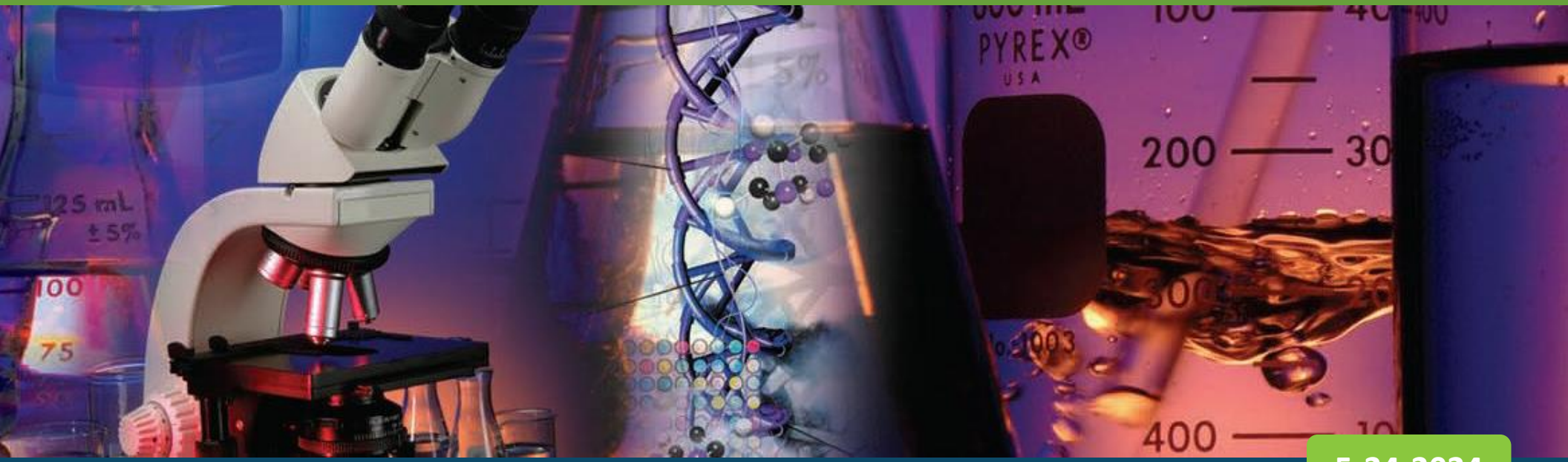
Report Writing



5-24-2024

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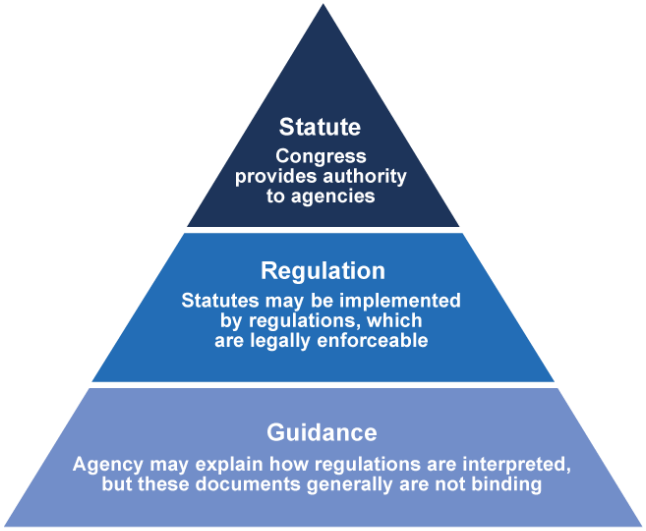
NAERMC
National Association of Environmentally Responsible Mold Contractors

ELEVATED OR NOT ELEVATED

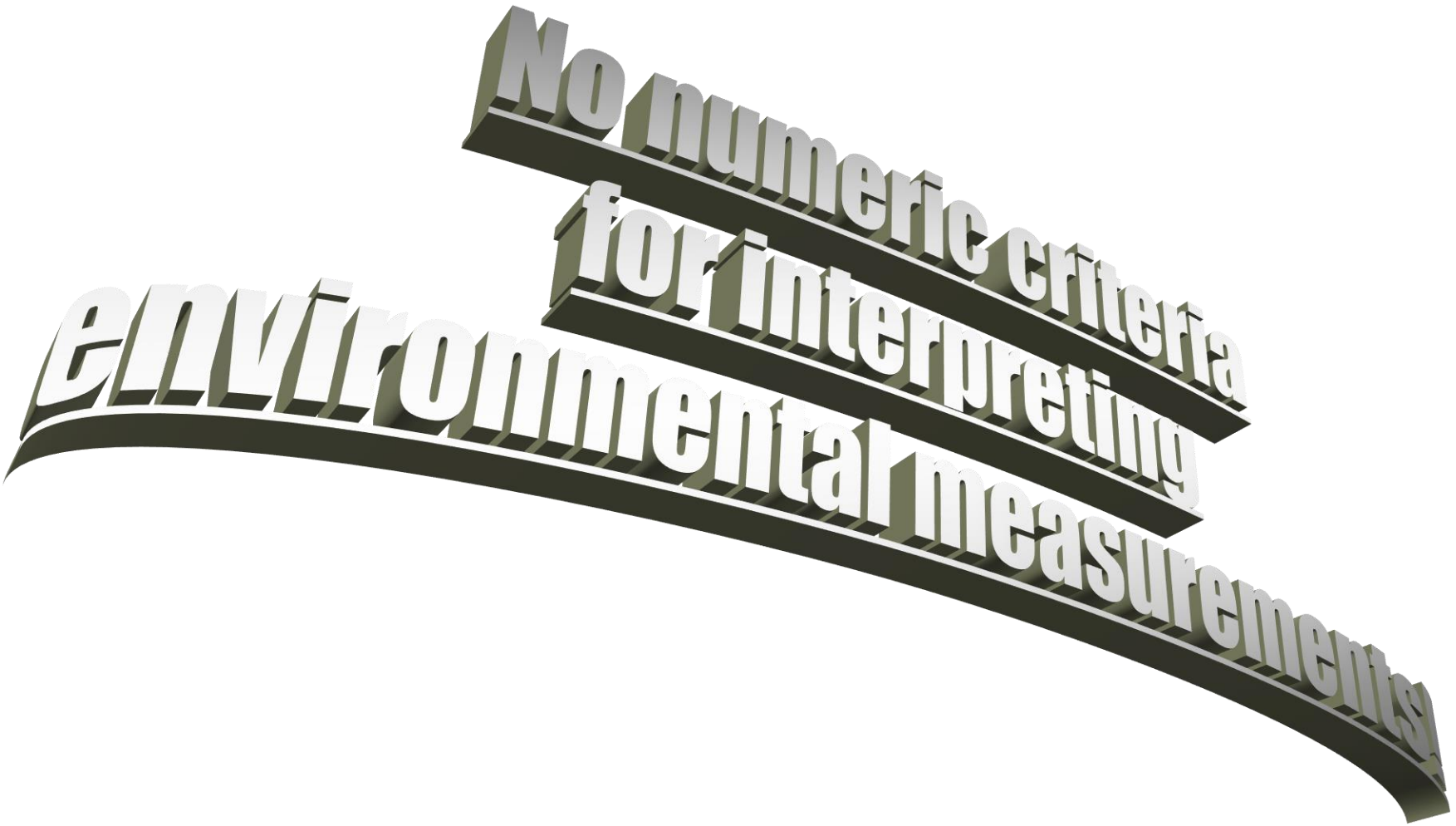
Elevated or Not Elevated. No State of Federal Guidelines

- Air contains a varying mix of mold spores.
  - Not a single entity. Many species.
  - Some dead. Some alive/viable.
  - Interpretation can be complex.
- Human sensitivity and response vary greatly.
- There are NO Federal or State guidelines (numeric criteria) as to what a safe or acceptable level of mold in the indoor air is.
- NO Federal or State guidelines as to what **Elevated or Not Elevated** levels of airborne mold means.
- **Mold is everywhere. Both inside and outside. How do you determine that there is a mold problem?**



Source: GAO analysis of regulatory authority | GAO-18-436T

No Numeric Criteria For Interpreting Mold Results



Best To Keep Testing Prices Low And Recommend Many Tests

- We recommend that you take more tests rather than fewer tests.
- Keep the per unit pricing for samples low.
- The more testing the merrier in terms of helping to find mold problems and protecting you from liability.
- If a spore trap sample costs $25 and you charge $75 you make $50 per sample.
- If you take 5 samples at $75 each you make $250 (rather than 2 samples at $100 each) you come out nicely and don't break the bank.
- You can't effectively test a home taking only 1-2 air samples!

Why Not Suggest …

- Why not suggest:
  - One air sample for every 1000 sq ft of the home.
  - Plus one sample under the kitchen cabinets.
  - One outside control.
- For a typical 3000 sq ft home that is **a minimum of 5 air samples.**
- Do you ever need to take a swab? What does that prove? That obvious mold is mold?
- We suggest replacing the surface sample with an air sample. *(Note: For an insurance claim inspection we always take a surface sample of obvious mold proving mold is mold to assure the need for mold remediation. And we take no initial air samples.)*

AIR & SURFACE SAMPLING FOR TOTAL SPORES (BOTH DEAD AND ALIVE.)

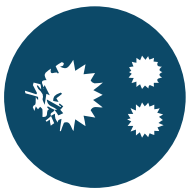
Spore Traps Test for Total Spores. Both Dead and Live/Viable.

Molds reproduce by producing mold spores. Spores are tiny (2-10 micron in diameter).

Spores can be fresh/live (viable) and ready to germinate (start to grow) once they land on a wet food source such as wet drywall or cabinets or moist dust on furniture, baseboards or doors.

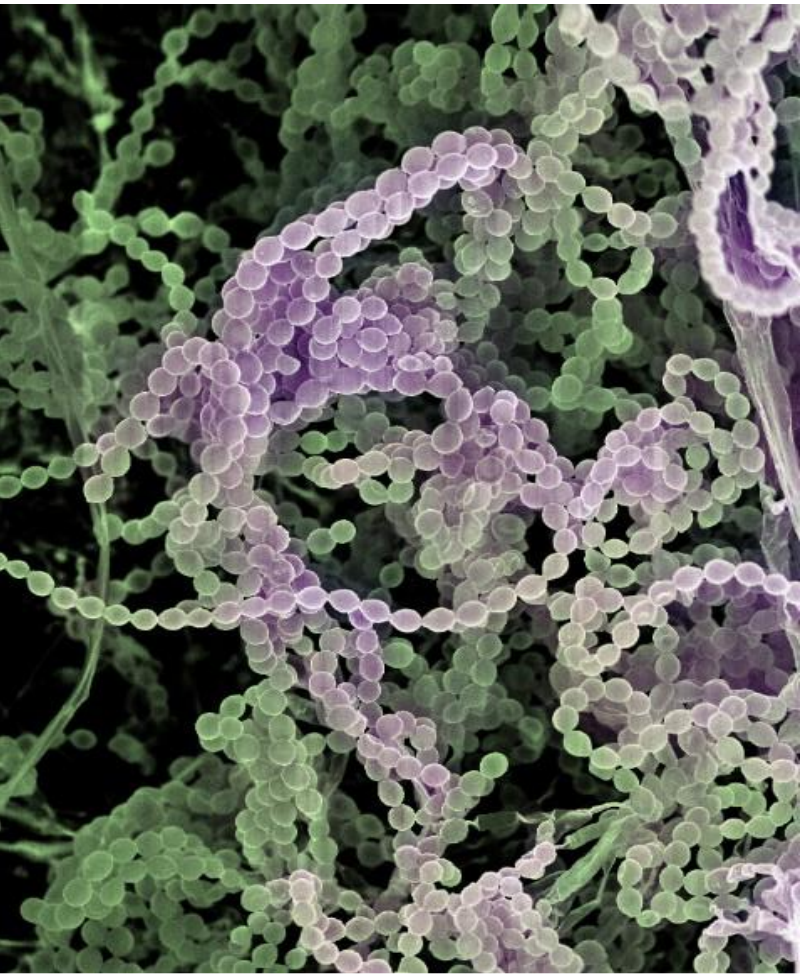
Or they can be old/dead (non-viable.)

