESSMENTReport** ™ **Air-O-Cell(™) Analysis of Fungal Spores & Particulates (Methods EMSL 05-TP-003, ASTM D7391)**

171500805-0002

**Client Sample ID**
21149873

**Location**
Kitchen

**Sample Volume (L)**
75

**Sample Type**
Inside

**Comments**

| Particle Identification | Raw Count | (Count/m³) | % of Total | Interpretation Guideline |
|---|---|---|---|---|
| Alternaria | - | - | - | |
| Ascospores | - | - | - | ☑ |
| Aspergillus/Penicillium | 150 | 6330 | 81.8 | ⊘ ✹ |
| Basidiospores | - | - | - | |
| Bipolaris++ | - | - | - | |
| Chaetomium | - | - | - | |
| Cladosporium | 34 | 1400 | 18.1 | ⊘ ✹ |
| Curvularia | - | - | - | ☑ |
| Epicoccum | - | - | - | |
| Fusarium | - | - | - | |
| Ganoderma | - | - | - | |
| Myxomycetes++ | - | - | - | |
| Pithomyces | 1* | 10* | 0.1 | ⚠ ▲ |
| Rust | - | - | - | ☑ |
| Scopulariopsis | - | - | - | |
| Stachybotrys | - | - | - | |
| Torula | - | - | - | |
| Ulocladium | - | - | - | |
| Unidentifiable Spores | - | - | - | |
| Zygomycetes | - | - | - | |
| **Total Fungi** | **185** | **7740** | **100** | ⊘ |
| Hyphal Fragment | - | - | - | ☑ |
| Insect Fragment | - | - | - | |
| Pollen | 1* | 10* | - | ☑ ▲ ✹ |

Analytical Sensitivity 600x: **42** counts/cubic meter
Analytical Sensitivity 300x *: **13*** counts/cubic meter

| | | |
|---|---|---|
| Skin Fragments: | **2** | 1 to 4 (low to high) |
| Fibrous Particulate: | **1** | 1 to 4 (low to high) |
| Background: | **2** | 1 to 4 (low to high); 5 (overloaded) |

No discernable field blank was submitted with this group of samples.

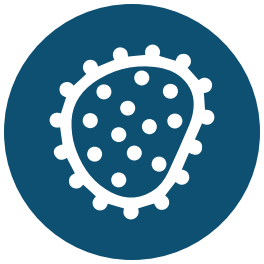
Bipolaris++ = Bipolaris/Drechslera/Exserohilum
Myxomycetes++ = Myxomycetes/Periconia/Smut

☑ Concentration at or below background
⚠ Concentration above background
⊘ Concentration 10X or more above background

▲ Not commonly found growing indoors, spores likely come from outside.
✹ Spores reported to be able to cause allergies in individuals.
☣ Potential for mycotoxin production exists with these fungi.
💧 These fungi are considered water damage indicators.

# Viable vs. Non-Viable

As discussed, spore traps cannot distinguish dead / old spores from live / fresh spores.



That's a big deal because only live / fresh spores can attempt to germinate in one's sinuses.

Even exposure to only a few live / fresh spores can result in strong allergy-like responses in sensitive individuals whereas exposure to even quite high levels of old / dead / non-viable (outside or inside) spores will not.

# No Genus & Species Info With Traps


- Spore trap lab results give you the genus of the mold spores present. For example: Aspergillus.
- But you do not know the species – what species of Aspergillus? Spore traps cannot provide this level of detail.
- Without knowing the species of the mold present, one cannot determine the type of allergens & toxins produced.
- Doctors often request this information in order to prescribe treatment.
- **But generally, we don't care what type of mold it is, just that it is gone.**

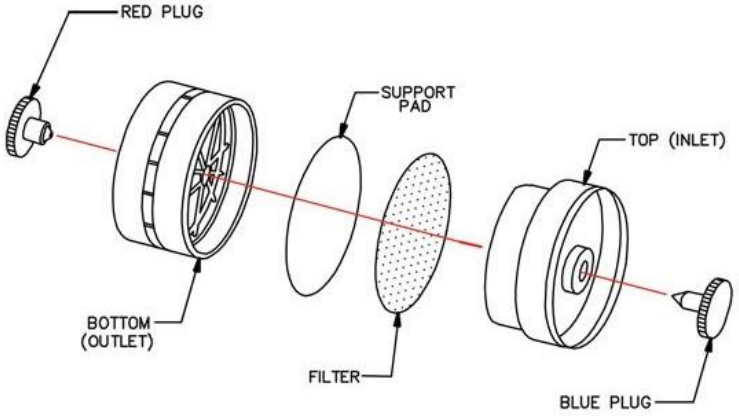
# What is Pen/Asp?

- Most of the common problem molds for allergic response are Penicillium and Aspergillus molds.
- Understand that when a spore trap result has a line item for Penicillium / Aspergillus, this may not even be Penicillium or Aspergillus spores.
- This category is just a catch all for small spores the size of Pen/Asp.

