aerobioLogical Solutions Inc.

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Microbial Investigation & Remediation

A site visit was made on November 11, 2014 to inspect the property. A physical investigation was conducted before samples were taken. Dust samples were taken with a dry Swiffer cloth folded so the inner 1/9th of the flat side was exposed while wearing a surgical glove. Surfaces with dust were used since they were not growth sites and microbial particles had to be airborne to settle on these surfaces.

The ground floor sample was taken from office area. Samples were taken in the basement around at the end with the conference table and chairs rather than the end with the heating, ventilation and air-conditioning (HVAC) unit, sump pump and crawlspace. The 2nd floor sample was taken from the 2 rooms over the new addition with office space.

The samples were sent to Mycometrics LLC in New Jersey for mold specific quantitative polymerase chain reaction (MSQPCR) analysis for 5 specific species (HERTSMI-2) found to be the most relevant for the patients of Dr. Ritchie Shoemaker:

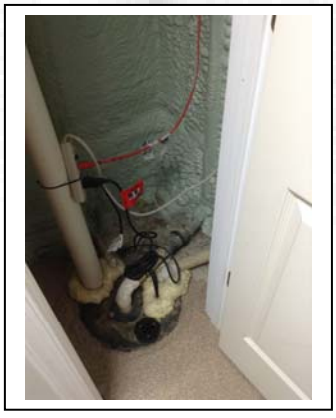
http://www.survivingmold.com/diagnosis/hertsmi-2

	Basement	**Ground floor**	**2nd floor**
Aspergillus penicillioides	1,500	100	69
Aspergillus versicolor	160	29	5
Chaetomium globosum	5	13	4
Stachybotrys chartarum	1	<1	Not Detected
Wallemia sebi	65	37	19
HERTSMI-2 score	**20**	**14**	**4**
Relevance	**High**	**Borderline**	**Low**

Results are given in spore equivalents per milligram dust analyzed. A spore equivalent is a theoretical amount of DNA for the average spore for the particular species even though the microbial fragments may have also originated as mycelia. PCR is the only commercially available way to identify microbial fragments as long as the correct PCR primer is used for comparison.

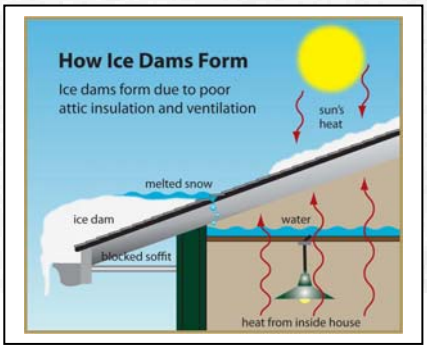
The heating, ventilation and air-conditioning (HVAC) in the basement had visible mold on the coils and a dirty drain-pan on the oldest unit. The HVAC unit in the crawlspace is also older and needing cleaning.

The sump pit in the basement closet has closed cell, spray foam insulation. It may be a respiratory issue if it was applied improperly or too much too soon. It's possible some basement contamination could be coming from the sump pit if it can communicate with the air. The pipe leak on the other side of the mechanical room has been resolved.



The basement has obvious waterproofing problems. The finished part of the basement may have mold at the bottom of the walls along the perimeter. The rear wall is the most likely source. The sample was taken at the opposite side of the basement from the mechanical room. This is the likely location of growth for Aspergillus versicolor, Chaetomium globosum and Stachybotrys chartarum. They are rare outdoors but common in paper, cardboard, paper-faced gypsum board, particle board and chipboard or oriented strand board (OSB). The really high levels of Aspergillus penicilliodes shows long-term humidity control problems.

The office area is an addition to the original structure. The roof has a flat section on the northeast corner. This is where snow accumulations will likely lead to ice damming which may cause water damage and mold.



The clothing dryer needs to be ducted and sealed to prevent the aerosolization of laundry lint which contains mold, moisture and food.

The humidifier needs to be removed if regular maintenance including filter changes doesn't occur. The filter is the most like microbial reservoir.

The crawlspace needs a more durable liner that does not cover the plumbing line.

1) Remove small contents needed in each area to be remediated (basement and office areas). It is better to remove small contents to avoid cross-contamination when performing remediation or demolition activities. Contents should be bagged and removed to clean outdoors. Contents should not re-enter the house until the basement is remediated to include the HVAC system including ducts, air cleaning as described below, surface cleaning and sealing of porous surfaces.

2) The baseboards should be removed in the basement to look for moisture damage. The most likely place is the wall facing the rear of the house due to past drainage issues. The amount of wall to remove will be determined by the contractor. Removal of gypsum board should only occur with a negative air pressure differential containment appropriately sized no more than 4 feet from the wall to create laminar flow as described in *Mold Remediation for Small Particles*.

3) The sump pumps should be sealed so there is no air exchange with the indoor environment. It looks sealed but, whoever installed this system should check it to ensure it does not communicate or exchange air with the indoor environment.

4) The Old HVAC should be replaced. The HVAC and ducting should be cleaned according to NADCA methods. No antimicrobials should be applied to the ducting. The inside of the coil cabinet can be cleaned with dilute Windex (1 part Windex to 7 parts water) to wipe until white glove clean with terrycloth towels.

5) The dryer exhaust needs to be sealed to prevent aerosolization of laundry lint and microbial particles.