Both live and dead spores can produce irritation and potentially illness.



Spore trap air testing, tests for both viable and not viable (total) spores in the air.

Mold Spores: Dry Molds. Adapted For Air Dispersal



- **Dry Molds** produce, hydrophobic (dry) light weight small spores that are adapted for wind dispersal and may remain airborne for long periods of time. Found both in the air and settled dust.
- These are “thin skinned” light colored, fragile spores that typically have limited life spans and are easily damaged by UV light in the outside air.
- Penicillium and Aspergillus are examples of these types of molds.

Dry molds grow fast and with minimal water.

Mold Spores: Wet Molds

- **Wet Molds** spores are bigger/ heavier, have slimy/wet sheaths. Found in soils, dirt, house dusts. **Rarely found in the air.**
- They are more suited to dispersal when a home or office is flooded.
- In some, the cell walls are thick and darkly pigmented, providing resistance to damage by UV radiation and they have long life spans.
- Stachybotrys shown on the right is an example of a thick skinned, wet mold, black in color, with spores that can remain viable for decades.

Wet molds require a great deal of water vs dry molds in order to grow. They grow slower than Pen/Asp molds.

Outdoor Spores

Basidiospores								
Penicillium Aspergillus	27	601	100	22	490	38	846	91
Smuts,myxomycetes						4	89	9
Unidentified Spores								

- Basidiospores, smuts, myxomycetes (slime molds), rusts are all from the outside air. They do not grow inside.
- If these are found in significant concentrations in the indoor air, then a door or window was open.
- Or there was no or a poor quality air filter in the AC.
- Or the house was dirty.

Slime Mold

Spore Trap Testing

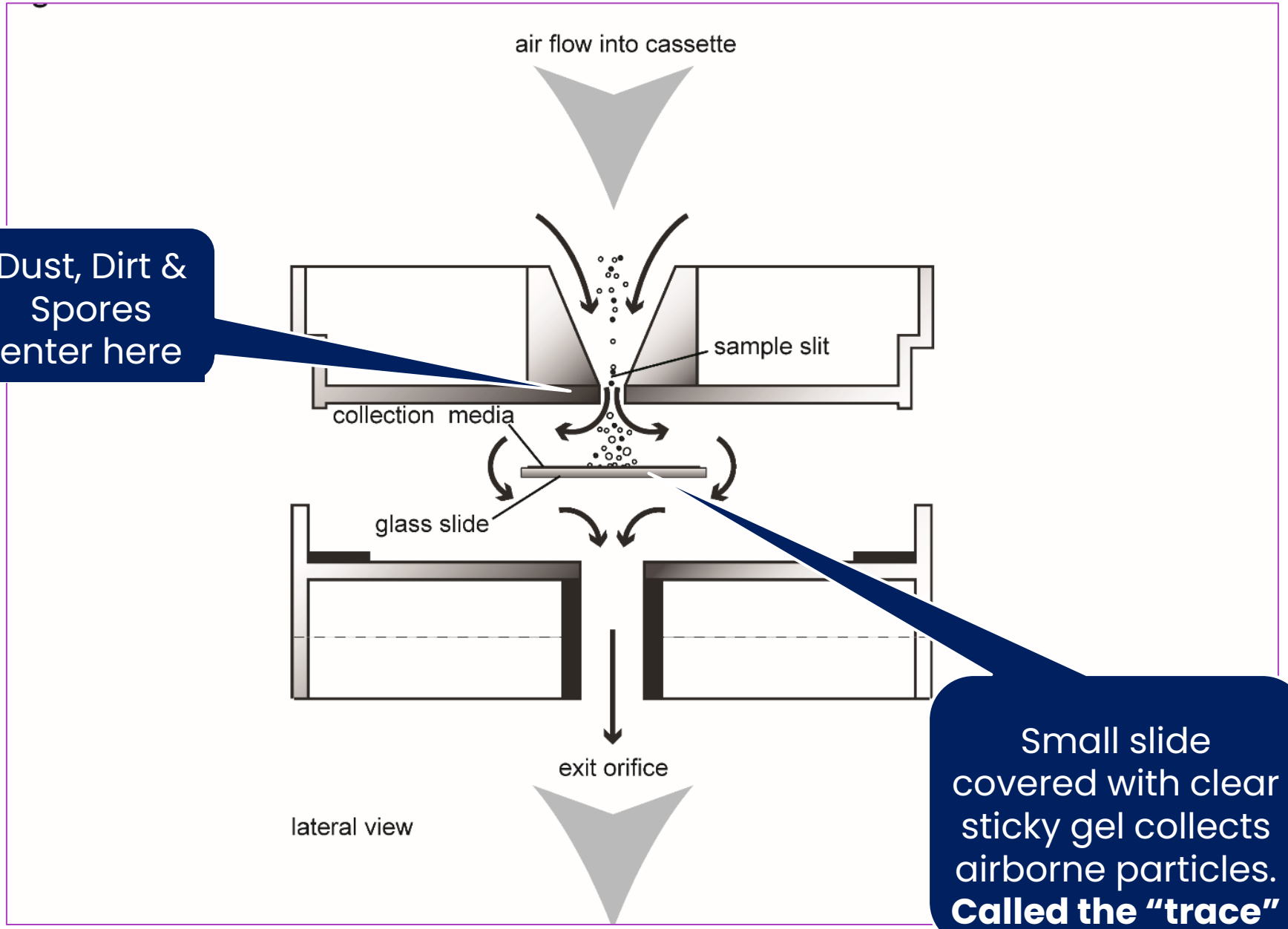
- The types and amounts of mold spores in the air are determined by taking air samples.
- Mold assessors test for “total” airborne spores (live and dead) using spore traps (air sampling cassettes e.g. Air-O-Cell; Pro15; Allergenco.
- Spores can be released as single spores or as a clump of spores making interpreting air sampling a bit tricky.
- **Since spore testing cannot distinguish live/fresh/new spores from old dead spores, it does not distinguish whether spores are from an actual/ recent water event/leak or are old/ background spores.**

15 lpm air sampling cartridge/cassette.

Spore Trap Testing

- Spore trap sampling collects mold spores from the air onto small sticky microscope slides inside the air sampling cassette.
- The slides are removed at the lab and analyzed by Direct Microscopic Examination (DME).
- DME cannot distinguish dead from live spores. Cannot distinguish new fresh spores from old/background spores.

AOC/Pro15 Principal of Operation



Spore Trap Sampling – Distinguishing Spores

- The lab removes the micro-slide and then, using Direct Microscopic Examination (DME), identifies and counts the different kinds of (live and dead) mold spores based on:
  - The unique characteristics of the spore surface
  - Size, shape and color of the spore
- DME cannot distinguish small spores such as Penicillium and Aspergillus spores from one another.
- They are in the 2-3 micron range and are grouped together and called Penicillium/ Aspergillus**-like** (Pen/Asp-like). Why?
- Because typically the predominant mold in this 2-3 micron size range is Pen/Asp but there may be no Pen or no Asp … could be other small mold spores such as Trichoderma.

High Volume vs Low Volume

- High volume cassettes such as the Air-O-Cell/ Pro15 take in larger amounts of air … sampling is done at 15 liters per minute (lpm) flow rate.
- Lower volume cassettes are at 5 lpm. Sample size is 1/3 the size of the AOC/P15. 1/3rd the accuracy for the same sampling time.
- **But!** Z5's are defined by the manufacturer as: "A cost effective first-line mold screening tool that efficiently and reliably collects mold and allows for simple lab analysis."
- Mold Assessors should not use a sampling cassette that is considered a first-line screening tool just because it is simpler (less costly) for the lab analysis.
- Labs generally do not charge any more to analyze AOCs/Pro15s that gives you 3x the accuracy of the Z5s. **Mold Assessors should only do high volume 15 lpm sampling.**

Battery Operated High Volume Air Sampling Pump

Zefon Z-Lite pump. The choice of professionals.

- Battery operated spore trap sampling pump with built in calibration (yellow arrow.) Blue arrow points to air sampling cartridge. Red arrow points to timer.
- This type of pump has a large battery and is very stable. Rarely needs adjusting. It should sit on the floor.
- Because it has a count down timer, you can efficiently take more samples because you can continue the inspection while taking samples.
- Because it has a battery, you don't need to locate it near an outlet or have an extension cord.
- **Expensive but worth it. The sampling pump for the professional.**

Sampling Guidelines for Air-O-Cells/ Pro15's

- The sampling time is dependent on the density of particulate [dust/dirt] in the environment.
- It is important not to overload the sample with dust/dirt, otherwise it will be impossible to assess the types of spores, pollen and particulates that are present. Why?
- Because lab analysis of spore traps cannot see mold spores under collected dust.
  - Cleaner environments: You can test longer.
  - Dirty/dusty environments: Test shorter.
  - Sampling closer to the floor: Test shorter.

Major Lab Recommended Sampling Time at 15 lpm

Environmental conditions	Recommended sampling time at 15 1iters per minute
Wall cavities	1 minute
Dusty, dirty, visible particles in the air	3 minutes
Normal office	5 minutes
Very clean indoor areas	10 minutes

- Initial Inspection or Post Remediation Verification? Does not say.
- What is a normal office? What about homes? Does not say.
- Blowers/ air scrubbers On or Off? Does not say.
- AC On or Off? Does not say.
- Recent activity to stir up dust? Does not say.
- Unless you have a laser particle counter to measure airborne dusts, impossible to distinguish levels of dust in the air.

For Spore Traps We Test … Depends if Lab Reading 25% of the Trace or Not.

- Never really know how much dust/dirt is in the air.
- We test 3 minutes for Initial Inspection and 3 minutes for Post Remediation Verification (PRV) both at 15 liters per minute (lpm). A fairly short period.
- Testing longer may overload the microslide with dust/dirt making it impossible for the lab to accurately read.
- We test 30" under cabinets. (We don't test inside of walls.)
- We test with scrubbers ON and AC ON because air flow elevates the spore count and is the more conservative way to test.
- There are no hard and fast RULES.
- **Depends if Lab Reading 25% of the Trace or Not.**

Environmental conditions	Recommended sampling time at 15 1iters per minute
Dusty, dirty, visible particles in the air	3 minutes

Why Do We Say: Depends if Lab Reading 25% of the Trace or Not.

- **Depends if Lab Reading 25% of the Trace or Not.**

ANALYSIS METHOD	Spore trap analysis	Spore trap analysis	Spore trap analysis	Spore trap analysis
LOCATION	TEST LAB	TEST LAB	TEST LAB	TEST LAB
COC / LINE #	1132425-1	1132425-2	1132425-3	1132425-4
SAMPLE TYPE & VOLUME	AIR-O-CELL 100 - 45L	AIR-O-CELL 100 - 45L	AIR-O-CELL 100 - 45L	AIR-O-CELL 100 - 45L
SERIAL NUMBER	25900425	25901028	25900529	25900488
COLLECTION DATE	May 12, 2018	May 12, 2018	May 12, 2018	May 12, 2018
ANALYSIS DATE	May 14, 2018	May 14, 2018	May 14, 2018	May 14, 2018

- Here on this ProLab report it says: AOC 100-45L
- This means that they read 100% of the trace and there was 45 liters of air collected.
- To save money many labs will read 25% of the trace and then multiply the count by 4.
- That may be acceptable for Home Inspectors but not for Professional Mold Assessors.

Shorter = Better. Take More Samples.