**Spore trap results can be useful in certain situations, but what do they mean?**

# DNA / ERMI Testing

- The 2nd most popular form of mold sampling (after spore traps) collects surface dust and /or air samples that are then analyzed by DNA profiling. The technique was developed by the U.S. EPA and is called ERMI: Environmental Relative Moldiness Index.
- For DNA-based air sampling mold professionals use a Zefon 37mm Air Sampling Cassette w/ MCE Filters (designed to meet all applicable NIOSH, OSHA and EPA air sampling standards).



# DNA / ERMI Test Results

- ERMI / DNA testing provide both genus and species of the mold spores found. This is useful in some medical situations, but generally we don't care what type of mold it is, just that it is gone.

## Analysis Report by Real Time PCR

| Location | Canyon Lakes |
|---|---|
| | Spores E./mg |
| Fungal ID/Sample ID | HC-XXXX |
| Aspergillus penicillioides | 800 |
| Aspergillus versicolor | 50 |
| Chaetomium globosum | 170 |
| Stachybotrys chartarum | ND |
| Wallemia sebi | 300 |

# Indoor vs. Outdoor

These two forms of mold testing (spore traps and DNA / ERMI) do not distinguish viable from non-viable mold spores. Again, this is a big deal.

Ever wonder way a mold sensitive person will be fine outside even with super high spore counts but ill indoor when the spore count is much lower?

The outside spores are almost all dead whereas the indoor spores are mostly fresh / viable if there are coming from contaminated ducting. **A very low ratio of indoor to outdoor spores can dramatically underestimate exposure to allergenic (live) mold.**

# The Most Common Forms of Mold Testing: Not Reliable

- It is no wonder that the CDC concludes that spore trap air sampling is not reliable in determining health effects from mold exposure.
- As well, the Inspector General has issued a statement that the DNA testing (ERMI/HERTSM-2) technology developed by the EPA should be considered only as a research tool and is not recommended for consumer use.
- For a detailed treatment of the problems with ERMI see: Is ERMI Testing Being Used for Its Intended Purposes? (at www.Mold-Toxins.com)

**The Two Most Common Forms of Mold Testing: Not Reliable**

# Viable Spore Testing

- The 3rd method of mold spore testing is culture testing. It is rarely used by mold assessors but we like it. We use it.
- For this method, mold spore air samples are cultured in a petri dish. Only viable spores grow / are counted.
- But many factors affect the germination of spores in culture media.

# Many Factors Affect Germination

- Some species of mold take a few days to germinate. Others take 7-14 days and will always be missed by viable testing that has a 5 - 7 day turn around time.
- Some species of spores, to germinate, need fairly dry conditions. Some need wet conditions. Not all culture media have the appropriate moisture content and not all spores will grow.
- Temperature also affects mold growth.
- Different molds grow on different substrates: wood; drywall; fabric; etc. And the culture medium used by the lab to grow the mold will grow only a subset of the molds in the air because many do not grow well on the specific culture medium. As a result …
- **Culture testing will always underestimate the types and amounts of viable molds.**
- **But knowing how fresh/viable the mold is can be very useful because viability is an important factor in allegenicity.**

# Many Benefits of Culture Testing

Spore traps do not allow one to determine the genus and species of molds. (i.e. Aspergillus versicolor). Without knowing the genus and species, one cannot know if the mold is a toxin producer. Cannot distinguish dead or alive.

DNA / ERMI testing will provide genus and species of molds, but is limited to only 36 molds. Cannot distinguish dead from alive.

Culture methods have no such limitations. So, there is a place for culture testing to complement DNA / ERMI and spore trap testing.

# Summary on Mold Testing

- To thoroughly test a home will require multiple forms of testing. Typically, this means numerous spore traps throughout the home; one or two DNA samples; and one or more viable samples.
- The cost to thoroughly test a home for health problems we have found can be more than the cost to remediate.
- Therefore, except for special situations, more than limited mold testing is not typically recommended.
- The focus of a mold inspection / assessment is visual methods.


VISUAL INSPECTION FOR
HIDDEN MOLD IN THE AC
& DUCTING

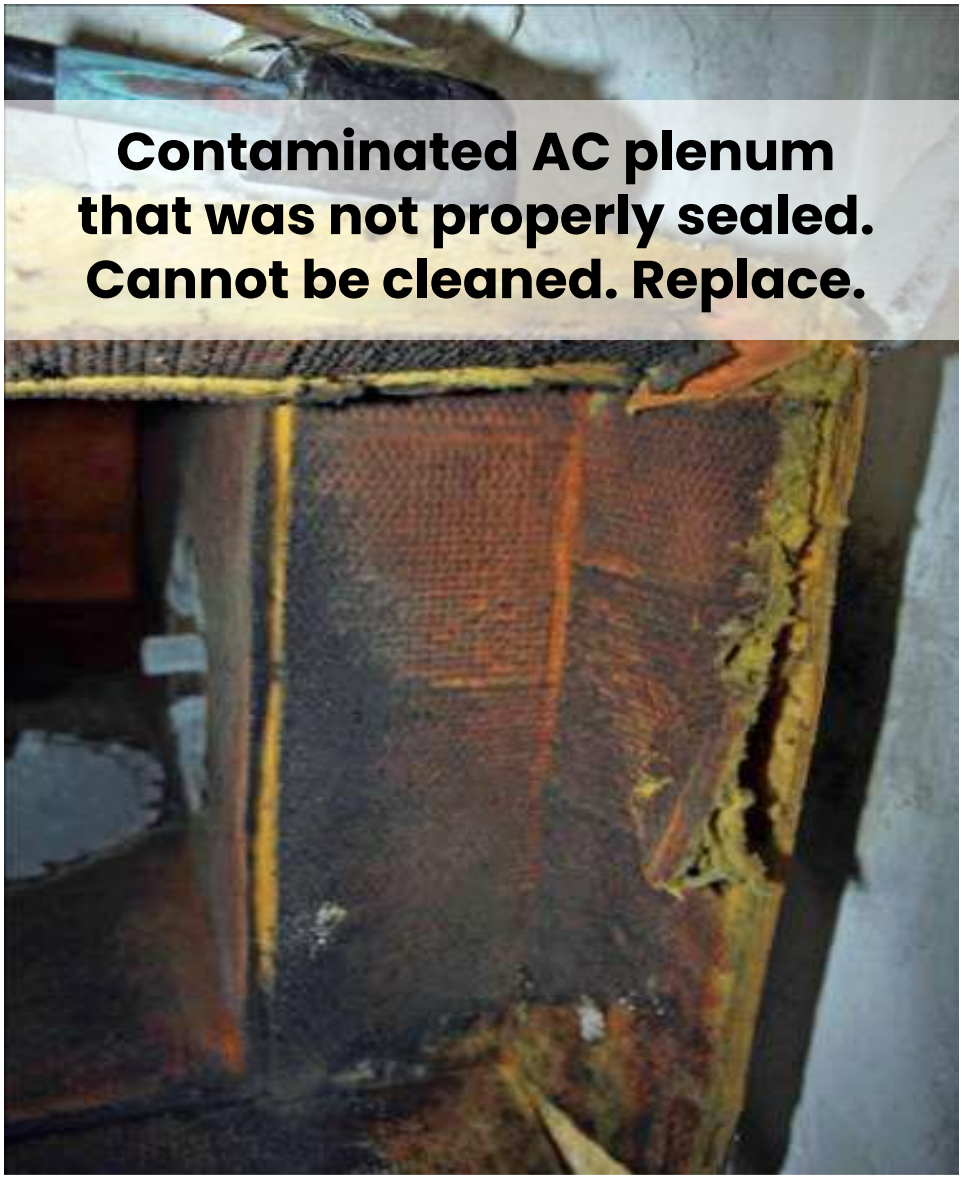
# Finding Mold Hidden in AC and / or Ducting

- The only reliable way to determine if there is mold contamination in AC or AC ducting is by visual inspection. Not by testing. Which means taking things apart.
- Once the AC is open and the plenums are accessible, the general comment by the AC contractor is: “I’ve seen worse.”
- If they determine there is mold, neither their insurance nor their license allows them to clean the coils (remediate the mold).