- When you collect samples using a high volume 15 liters per minute (lpm) cassette a shorter sampling time versus a low volume (Z5) cassette is warranted because you are taking a sample 3x the size.
- As long as the lab is reading 100% of the trace.

Sampling for 3 minutes with a high-volume cassette versus 10 minutes with a low volume cassette allows you the time to easily take additional samples.

Air Testing in Quadruplicate. Check Out the Huge Variation.

ANALYSIS METHOD	Spore trap analysis	Spore trap analysis	Spore trap analysis	Spore trap analysis
LOCATION	TEST LAB	TEST LAB	TEST LAB	TEST LAB
COC / LINE #	1132425-1	1132425-2	1132425-3	1132425-4
SAMPLE TYPE & VOLUME	AIR-O-CELL 100 - 45L	AIR-O-CELL 100 - 45L	AIR-O-CELL 100 - 45L	AIR-O-CELL 100 - 45L
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IDENTIFICATION	Raw Count	Spores per m^3	Percent of Total	Raw Count	Spores per m^3	Percent of Total	Raw Count	Spores per m^3	Percent of Total	Raw Count	Spores per m^3	Percent of Total
Bipolaris/Drechslera												
Cladosporium	5	110	63	2	44	20						
Epicoccum												
Ganoderma				2	44	20				1	22	7
Other Ascospores										4	89	29
Other Basidiospores	2	44	25	6	130	60	10	220	100	6	130	42
Penicillium/Aspergillus										3	67	22
Pithomyces												
Smuts, myxomycetes	1	22	13									
TOTAL SPORES	8	176	100	10	218	100	10	220	100	14	308	100
MINIMUM DETECTION LIMIT*	1	22		1	22		1	22		1	22	

Four samples. Identical conditions. Same time. Same place. Same equipment. Always huge variation when sample size is small. So what? The only thing important here is that there is clearly not much there. And no Stachybotrys toxic mold.

Air Testing in Quadruplicate. Huge Variation.

- Spore trap mold (air) sampling is quantitative but is not a precise science.
- There is random variation. Consider that test results can often vary by +/- 50% or more.
- **Do not make conclusions based on small variations in test results.**

Powered sampling pump. That means a cord. And inconvenience. Does not have a count down timer. And that means wasting time. You get what you pay for.

Surface Sampling for Total Spores

Surface sampling with flexible slide.

Surface testing with swab.

- Mold Assessors do surface sampling for total (dead + live) spores.
- Analyzed by DME.
- Lift tapes, flexible microscope slides, and swabs.
- Or bulk samples of drywall in a zip lock bag.
- Swabs are the most popular.
- Surface sampling is not quantitative. The lab may give you a number, but it is not reliable.

Spore Traps: Pros & Cons

- For Post Remediation Verification Testing: Taking spore traps that you determine are Not Elevated means the job site and surrounding areas have been left clean and not cross contaminated. Simple (so to speak clean) interpretation.
- For Pre-Remediation Testing: What Elevated levels of spores for initial (pre-remediation) testing means … not always a simple answer. Could be:
  - Dirty AC/ducting
  - Dirty AC filter
  - Old carpets
  - Clutter, etc.
- All of these factors/complications can result in an elevated spore count in an initial test sample but not in any way indicate an indoor mold growth problem.
- Because traps don't distinguish old from new spores, they do not help identify that the source of the problem is actual mold from a current or recent leak.
- To determine old or new mold spores, we use Viable Sampling.

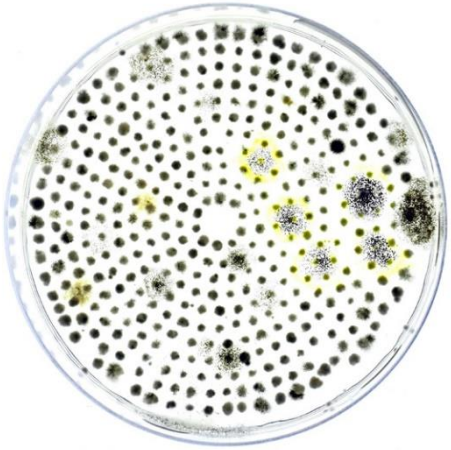
Viable Air Sampling (Culture Method) Useful for Insurance Claims

Viable Air Sampling
Petri Dishes/ Growth Media

- Petri dishes contain growth media (agar) at the bottom.
- Malt Extract Agar (MEA), DG-18, Cellulose, Potato/Dextrose (PDA) are common media for mold growth.

Petri dish with growth media.

- Spores (both live and dead) are collected onto the growth media using an **Andersen sampler**.
- Of course only the live ones will grow and are counted.



Culture testing. Visible results. Seeing is believing.

Air Samples for Mold Culture Analysis Andersen

This method of air sampling involves drawing a measured volume of air over culture media in Petri dishes using an Andersen type sampler.

Air flow rate is 28 lpm (vs. 15 for spore traps).

Requires higher capacity pump than spore traps.

Clean with alcohol after each use.

Andersen Impactor

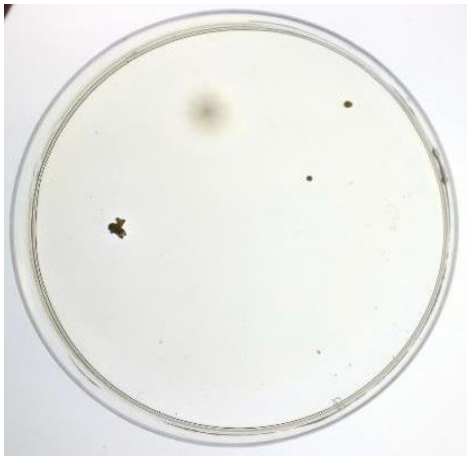
Air Samples for Mold Culture Analysis Andersen

The Petri dishes are sent to the lab where they are incubated at elevated temperature typically 5-7 days.

Viable spores impacted on the plate germinate and grow. The molds/fungi are then counted and identified down to the species level.

There is no better method to "show" a problem exists or that you cleaned up a problem than with Culture sampling. Seeing is believing.

Pre-Remediation Air Sample



Post Remediation Air Sample

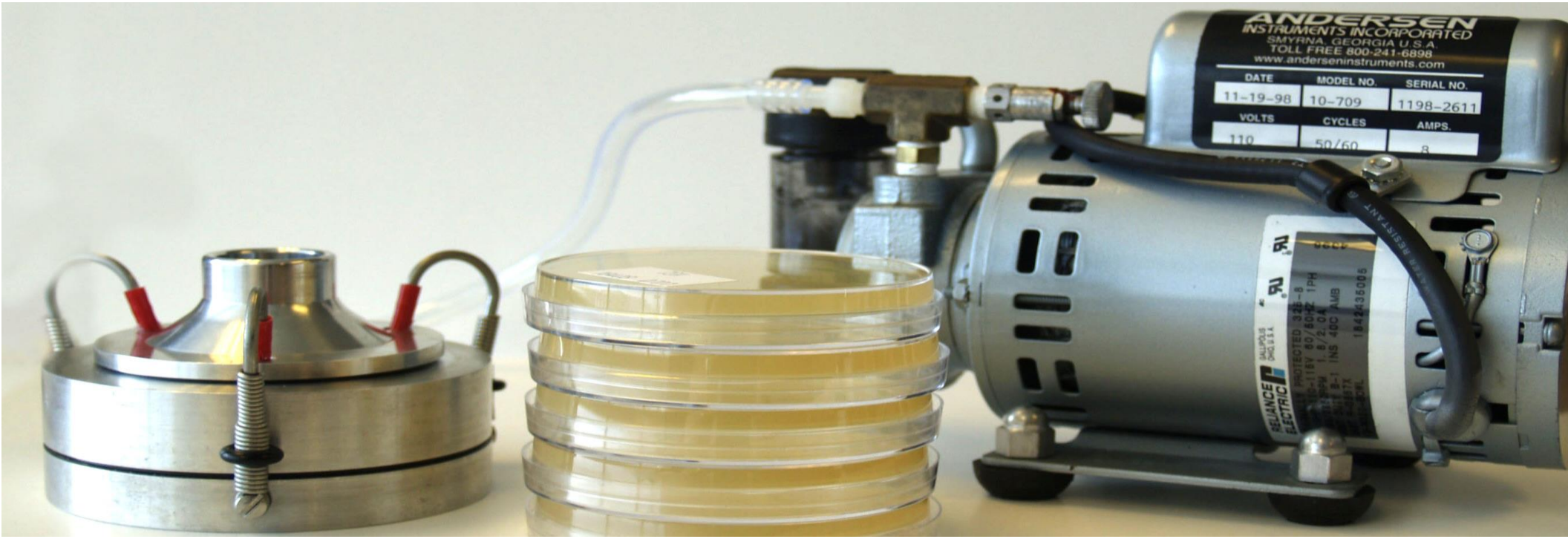
Major Lab Recommended Sampling Times for Andersen

Environmental conditions	Recommended sampling time at 28.3 1iters per minute
Dusty, dirty, visible particles in the air	1 minutes
Normal office	2-3 minutes
Very clean indoor areas	5 minutes

- Again is this for Initial Inspection or Post Remediation Verification?
- What is a normal office? What about homes? Not defined.
- Blowers/ air scrubbers On or Off? Not defined.
- AC On or Off? Not defined.
- Recent activity to stir up dust? Unknown.
- Again no way to know how much dust is in the air unless you test with a Laser Particle Counter.

For Andersen We Test …

- Never really know how much dust is in the air and air flow is high (28 lpm vs 15 with AOC).
- We test 2’ for Initial Inspection and 2’ for PRV at 28 lpm.
- 10’’ under cabinets. (We don’t test inside of walls.)
- We test with scrubbers ON and AC ON.
- There are no hard and fast RULES.