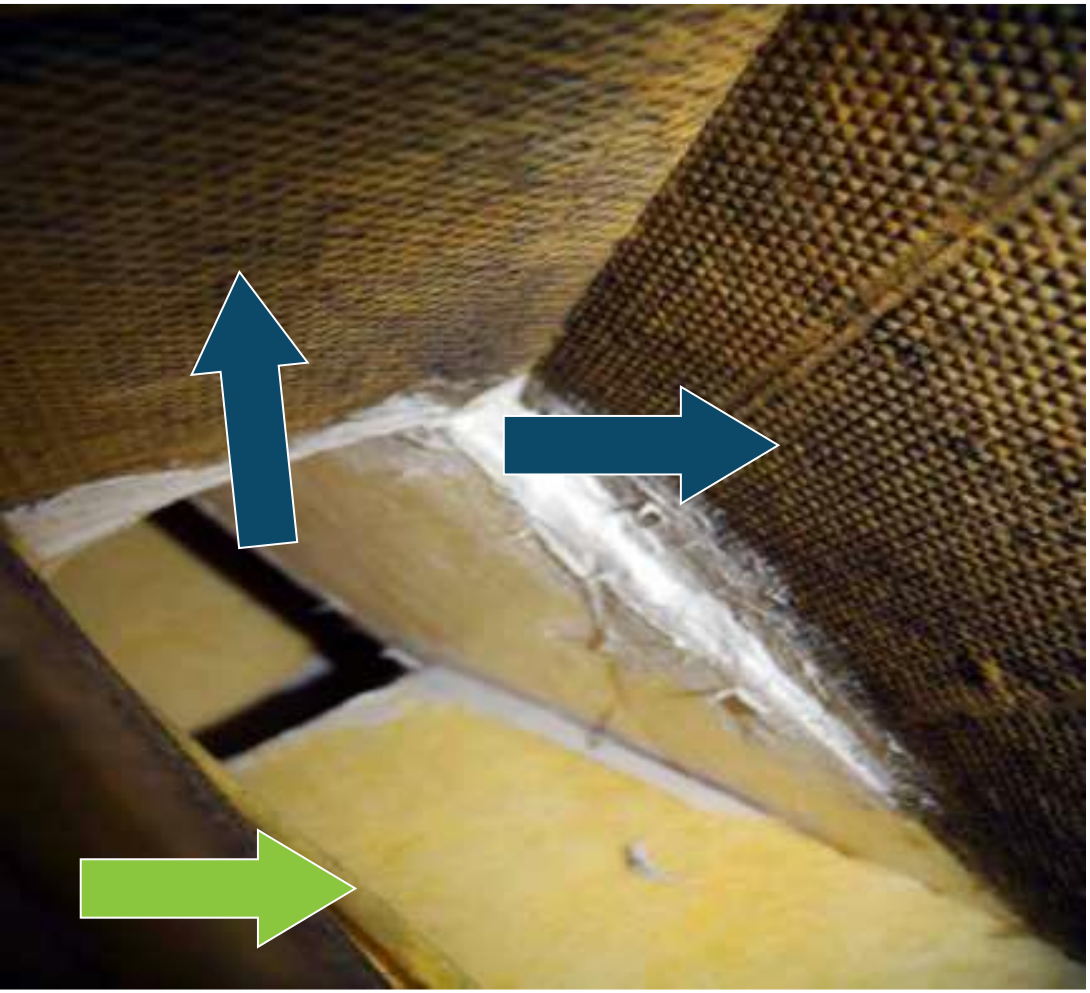
**No wonder AC contractors don’t find mold in ACs and ducting.**

# Fiberglass Lined Supply Plenums

- The fiberglass-lined supply plenum connects the Air Handler to the ducting. The rough fiberglass lining collects dust and mold.
- Most of the time when there are sick or irritated occupants, the problem is with a mold contaminated supply plenum.
- Note: When a new AC is installed, the old supply plenum is almost never changed or cleaned.



# Mold on Fiberglass Lined Supply Plenum



- New (yellow color) duct board (green arrow) was installed with the new air handler.
- But most of the original (dark colored) fiberglass plenum material remains in place and is covered with mold and dirt. (blue arrows.)
- This area is not accessible to air duct cleaners. And it is rarely addressed by AC contractors because it extends from the top of the air handler through the AC closet ceiling and therefore is not easily replaced.
- So they don't replace it.

# Mold in AC Closet

If there is even small amounts of mold in a previously water damaged AC closet …

- Mold will be pulled up into the AC system and disbursed throughout the occupied space and irritate sensitive people.
- Careful visual inspection for mold in the AC closet and / or defects in the AC closet allowing attic air into the AC closet are critical.
- No amount of air testing will find defects in the AC closet, and such defects will always irritate mold-sensitive occupants.

# Checking for Mold in the AC

- A musty odor coming from the AC ducting is a reliable indicator of mold problems in the AC, plenum or ducting. But it does not tell you where the problem is in the AC system or the extent of the problem.

**The only completely reliable way to determine…**

If there is a mold contamination.

Where it is: AC coils, blower, lining or AC ducting.

And how extensive the problem is.

**… is by visual inspection that requires AC disassembly.**

**At which point one is usually better off doing the cleaning instead of just inspecting!**

# HIDDEN MOLD IN AC & DUCTING.

# HOW TO RENOVATE TO LIKE NEW.

# CDC on Cleaning AC/Ducting

- The CDC has provided advice for AC and duct cleaning.
- "After cleaning all surfaces both inside the air handler and the interior lining of the ducting and plenums **sanitize these surfaces with a bleach solution** (strong peroxide also works well.)"

- This is a good idea but better yet (after sanitizing) is to then seal the surfaces with a mold inhibiting encapsulant such as DP2545 so the problem does not come back.
- (Note: We have no affiliation with Design Polymerics.)

# Cleaning Fiberglass-Lined Ducting & Plenums

- Fiberglass-lined ducting and plenums can be cut open, **cleaned**, and then sealed.

# Sealing Fiberglass-Lined Ducting & Plenums

- Fiberglass-lined ducting and plenums can be cut open, cleaned, and then **sealed**.