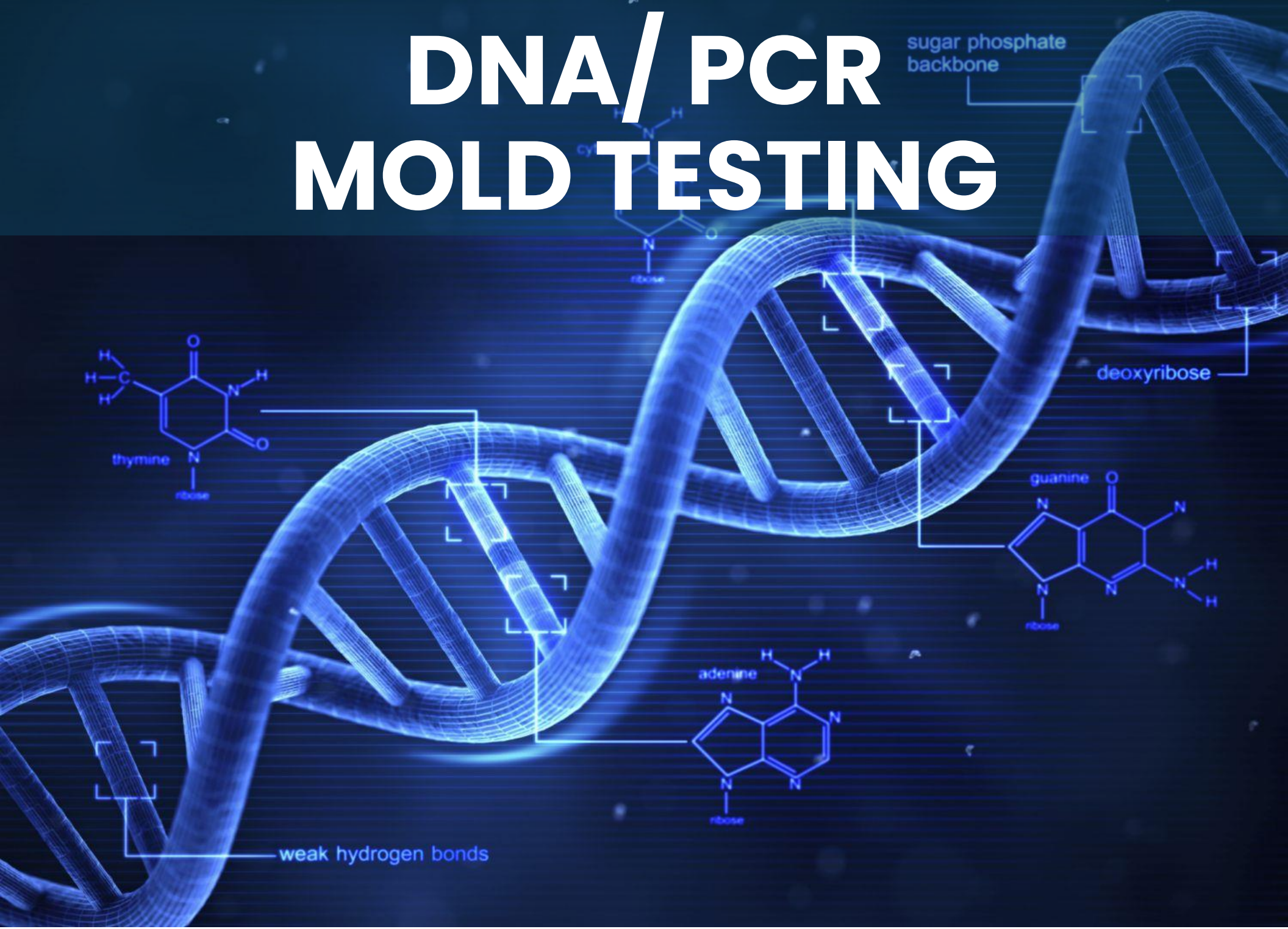


Benefits of Mold Culture Analysis

Incubator. We incubate for 36 hours. Take pix. And then send to lab for analysis.

1. Mold cultures determine whether the mold spores are viable (alive/new growth) or dead (old growth).
2. Distinguishes Penicillium from Aspergillus down to species level which is important in determining which are water damage indicators and which are background.
3. Culturing mold in a petri dish on fast growth media such as Potato/Dextrose (PDA) at elevated temperature can visually show clients the degree of mold contamination in only 2-3 days.
4. We have our own Incubator. We incubate for 36 hours. Take a picture and then send to lab for analysis.
5. NOT EXPENSIVE. At least at some labs, culture analysis is the same price as spore trap analysis.

DNA/ PCR MOLD TESTING



DNA/PCR Mold Sampling. Determines Genus & Species. Detects Mold Fragments

Developed by the U.S. EPA on or about 2006. Their procedure is called ERMI. Environmental Relative Moldiness Index. Determines both Genus and Species (as does Culture testing.)

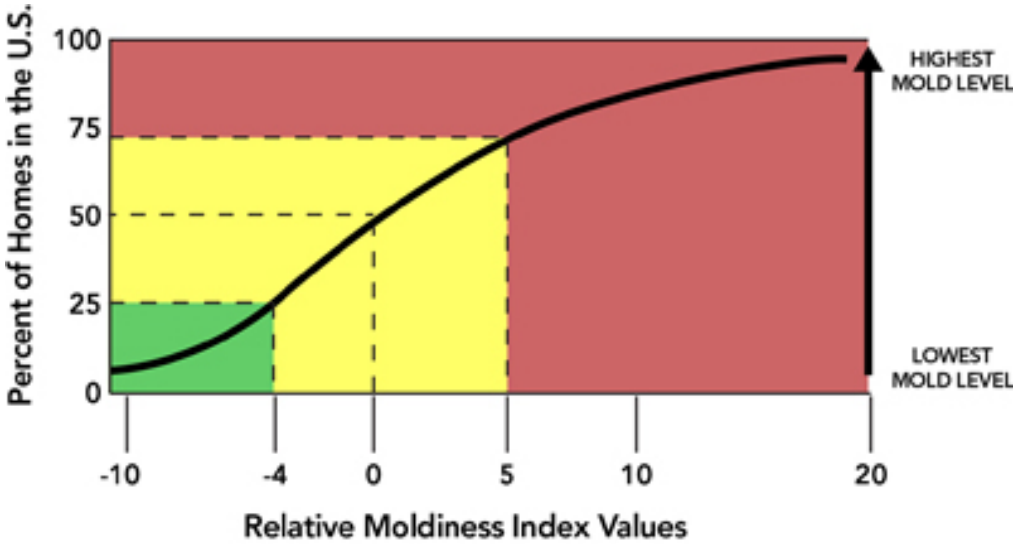
One of the breakthroughs of ERMI DNA mold sampling is that DNA sampling detects mold fragments in addition to spores.

Mold fragments are invisible to traditional testing but are more numerous and more of a health problem to mold sensitive people than spores.

Therefore, DNA testing that counts fragments in addition to spores was a game changer.

EPA's ERMI Test Panel Defined

- The EPA's ERMI consists of testing for 36 molds, broken down into two groups:
  - Group 1: 26 species of molds that represent the species most associated with water-damaged environments but certainly not anywhere near all molds found in water damaged homes.
  - Group 2: 10 species that are considered common molds in homes that come from the outside air. These are not water-damage indicators.



EPA's ERMI Test Panel Defined Genus & Species

Group 1: Water Damage Molds	Group 2: Common Indoor Molds
1) Aspergillus flavus/oryzae,	27. Acremonium strictum
2) Aspergillus fumigatus	28. Alternaria alternata
3) Aspergillus niger	29. Aspergillus ustus
4) Aspergillus ochraceus	30. Cladosporium cladosporioides1
5) Aspergillus penicillioides	31. Cladosporium cladosporioides2
6) Aspergillus restrictus	32. Cladosporium herbarum
7) Aspergillus sclerotiorum	33. Epicoccum nigrum
8) Aspergillus sydowii	34. Mucor amphibiorum
9) Aspergillus unguis	35. Penicillium chrysogenum
10) Aspergillus versicolor	36. Rhizopus stolonifer
11) Aureobasidium pullulans	
12) Chaetomium globosum	
13) Cladosporiumsphaerospermum	
14) Eurotium (Asp.) amstelodami	
15) Paecilomyces variotii	
16) Penicillium brevicompactum	
17) Penicillium corylophilum	
18) Penicillium crustosum	
19) Penicillium purpurogenum	
20) Penicillium Spinulosum	
21) Penicillium variabile	
22) Scopulariopsis brevicaulis/fusca	
23) Scopulariopsis chartarum	
24) Stachybotrys chartarum	
25) Trichodermaviride	
26) Wallemia sebi	

Ratio of Group 1 to Group 2

- The ratio of Group 1 to Group 2 can be used to classify an indoor environment as having elevated levels of water damage indictors or not.
- Elevated levels of Group 1 (water damage indicator molds) vs Group 2 molds means that there (likely) is/has been previous water damage in the home.
- Keep in mind that DNA testing just like spore traps counts both dead and live spores and therefore can provide no information as to timing of the water damage.

ERMI Overly Focused On Mold In DUST

- Developed for both air sampling as well as dust sampling (with swabs or wipes or carpet dust collectors.)
- But the sole focus of most assessors is on DNA dust sampling and not air sampling. Why?
  - Dust sampling is very simple/ very easy using a swab or wipe or vacuum dust collector nozzle.
  - So simple can even be done by a consumer with no special training and no special air sampling equipment.
- But simpler is not necessarily better.

Surface sampling for DNA. Swabs and dust magnet cloths are popular.

Dust Vacuum Collection Nozzle

ERMI Overly Focused On Mold In DUST. Not the AIR

- Mold in pockets of dust does not measure actual exposure which is from breathing mold.
- In fact, DNA dust testing for mold always greatly over-estimates mold in the air. And it is only mold in the air that represents exposure.
- Many mold assessors use the very high values of mold DNA in dust as a scare tactic to push expensive remediation.

Mold In DUST DOES NOT Measure Exposure.

- ERMI DNA mold testing is about $250 to $300 per sample. Not used in Home Inspections. Often used when there are sick people.
- Several procedures: ERMI and HERTSMI-2 are the two most popular.
- ERMI is a 36 panel procedure developed by the EPA for both air and dust.
- HERTSMI-2 is a 5 panel (cost reduced) proprietary procedure prescribed by many doctors, but it is only for testing dust. Not Air.

Again, keep in mind, mold in pockets of dust does not measure actual exposure which is from breathing mold. Finding mold in dust which always comes back elevated is used as a scare tactic to pay for expensive medical treatment or mold remediation when this is often not needed.

If Mold in Dust, Then Clean. No Mold in Dust if No Dust.

- Finding mold in dust in no way helps determine if there is significant mold exposure.
- Finding mold in dust in no way helps determine the source of exposure for the purpose of remediation.
- If there is mold in the settled house dust … clean the dust. Swiffers do a good job cleaning dust.
- When there is no dust, then no mold in the dust. This is not mold remediation. It is cleaning.

Mold in dust. So what! Clean the dust. When there is no dust there is no mold in the dust.

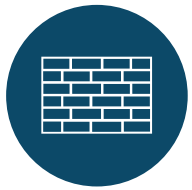
Mold Under Baseboard Inside Wall

Freshly painted baseboard but water-stained carpet tack and soil from ant colonies.

- When you see freshly painted baseboard in a not so new home there is quite often covered up mold problems.
- If the room is carpeted, pull back the carpet and check for water stained carpet tack, or mold or dirt from ant colonies living inside wet exterior walls as shown above.

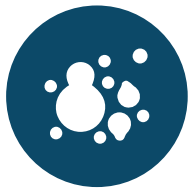
Suspicious Walls: What's an Assessor To Do?

When you see fresh paint or new carpet tack spliced in or stains under the carpet, check the outside for stucco cracks and leaking windows.



Or if you see interior drywall finish or wall or ceiling paint does not match original…

You may wish to flag such areas as suspicious or "Potential Concern".



Recommend that a MOLD REMEDIATOR PERFORM intrusive visual inspection — generally this involves removing or peeking behind baseboards.

We Do Not Recommend

- We do not recommend taking air samples in walls as some mold assessors do.
  - Walls are connected to attics. There is always some mold in the air in walls.
  - Inside of walls it is dirty. There is always **mold in dirt.**
- **But we do recommend taking air samples under suspicious cabinets.**

SUSPICIOUS CABINETS TESTING FOR HIDDEN MOLD UNDER CABINETS

Checking for Hidden Mold Under Cabinets with Particle Counter

Laser particle counter

- Checking for particles in the 1 to 10 micron range can help determine if there is hidden mold under cabinets.
- Insert the particle counter under the cabinet.
- Tap the cabinet side and bottom.
- Check the reading for Pen/Asp size particles in the 2.5 micron range.
- **If elevated, take an air sample under the cabinet.**

Checking for Hidden Mold Under Cabinets with Particle Counter

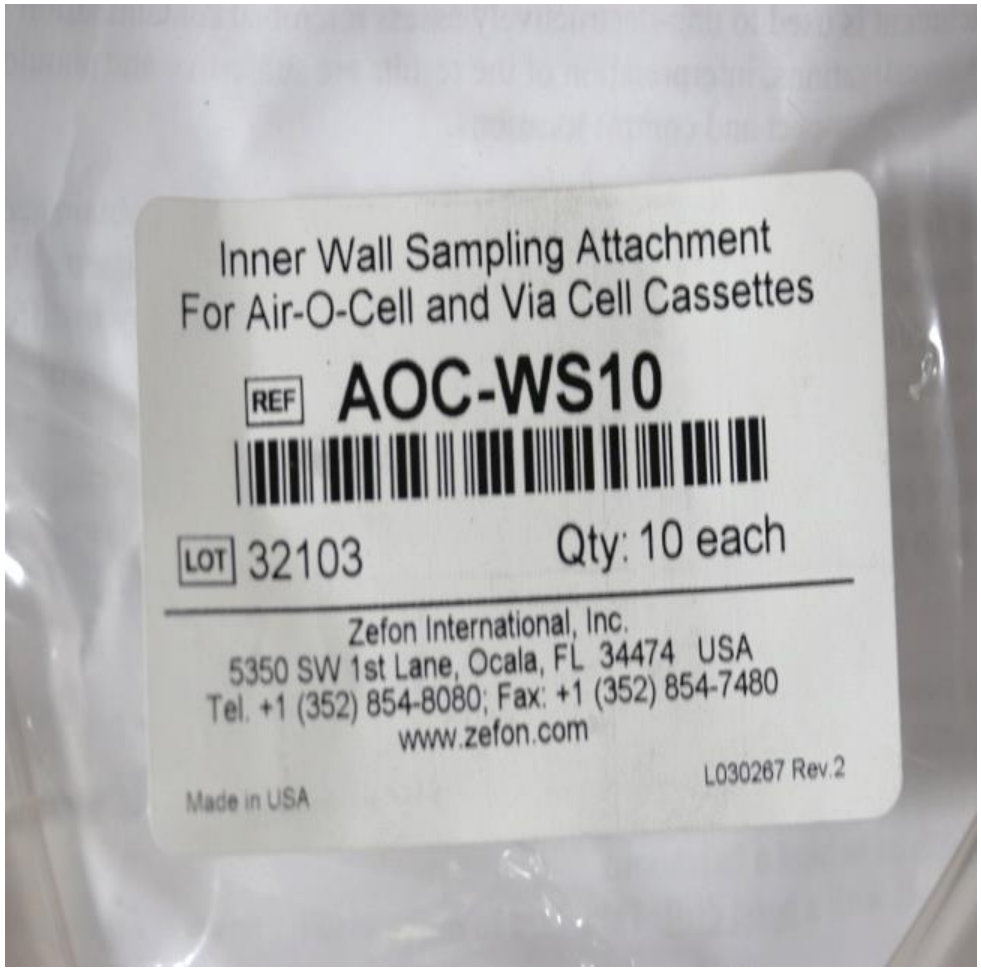
- Shown below, we have inserted a vinyl tube attached to the counter under the kitchen cabinets to check for mold size particles in the 2.5 micron range. (Pen/Asp size).
- In the kitchen/bath if there are no openings at toe kicks generally you can pull back an escutcheon around a pipe and fish the tube behind the cabinets.
- If the mold size particle level is elevated, take an air sample under the cabinet.

Laser particle counter with extension tube.

Pull back escutcheon around drain line. Test in the opening.

Air Sampling to Determine Hidden Mold Under Cabinets

- Air sampling can check for hidden mold under cabinets.
- **The beauty of the procedure is that it requires one air sample per each bathroom and one or more in the kitchen.**
- You need a special (low cost) extension in order to do so.



Inner Wall Sampling Attachment. We use these to test under cabinets. Not in walls.

Air Sampling to Determine Hidden Mold Under Cabinets

Inner Wall Sampling Attachment. We use these to test under cabinets. Not in walls.

- These extensions are called "Inner Wall Sampling Extensions".
- But you don't use them to check inside of walls but check under kitchen or bath cabinets.
- Once you attach the extension to the cartridge:
  - Fish the extension under the cabinets;
  - Turn on the pump; and then
  - Smack the inside of the cabinets (floors and backs to stir things up.)
- Sampling duration is 30 seconds.

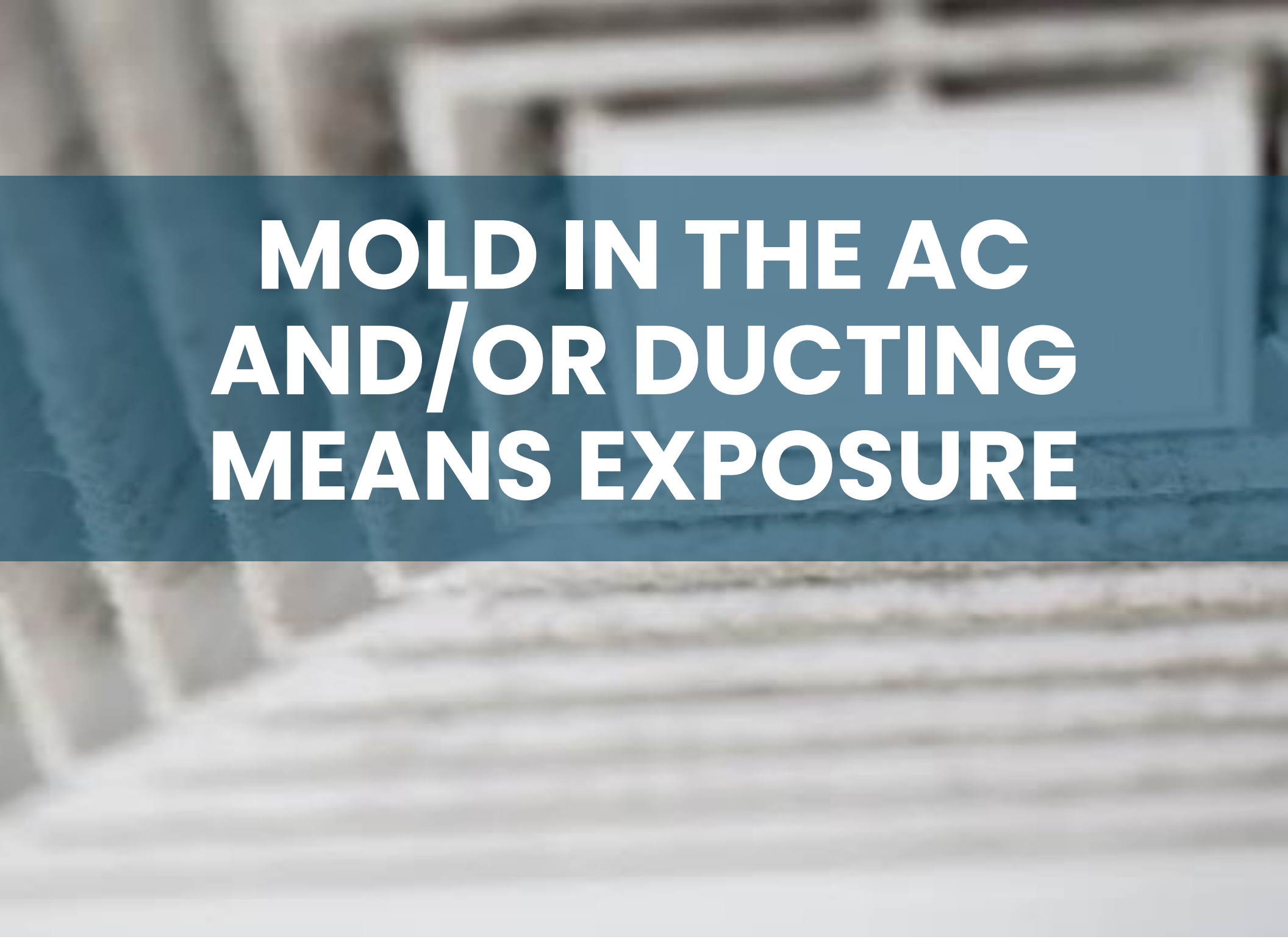
Review

1. Checking for hidden mold problems under kitchen and bath cabinets by air sampling with tube extensions: If results come back Not Elevated you say there are no problems.
   a) T. Easy as pie.
   b) F. You never say that are no (hidden) problems you only provide results that you say are Not Elevated.

2. High volume cassettes such as the Air-O-Cell take in larger amounts of air … sampling is done at XX liters per minute (lpm) flow rate.
   a) 15 lpm
   b) 5 lpm

3. Since according to the EPA dead spores are no less allergenic or toxic than XXXX spores, investigators most often use spore traps to look at total counts rather than only cultured viable spores.
   a) Viable
   b) Live
   c) Either "Live" or "Viable"

4. Total spore counts is the total of both viable and not viable spores.
   a) T.
   b) F.



MOLD IN THE AC AND/OR DUCTING MEANS EXPOSURE

Degrees of Exposure

- **Exposure** to indoor mold means breathing mold spores present in the indoor air.
- The presence of mold growth in a home does not necessarily equate to exposure.
- There must be a pathway for exposure to occur (breathing spores).
- For example, hidden mold behind shower tiles will not result in any elevated levels of mold spores in the indoor air unless it is improperly remediated.
- What the Mold Assessor focuses on is obviously visible mold and visible water damage, but also, they must identify hidden mold problems that can affect the indoor air quality and the health of occupants and **is detectable by sampling the air.**

Hidden mold in the AC and ducting always represents potential for significant mold spore exposure as well as mold odors.

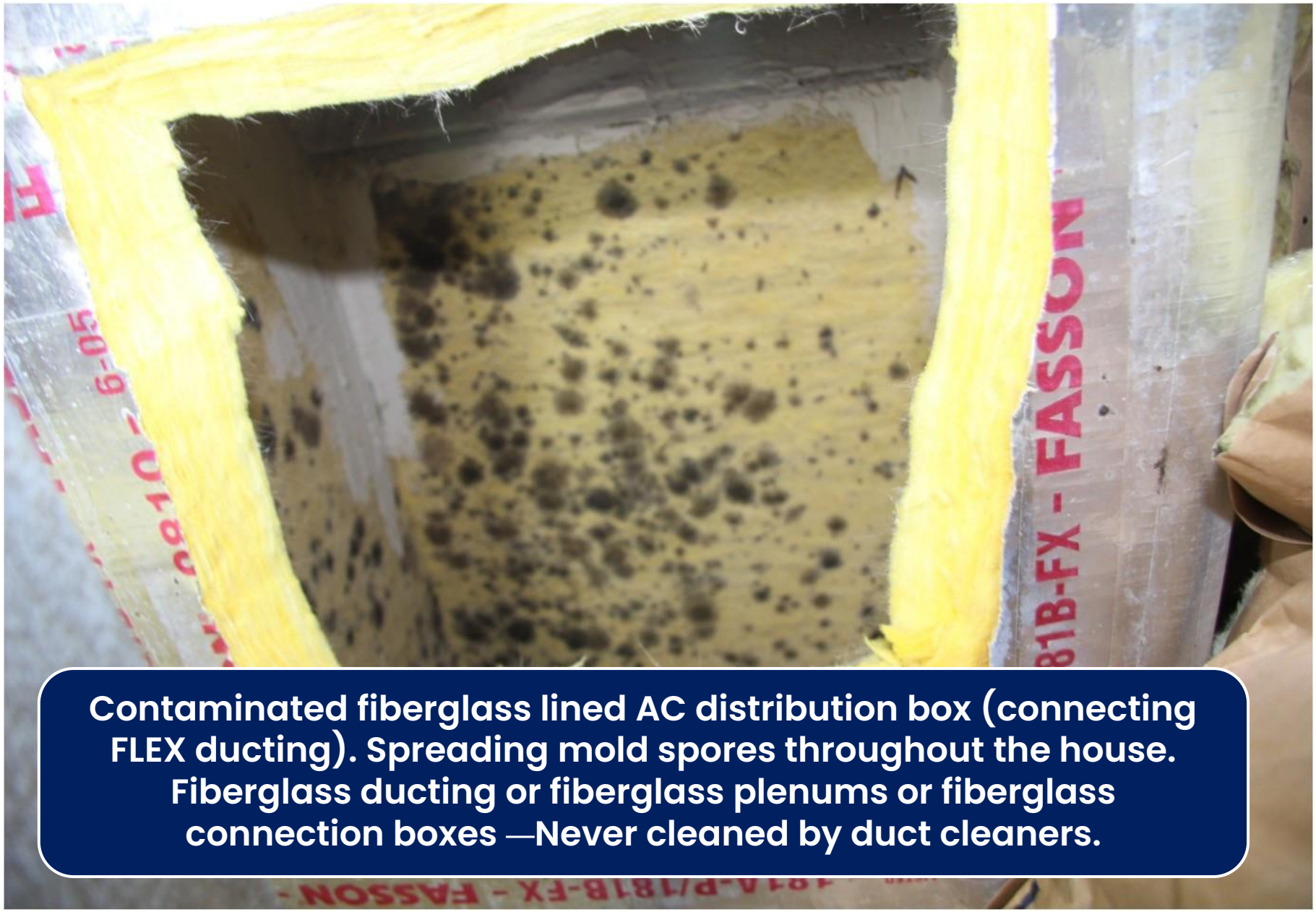
Hidden Mold in the AC

- Mold contractors (including both Assessors and Remediators) almost always overlook problems in the AC and ducting.
- Since most of the time, in homes without visible mold problems, it is mold in the AC and ducting that is making people irritated or sick, it is imperative to be able to assess mold problems in AC and ducting.
- **When you see the term "Elevated Mold Spores" in air sample test results from multiple areas of the home, the first thing that should come to mind is mold problems with the AC and/or ducting.**

Hidden Mold in the AC

- When you smell a musty odor throughout a clean home (no dirty carpets), the first thing that should come to mind is mold problems with the AC and/or ducting.
- Duct cleaners do not clean flex ducting or fiberglass lined ducting.
- They clean grills and then fog chemical deodorizers into the ducting.
- In Florida, duct cleaning is a non-licensed activity and is usually a scam.