# Sealing Fiberglass Lined Ducting

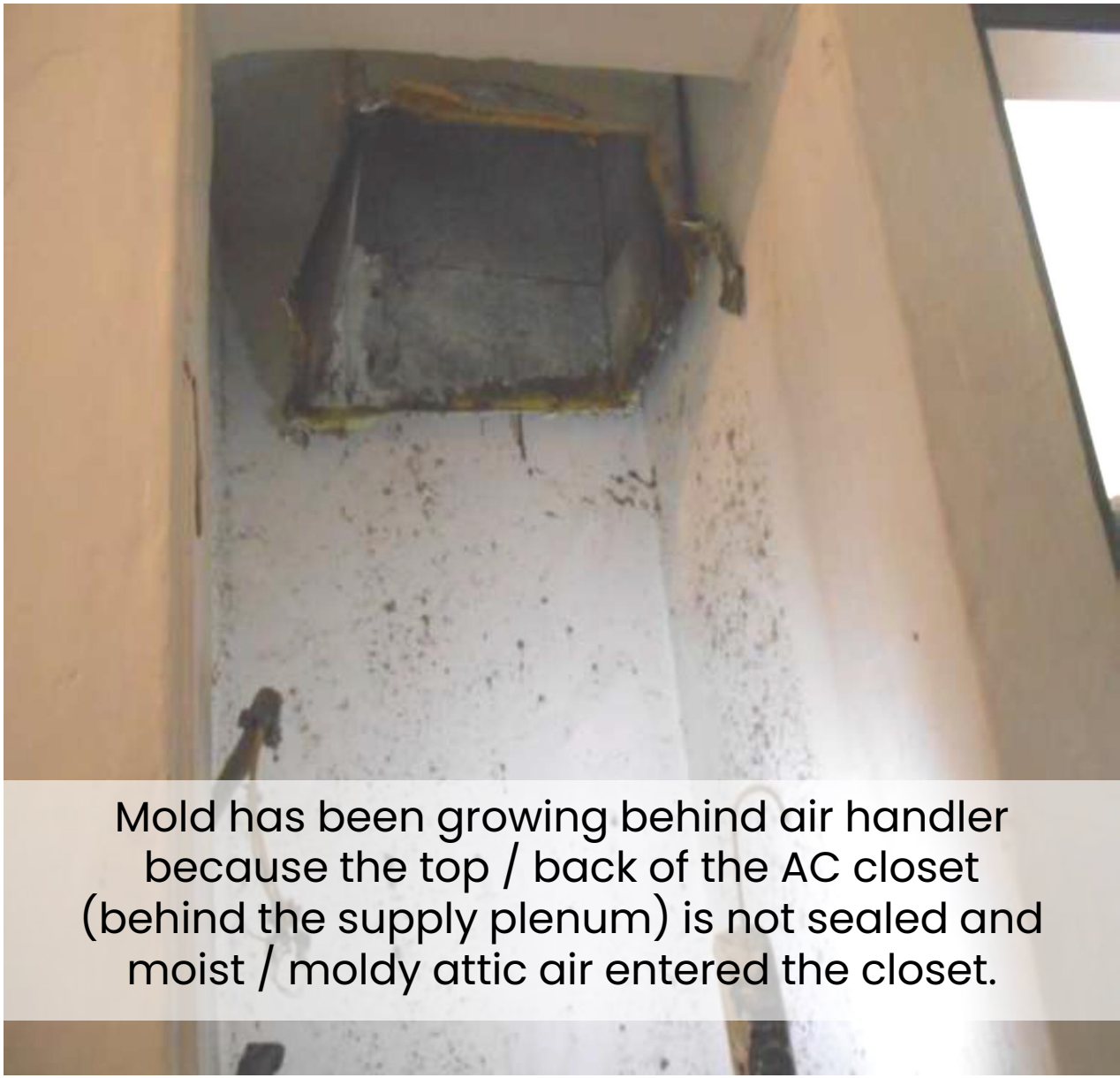
- Fiberglass-lined ducting and plenums can be cut open, cleaned, and **sealed** so they have a **smooth surface**. Now "better than new."

Sealed with Design Polymerics 2545*. Sealer contains mold inhibitor and results in a smooth non-stick lining that stays clean for many years compared to the rough, unsealed fiberglass.