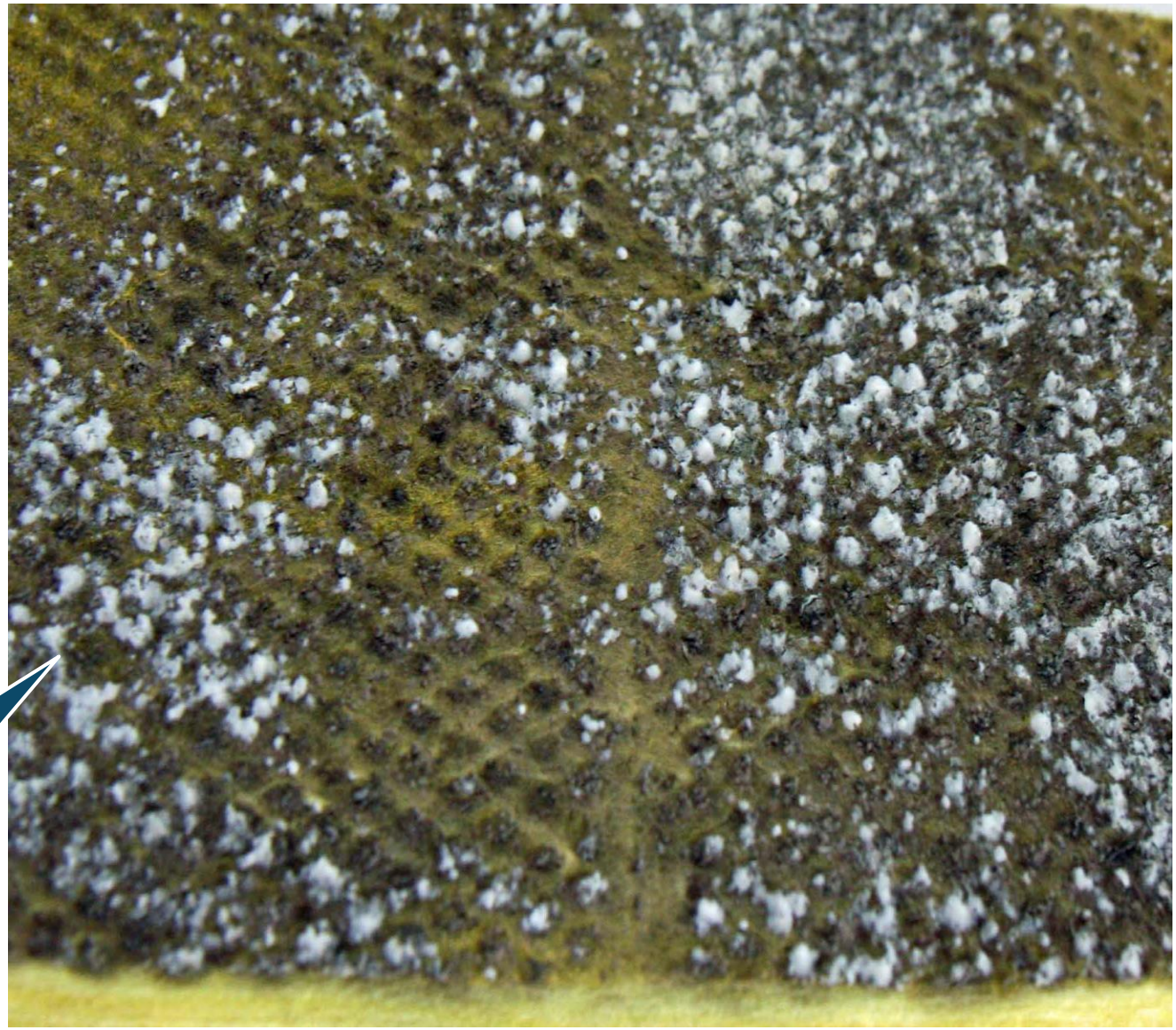
Moldy AC Distribution Boxes



Contaminated fiberglass lined AC distribution box (connecting FLEX ducting). Spreading mold spores throughout the house. Fiberglass ducting or fiberglass plenums or fiberglass connection boxes —Never cleaned by duct cleaners.

Mold in AC Supply Plenums

Mold in AC Supply Plenums



White Pen/Asp mold on fiberglass insulation in AC supply plenum (yellow arrow). Mold growing on AC insulation is dispersed into the air 24/7.

Mold in AC Closets

If there is hidden mold in the AC closet (behind the air handler for example), even small amounts …

It will be pulled up into the AC system and disbursed throughout the occupied space and make mold sensitive people sick.

Dark color is mold on wall behind where air handler had been located.

Mold Hidden in Return Air Box

Mold on exterior of AC return air box. Much worse mold inside!

- Oftentimes the air handler drain line clogs and the drain pan overflows. Mold will result.
- Here mold is shown growing on the outside of the return air box that the air handler sits on.
- But inside, the box is also full of mold.
- The mold inside the box is being disbursed into the occupied space making occupants sick.
- **If the AC is old and the return air box is freshly painted, the Assessor MUST peek under the baseboards to make sure there has not been a coverup.**

Review

1. AC return air boxes that look perfect on the outside: (Choose the one best answer.)
   a) Are usually also perfect on the inside.
   b) Are oftentimes nasty and full of mold on the inside. Always check AC return air boxes for mold and/or water damage problems.

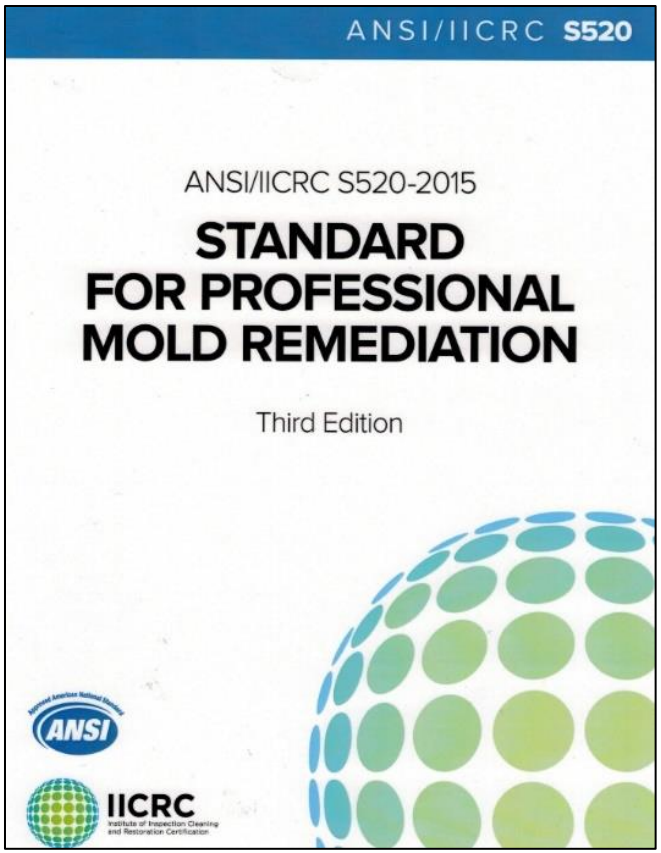
2. Sometimes a small amount of hidden mold is not a health problem. Choose the best answer:
   a) However, when there is mold, even small amounts, in an air handler or ductwork there is always the potential for major exposure.
   b) Hidden mold inside a wall is not usually a problem and the wall should be opened and the mold removed as quickly as possible. **(Why not this one?)**
   c) Hidden mold inside an attic is usually a problem except when the wind blows and clears out the attic.

Review

3. Checking for hidden mold problems with regard to AC or ducting by air sampling: If results come back as Not Elevated you say there are no problems.

T. Easy as pie.
F. You never say that are no problems you only provide result saying results came back as Not Elevated.

POST REMEDIATION VERIFICATION (PRV) ACCORDING TO IICRC



IICRC S520 Post-Remediation Verification

12.2.12 [Initial] Post-Remediation Verification

"Following post-remediation evaluation by the remediator, **it may be requested or required** to verify the return of a structure, systems or contents to Condition 1 [Normal Fungal Ecology]."

- IICRC S520-2015, 12.2.12 PRV comes right before 12.2.13 which is containment breakdown.
- PRV here is **testing only inside the containment before it is broken down.** Not in adjacent living space areas.

- **IICRC [Initial] PRV testing is not required by IICRC. Does not say "should" be performed.**
- **IICRC [Initial] PRV testing is inside the containment. Usually with an air scrubber running inside. Does not test to see if there has been cross contamination.**

Home Contaminated Beyond the Specific Remediation Location?

- How do you make sure that the entire home is not left contaminated if the only place tested during PRV air testing is inside the containment? You cannot.
- PROTECT YOURSELF FROM LIABILITY: PRV air testing must be performed outside the containment (and optionally inside as well before removal.)
- Initial PRV testing is not only air sampling but also visual inspection before walls are closed up as well as testing for absence of surface dust.

PRV Testing Usually Inside Containment With Air Scrubber Inside

- Caution: PRV is often or usually performed inside the containment with an air scrubber inside. But not outside in the living space.
- Pretty hard to fail such a PRV.
- But that is pretty much how the game is played.
- Until you get sued … Why?
- **Because there was no testing of areas outside of the containment to check for cross contamination.**

1400 CFM Air Scrubber

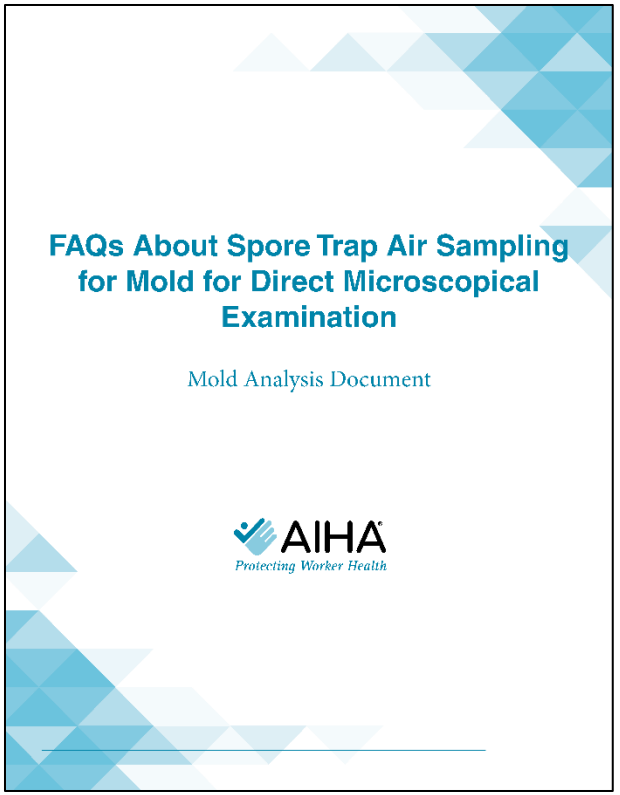
PRV Testing Inside Containment With Air Scrubber Inside

- What about pre-existing contamination outside the work area that was found by Initial Testing either in the air or settled dust?
- What about potential cross contamination from the work area because the containment was breached, or people carried contaminated materials through the home rather than bagging?
- IICRC S520-2015, 12.2.12 PRV testing is only inside containment and does not check for either cross-contamination or pre-existing background mold contaminants.

500 CFM Air Scrubber

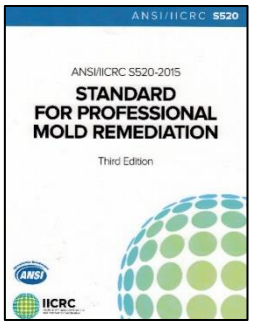
COMPARING TO THE OUTSIDE AIR

- Both direct examination and culturable approaches typically involve collecting and comparing indoor versus outdoor samples.
- Based on on-site environmental conditions, the investigator is usually trying to determine whether any significantly elevated fungal levels are occurring indoors that are different or unusual when compared with the outdoor microbial flora.
- Some investigations also compare levels of fungi in complaint/ concern versus non-complaint/no concern areas in the indoor environment.



IICRC Final PRV Return of Structure. Not Inside Containment

15 [Final] Post-Remediation Verification



"Following post-remediation evaluation by the remediator, **it may be requested or required** to verify the return of the structure, systems, or contents to Condition 1 [Normal Fungal Ecology]." **Does not say "should".**

- S520-2015 Chapter 15: PRV air testing outside the containment can be performed to verify that the **structure, systems and content** are Not Elevated.
- Ch 15 is at the end of S520-2015. It is not emphasized by IICRC.
- The industry training emphasis is on 12.2.12 which is PRV testing inside the containment. Why? Easy to pass with an air scrubber inside. No one generally cares if the home is left contaminated. But we do!

- **[Final] PRV is not required by IICRC. Does not say "should" be performed.**
- **[Final] PRV is outside the containment. Never done as this tests for Cross Contamination. Which is not something remediators generally worry about. Sad but true**

Review

1. IICRC S520-2015 the focus on PRV is: Choose the one best answer:

   a) Testing only inside the containment… but it should not be!
   b) Testing both inside the containment but also in the living areas outside the containment.

HOW WE LIKE TO DO PRV

Post Remediation Verification Not Simply Air Sampling

- Post Remediation Verification (PRV) means that you have:
  1. Verified the moldy materials have been removed while the containment is still up and the walls still open.
  2. The work area and adjacent areas outside the containment both surfaces and air, have not been left contaminated; and
  3. The cause of the mold is fixed (usually moisture).
- Many mold professionals attempt to define PRV as only air sampling.
- One should not overly rely on air sampling to determine if a job is well done.
- One must make sure that there is no mold in the settled dust.
- **Surface testing for mold is not done by swabs or lift tapes as dust will interfere with DME (Direct Microscopic Examination.) But instead…**

“Testing” for Settled Dust. EPA Procedure

Use “white glove” tests (we use a wet Swiffer) to visually check for the absence of settled dust either on surfaces or inside AC ducting.

No settled dust = No mold spores in the settled dust

How is this determined “scientifically”?

“Testing” for Settled Dust EPA Procedure

When you take the EPA Lead Paint Dust class which all mold assessors and remediators should/must take… you will receive a laminated card that allows you to perform PRV testing for elevated dust or not.

While developed for lead paint, this is appropriate for mold work as well.

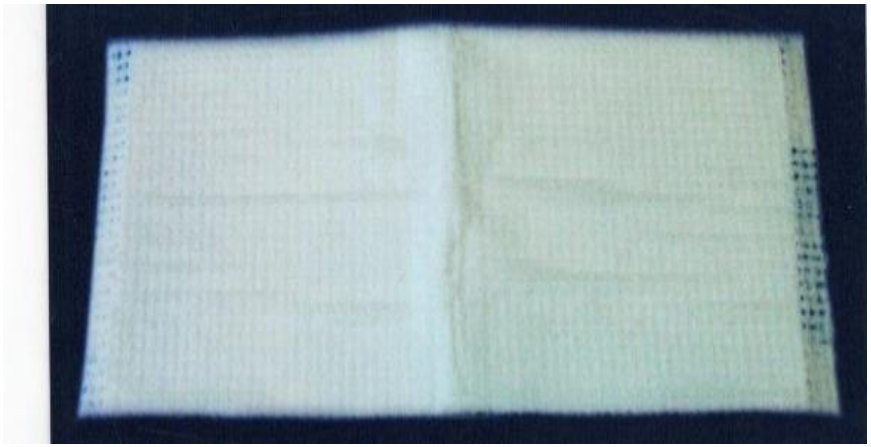
Testing Settled Dust Using Swiffer

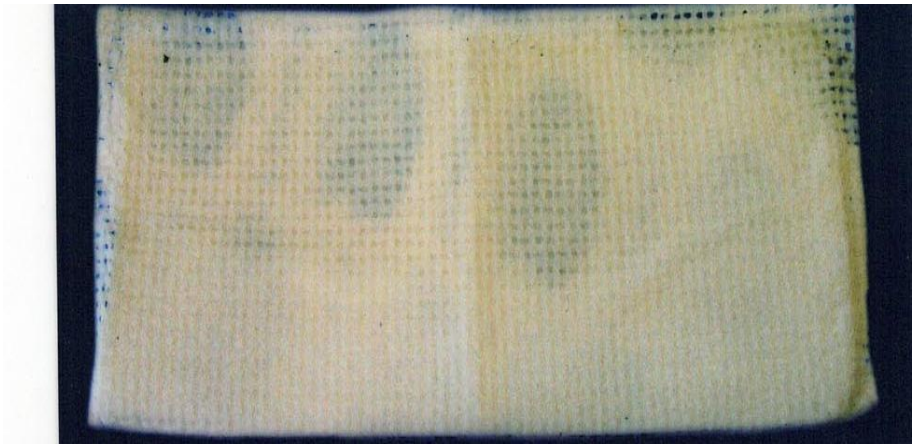
- After cleaning the floor, wipe the surface (floor) with a wet Swiffer.
- And compare to pix at bottom right.
- If darker, this is defined as elevated dust. PRV surface dust test fails.
- If lighter … PRV surface dust testing passes.

Unused Wet Disposable Cleaning Cloth

EPA Post-Renovation Cleaning Verification Card

Marginally Passing Wet Disposable Cleaning Cloth





Testing Settled Dust Using "Background Debris"

- Taking air samples with the pump at floor level will give you a useful measure of dust on the floor since normal activity aerosolizes floor dust that will be captured in the air sample along with mold spores.
- Labs provide a value for Background Debris found in the air sample: Light, Moderate, Heavy, etc.
- **Our recommendation: If the Background Debris in the air sample is more than "Light", then the testing indicates fail for clean of settled dust.**

Smuts, myxomycetes										4	89	50	
Unidentified Spores													
TOTAL SPORES	4	89	100	4	89	100	4	89	100	8	178	100	
MINIMUM DETECTION LIMIT	1	89		1	89		1	89		1	89		
BACKGROUND DEBRIS	Light			Light			Light			Moderate			
Cellulose Fiber	8	180		8	180								

Review Questions

1. It is generally preferable to use scientific testing methods rather than relying on visual inspection to determine that remediation work has been effective
   a) True
   b) False. Best to use a combination

2. Which of the following testing methods provides immediate feedback? (*check all that apply*)
   a) "White Glove" (Swiffer) surface inspection
   b) Visual inspection of AC, ducts & plenum interiors
   c) Air sampling or surface sampling.

3. Environmental test results should be interpreted according to official EPA numeric criteria.
   a) True
   b) False. There are none.

4. Mold contaminated air handlers, ducts or AC plenums will **always** irritate sensitive occupants even if there is no measurable Elevated mold spores in the air.
   a) True
   b) False. Depends on sensitivity. What if we said "may".

Explaining Your Criteria for PRV

- The Assessor [IICRC calls them Indoor Environmental Professionals (IEP)] MUST (but only Recommended and Not Required by IICRC) explain up front in the Protocol/Initial Report both the **criteria and process/ method** the assessor will use to perform PRV.
- The remediator needs to know the criteria and process/methods that will be used to judge their work that can result in holding back final payment.
- What type of testing? Air and dust?
- What is the criteria for failing air sampling if there are no Federal or State Guidelines?

12.2.12 Post-Remediation Verification

Following post-remediation evaluation by the remediator, it may be requested or required to verify the return of a structure, systems or contents to Condition 1. In such situations, post-remediation verification should be performed by an independent IEP. It is recommended that:

- the criteria and process used in the post-remediation verification be documented;
- the remediator and IEP clarify the minimum performance requirements of post-remediation verification prior to commencement of work; and

NAERMC (That's us) Recommended Mold Assessment Procedures

Pre-Remediation Sampling Procedures

Pre-remediation sampling:

- Testing should be in conjunction with visual inspection and moisture meters/FLIRS.
- Do not overly rely on testing in place of visual inspection. Find the moisture or earlier stains… find the mold.
- Air testing for hidden mold behind or under cabinets is recommended.

PRV Testing Procedures

- PRV Testing: Air sampling outside of the containment (testing inside containment is optional.)
  - AOC/P15 at 15 lpm, 3 min, reading 100% of the trace.
- PRV Testing: Settled dust testing both inside and outside the containment.
  - Wet Swiffer works well.
  - Looking at the Debris Levels of the air samples works well. Anything more than Light. Fail.

What About FLA Mold Law. Assessment.

Definitions.—As used in this part, the term:

(3) "Mold assessment" means a process performed by a mold assessor that includes the physical sampling and detailed evaluation of data obtained from a building history and inspection to formulate an initial hypothesis about the **origin, identity, location**, and **extent** of amplification of mold growth of greater than 10 square feet.