- http://designpoly.com/wp-content/uploads/INDOOR_AIR/DP2545/DP2540-2545tsb.pdf

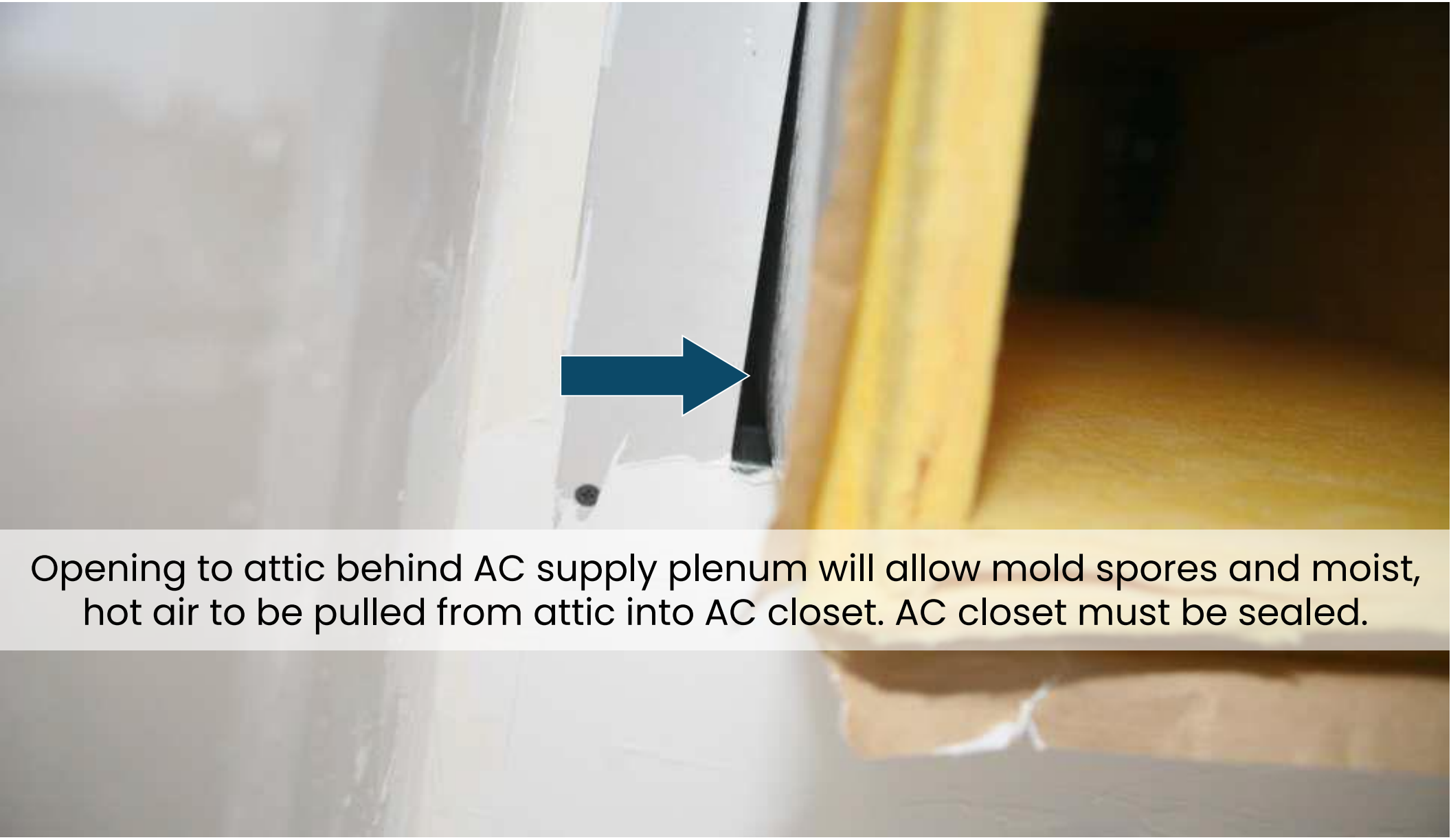
# Defect in AC Closet

- The AC closet is rarely properly sealed.
- Moist, dirty attic or wall cavity air can enter the closet and mix with cool indoor air.
- Result = Mold



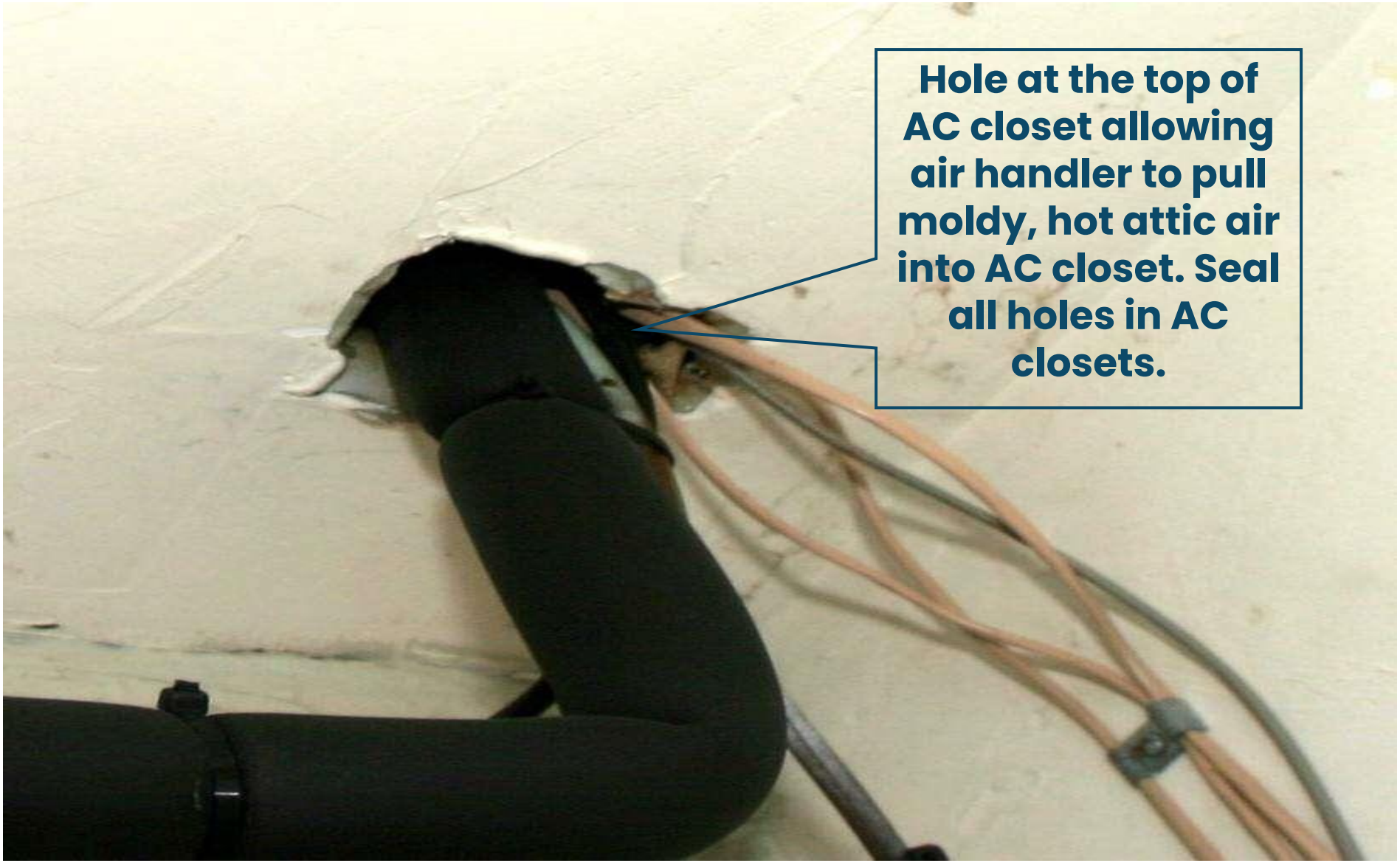
Mold has been growing behind air handler because the top / back of the AC closet (behind the supply plenum) is not sealed and moist / moldy attic air entered the closet.

# Seal AC Closets Behind Supply Plenum

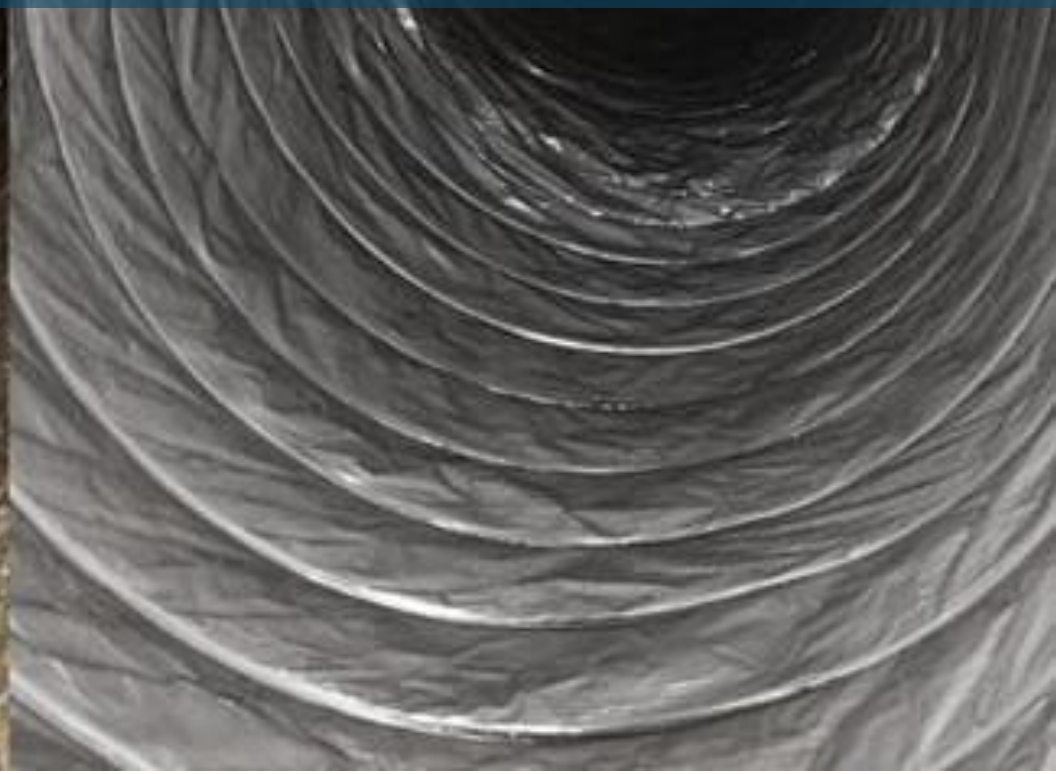


Opening to attic behind AC supply plenum will allow mold spores and moist, hot air to be pulled from attic into AC closet. AC closet must be sealed.