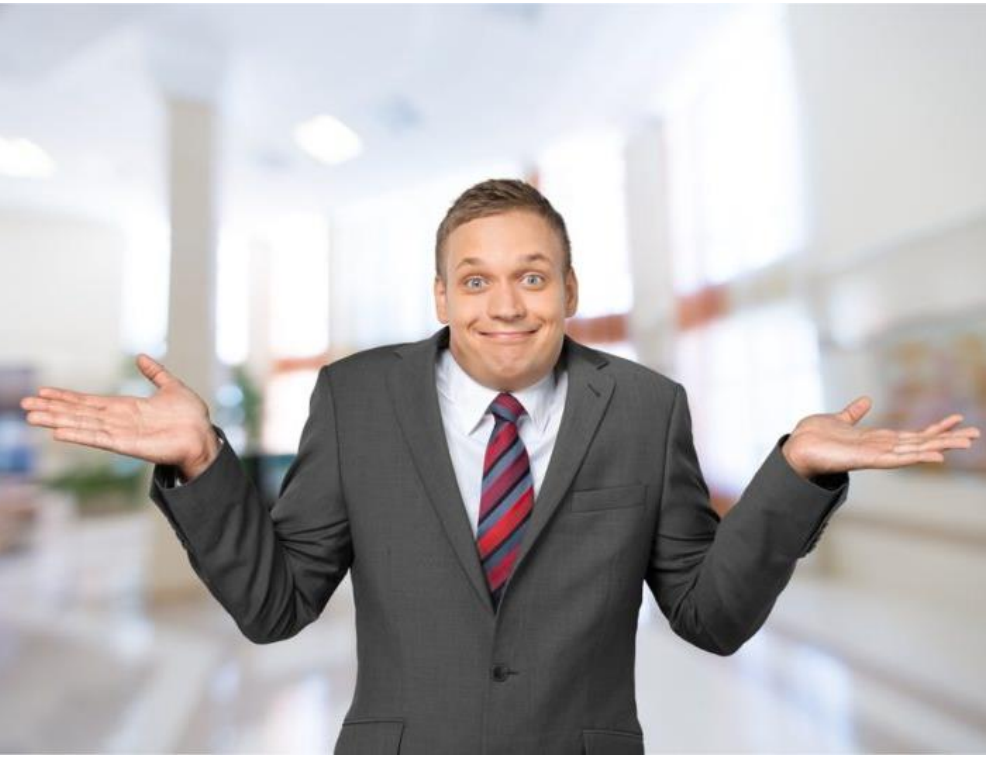
- Since most mold assessments are non-intrusive, it will often or generally not be possible to perform a complete assessment as defined by Florida Mold Law:
  - Cause/Origin: Until walls are opened by the remediation contractor the Cause/Origin of mold can often not be determined.
  - Identity: Until the walls are opened the identity of hidden mold cannot be determined.
  - Extent/Location: Until walls are opened by the remediation contractor, the Extent/Location of hidden mold cannot be accurately determined.

If Someone (Perhaps in a Deposition) Asks You …

- Why as an Assessor, didn't you follow FLA Mold Law's definition of a Mold Assessment and determine: **the origin, identity, location, and extent** of amplification of mold growth and if greater than 10 square feet.
- How are you going to answer?
- There could be many answers. Make sure you have one.
  - I was hired to do a limited assessment.
  - To perform a complete assessment as defined by FLA Mold Law requires that we open walls. The buyer/owner/realtor … did not want or did not allow an intrusive inspection.
  - We follow EPA guidelines that bases an assessment on: Find the moisture/ find the mold.

FLIR: Find the moisture. Find the mold.

I'm Just Sayin' …



- Gary Rosen's personal opinion (this means I am not telling you not to follow the FLA Mold Law definition of a mold assessment.)
- I'm just sayin' …
  - The Assessor's job in a protocol is generally to point out the locations of mold or possible hidden mold.
  - The rest is up to the Remediator when he opens the walls, removes baseboards, or cabinets.

Mold Report AC Issues. Flag Them.

If there are obvious visible mold problems with the AC and/or ducting, point that out in the report and say needs to be addressed by a Licensed AC contractor.

If the air sampling comes back with elevated Pen/Asp in 3-4 different areas, state that this points to a mold problem in the AC or ducting … needs to be addressed by a State Licensed AC contractor.

Elevated mold throughout the home? Points to mold contaminated AC, AC closet and/or ducting.

Mold Report: Duct Cleaner Warning

- If there are issues with the AC and Ducting, point out that duct cleaners are Not licensed in Florida.
- Their warranty or promises have no meaning.
- AC contractors are State Licensed… only some do duct cleaning.
- Remediators that are not also State Licensed GC's may not sub-contract other licensed trades such as AC contractors.

Duct cleaners are not licensed in FLA. They Do NOT actually clean ducting.

A Good Protocol/Mold Assessment Report

- A good report and protocol provides a remediator assistance as to how to quote a job (sometimes they quote the job from the inspection report/protocol without visiting the site).
- Focuses on high quality pictures. Limited boilerplate.
- But a good protocol is also:
  - Something that builds trust with all concerned parties (including remediators). So everyone should understand it! So keep is short & simple.
  - Reduces Assessor's liability.
  - **And gets Assessors post remediation testing business.**

Explain Why PRV Needed: To Provide Warranty

In the Assessor's Protocol/ Report explain why PRV is needed:

- To make sure that the mold has been completely removed.
- To verify that the Origin of the mold (moisture source) has been corrected.
- To show that there has not been cross contamination, leaving the home in an unsafe condition.
- **We recommend visual inspection inside the containment and both visual inspection and testing outside the containment before rebuild.**
- **And most important: To provide warranty for work performed. Offering a warranty is key to getting the PRV testing job.**

PRV Clearance Testing. Very profitable. Easy work. And important work.

Generally, Remediators Do Not Provide Warranty

- How hard is it for the Assessor to provide a warranty? It is easy.
  - Let's say the work performed was ripping out wet/moldy drywall and replacing with new mold resistant drywall.
  - When the containment is still up and before rebuild you inspect for mold. Mold is confirmed gone.
  - You say "We provide a 1 year mold free warranty for the work performed." You do not say limited warranty. You do not make a general statement: "Provide a Warranty" … but that you provide a warranty for only the work performed.
  - Is there ever any reason not to say that? No. This is easy to do. No risk. Mold is gone. Drywall is new.

PRV: Not only testing. But checking inside the containment to make sure mold is gone.

AVOIDING THE PRESSURE TO PASS BAD WORK

Pressure to Pass BAD Work. Comparing to Outside Air

- Most Mold Assessors usually define the criteria for passing a PRV as less than or equal to the outside air.
  - That is unless the job is on Miami Beach where the on-shore breeze may only have 1-2 mold spores. Or …
  - After a big rain there is essentially no mold spores in the outside air.
- The amount of mold spores in the outside air varies depending on geographic area as well as season and also wind conditions.
  - On a breezy day the outside spore count in Florida can reach 10,000 spores per cubic meter of air.
- Not very hard to pass a PRV air test for an air conditioned / air filtered home with windows and doors never left open, when all you have to do is be less than 10,000 spores per cubic meter of air.

Pressure to Pass BAD Work. Comparing to Outside Air

Typical Outdoor Mold Spore Concentration Ranges

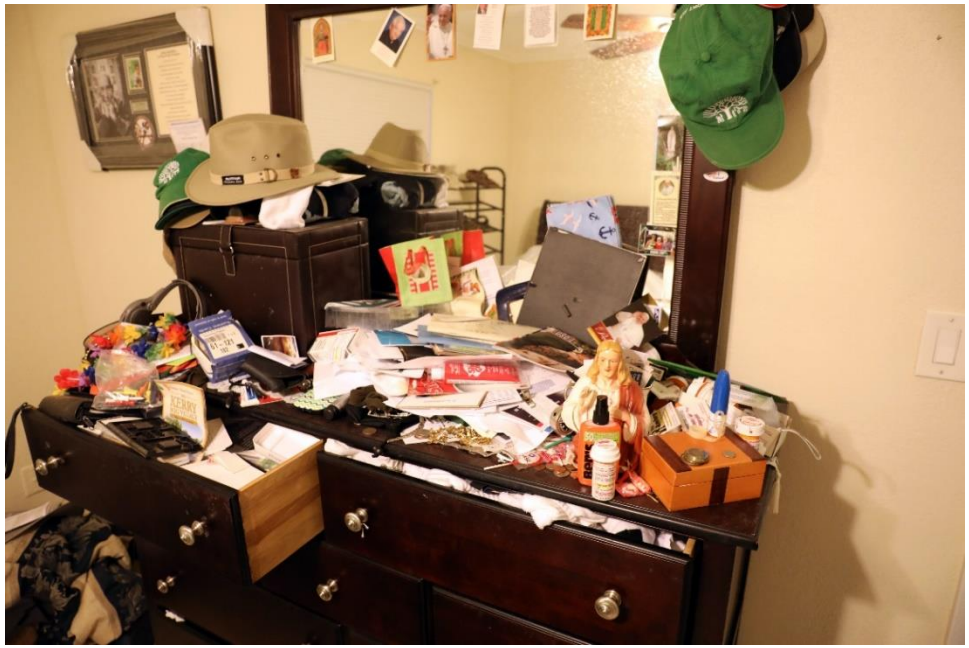
Description	Spores (cts/m^3)	Predominant Types *
Arid / desert regions	50 – 5,000	Cladosporium, asco/basidospores Alternaria, Penicillium, Aspergillus
Urban & coastal strip	200 - 10,000	Cladosporium, asco/basidospores Alternaria, Penicillium, Aspergillus
Inland valley & native vegetation	500 - 20,000	Cladosporium, asco/basidiospores Penicillium, Aspergillus
Farms & heavy forestation	5,000 - 50,000	Cladosporium,asco/basidiospores Alternaria, Penicillium, Aspergillus

•Genus/category listed in order of decreasing concentration frequency

PRV: It is cheating when you only compare to the outside air when the outside air has a high spore count. Warning: If you get deposed, you will be asked how you determined Elevated or Not. If you only compared to the outside air you will not survive the deposition. You need to use judgment as well.

Pressure to Pass BAD Work. Test Inside Containment

- Many mold assessors routinely pass bad work by performing PRV testing inside the containment with an air scrubber inside.
- They do not perform any testing in the living environment. Hard to fail such a test.
- Note: Yes it is true that for many tenant occupied dwellings one must test inside thecontainment due to old carpet, tenant or HO neglect, etc.
- Or due to messy home …



Sure. In this messy home you may have to test inside a containment.

Pressure to Pass BAD Work. Compare to Phony Thresholds

- There is enormous pressure to invent guidelines for passing remediation work to make it so easy that marginal or even bad work passes.
- For example, this table from NORMI. (One of our competitors.)
- If PRV test results less than 2000. Not Elevated. NORMI has published guidelines that will allow their members to pass bad work.
- If you get sued … that won't help you. The EPA says there are no threshold limits. NORMI cannot just invent them for members.

Sample Type	Result /m^{3c}	NORMI Interpretation	NOTES:
Mold Air (non-viable)	Total Spore Count Aspergillus/Penicillium Target Molds (Stachybotrys, Chaetomium, Trichoderma, Fusarium, Memnoniella)	<2000 Normal <200 Normal NO Target Molds	Other molds may be found that have significance in some environments such as Cladosporium, which can be found as indoor sources and can be prevalent outdoors.

If you get deposed, you are toast if you use such a ridiculous threshold for Pass/Fail.

Pressure to Pass BAD Work. Compare to Phony Thresholds

- Another phony measure some assessors use is based on the National Allergy Bureau mold count rating.
- Many mold assessors pass PRV testing, if indoor count is < 2500 which is called a Moderate level.
- This will not help you if you get sued because someone claimed you left the property contaminated.

"The National Allergy Bureau considers mold counts in air of 0-900 as low, 901 to 2500 as moderate, 2501 to 25,000 as high, and above 25,000 as very high.".

If you get deposed, you are toast if you use such a ridiculous threshold for Pass/Fail.

Anyone Have a Suggestion How To Reduce the Pressure to Pass Bad Work?

- How about making sure that the Mold Remediation contractor leaves the entire home clean with a spore trap count that everyone would agree is Not Elevated.
- We do this by:
  - Exhausting dusts and contaminants outdoors during remediation. Then clean the air inside the containment after remediation.
  - After remediation, clean the floors and surfaces with a Swiffer. Make sure all surfaces are clean both within the containment and in the room adjacent to the contained area.
  - Use air scrubbers in the area directly outside of the containment.
  - And …. upgrade the home's air filter to MERV 13 **before starting work.**

Remediators: Keep High Quality Air Filters In Their Trucks.

- Keep a supply of 24x24 high quality (Merv 13 or APR 1550) air filters on hand. (www.filters-now.com).
- Cut them to exact size!
- Put them in the AC filter slot. Turn the AC FAN=ON. Run overnight before coming back to perform the PRV air sampling.

3M Filtrete Brand APR 1500

Accumulair Brand Merv 13.

Cut Filters to Exact Size

- Cannot easily cut filters with scissors or snips. They are wire reinforced fabric.
- We cut the filters to size with Wiss cutters (Home Depot).

Wiss brand snips do a great job cutting filters to size.