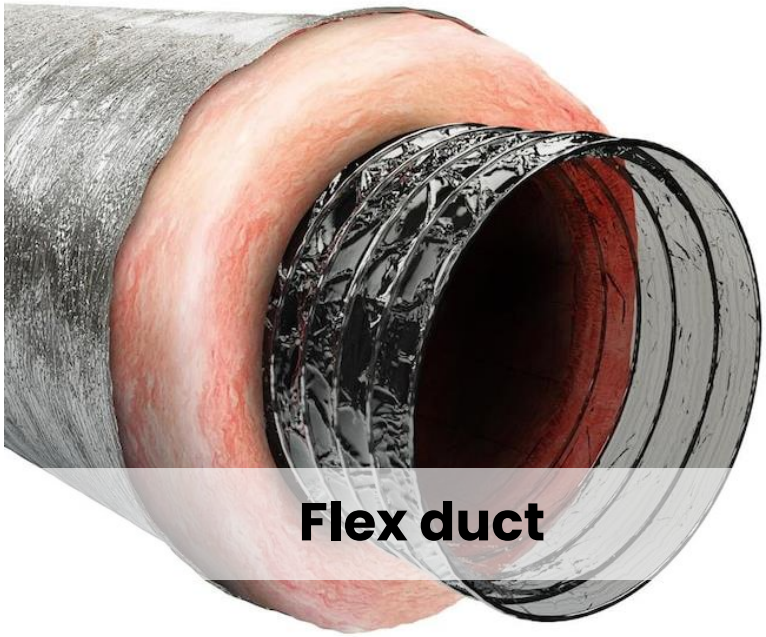
# Seal AC Closets Around Pipes



# CLEANING / REFURBISHING FLEX DUCTING



# Cleaning Flex Duct – WARNING



**Flex duct**

Air ducts are typically flex duct that has a thin and very fragile plastic lining.

The lining cannot be cleaned using the rotating brushes that duct cleaners use for metal lined duct because the brushes damage the fragile lining, causing tears and leaks, leaving you with even bigger problems.

# Cleaning Flex Duct -WARNING

For these types of ducts, “duct cleaning” by most duct cleaners is typically vacuuming out the supply registers (good idea) and then spraying chemicals inside the ducting (bad idea).

Any chemical (biocide) that advertises “keeps on killing” leaves a chemical residue that often makes sensitive people sick.

That’s why the CDC recommends sanitizing cleaned ductwork with bleach. Bleach kills and disintegrates the mold and then quickly breaks down to salt and water leaving no chemical residue that can irritate sensitive occupants.

# First Clean. Then Sanitize

- To properly clean fragile flexible air duct one cannot use the rotating brushes shown on TV that clean metal commercial ducting.
- Special “air wisk” types of products shown on the right must be used.

- Connected to high-capacity air compressors, these wisks crawl through the ducting and agitate the air inside the ducts. Using a strong vacuum, one then removes the loose, now airborne, dust.
- See http://www.air-care.com/product/fg0030

# First Clean. Then Sanitize

- Once the flex duct has been cleaned of dust / mold.
- Fog the ducting with strong bleach or peroxide to sanitize. No Biocides.
- With the air handler removed, apply negative air to the air ducts and then fog from the grills or from the open distribution boxes in the attic (as shown).

# WRAP UP

# What You Should Now Know

- Proper remediation, when mold sensitive people are involved, makes sure that the air handler, plenums and ducting are all clean even if the HVAC and components are not in the original remediation scope of work. This is often more important than the original remediation scope of work.
- AC closets must be properly sealed so that moist / dirty attic or wall cavity air (mold, dust, bacteria, rat & roach feces, insect parts, pesticides) are not pulled into the air handler and spread throughout the home.
- A quality (Merv rated 11 or better) air filter in the air handler can significantly improve indoor air quality once the AC and ducting are clean. This will also keep the cleaned AC and ducting clean for many years.
- But if there is mold in the AC, ducting or plenum, these areas are downstream of the air filter. The good filter cannot help with toxins, allergens, inflammagens released by dirty AC / ducting.

# What You Should Now Know

- Rarely are AC contractors knowledgeable about properly dealing with mold contaminated ACs and ductwork.
- And mold remediation or mold assessment contractors are usually not trained to either inspect or know what is involved in having an AC contractor remediate air handlers or ducting.
- As a result, mold in these crucial areas is **almost always overlooked.**

# Mold Assessors Assemble a TEAM

**Mold Assessors must assemble a team to do the AC assessment, cleaning and remediation if it is to be done right.**

**Free training on how to do it right is available at:**

**FREE-MOLD-TRAINING.ORG**

This free mold training is approved Continuing Education for Florida Mold Contractors and provided as a public service by Gary Rosen, Ph.D. and Certified Mold & Allergen Free Corp.

# For More Information on Mold & Health

## See us at:

## www.Mold-Free.org

# References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2. See Mold Toxins & Related Illness – Cause & Effect at www.Mold-Toxins.com
3. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3448089/ Diet-Induced Dysbiosis of the Intestinal Microbiota and the Effects on Immunity and Disease
4. http://www.cdc.gov/niosh/topics/emres/Cleaning-Flood-HVAC.html