6) The office area with the water damage should have a small negative air pressure containment placed on both sides of the wall. This will require moving some heavy office furniture. This is the leak location from the roof over the new office that may also impact the client's desk.

7) The humidifier filter should be changed or have the whole system removed if regular maintenance is not happening.

8) The crawlspaces should have a liner system installed with the brick vents closed. Drainage and a dehumidifier should be installed in each. All penetrations for HVAC ducting, electrical of plumbing should be

sealed with fire rated spray foam (orange in color). Please read *Crawlspace Liners* for more details.

19) The air should be cleaned by fogging AeroSolver Pure according to directions. Fogging disinfectants is dangerous since the US EPA did not take evaporation of liquid droplets into consideration when assessing safety based on inhalation toxicology studies required under the Federal Insecticide, Fungicide and Rodencide Act (FIFRA). Fogging hydrogen peroxide (H2O2) is dangerous because it remains H202 until it reacts with metals or sulfhydryl amino acids that are part of the protein in tissues like eyes and respiratory systems. The basement and ground floor are the target areas.

10) The surfaces should be damp-wiped with 10% alcohol. You can use 95% grain alcohol (Everclear from the liquor store). Mix 1 part grain alcohol with 8.5 parts water to yield 10% grain alcohol. This can be done by the contractor or client and volunteers. The workers should wipe in for directions with well wrung terry-cloth towels. Gentle surface friction is necessary to transfer particles from the surface to the terrycloth towels. Blue painters tape should adhere to smooth surfaces after drying if residues such as dust and cleaning products have been removed with damp wiping. There is no need for antimicrobials since it is not possible to kill allergens, inflammagens or mycotoxins.

11) The smooth surfaces should be wiped with dry Swiffer cloths to remove what damp wiping does not remove. This is a cleanroom technique. The industry HEPA sandwich is not used in cleanrooms for a reason based on science.

12) Porous surfaces should be sealed with paint such as the concrete floor or any painted surfaces without washable paint. Surface porosity increases particle adhesion forces such as electrostatic energy and van der Waals force. Wood framing and bare gypsum board surfaces can be sealed with a clear sealer or Elmers wood glue diluted (1 part to 19 parts water) and vigorously stirred with a mechanical paint stirrer before applying with a pump sprayer with a fine mist. They can be found in a garden center. This accomplishes the same thing as using penetrating encapsulent for asbestos abatement.

13) The job is not complete to allow post testing until these 4 criteria are met. These testing methods can be performed by workers,

surpervisors, clients and the independent 3rd party performing post testing. All surfaces should be white glove clean/blackglove clean. There should be no visible dust when surfaces are viewed with a bright light such as flashlight. Blue painters tape should adhere to smooth surfaces. There should be no chemical odors or fragrances detectable.

14) Post testing will be done with a total surface dust sample marking a square meter of floor space with blue painters tape to take the vacuum samples with pre-weighed polycarbonate cassette samples. 39 1/3 inches equals 1 meter. The cassette will need a small Tygon tube inserted over the inlet with a 45 degree cut to vacuum the surface without scratching the surface and creating more particles that have no bearing on the contractor's efforts. The results should be 25 mg of dust per square meter or less unless infiltration can be seen with test results.

15) There may be a need for further cleaning outside these areas if the clients notice a difference or medical results dictate.

16) HERTSMI-2 samples can be taken by the client for medical purposes after the project has been complete for 1 month to allow for normal infiltration of air and dust to bring the composition of dust to normal dilutions of the 5 species of mold.

Please refer to *Mold Remediation for Small Particles* for further details. Most remediation standards and guidelines are based on methods that work with spore trap air samples. However, spores/conidia settle with gravity. I have contractors pass a total surface dust test as described in the AIHA book, *Recognition, Evaluation & Control of Indoor Mold* in the section written by Phil Morey, PhD Microbiologist & CIH. This is a vacuum sample with a pre-weighed polycarbonate cassette. The lab weighs the cassette and also does a wetmount view with a light microscope of the fine dust.

The air cleaning and surface cleaning should be done to the crawlspace and upper structure since mold creates small particles that travel with air currents as it dries. These particles can't be identified with a light microscope. The testing to show these microbial fragments with mold specific quantitative polymerase chain reaction (MSQPCR: genetic) is expensive:

Aerosolization of Particulate (1→3)-β-d-Glucan from Moldy Materials

In: *Applied Environmental Microbiology* (February 2008)
American Society of Microbiology, Washington DC

SC Seo, Tiina Reponen, et al University of Cincinnati

These are the important points in the study:

1) Mold spores or conidia settle with gravity. The study gives 2 examples of common water damage mold spores or conidia for reference. Aspergillus versicolor conidia (spore) with an aerodynamic diameter of 2.4 micrometers settles 1 meter in 96 minutes or 2 inches during a 5 minute spore trap air sample. Stachybotrys chartarum conidia (spore) with an aerodynamic diameter of 4.6 micrometers settles 1 meter in 26 minutes or 7.5 inches during a 5 minute spore trap air sample. The capture zone challenged with a smoke pencil is the size of a golf ball plus anything that settles from above this capture zone.

This is why I don't use quiescent spore trap air samples. They should not be used for post remediation verification unless the air is stirred with a paint spray shield. It can be cleaned with a dry Swiffer cloth before and after each sampling location in different rooms or outdoors. (http://www.homedepot.com/p/Trimaco-SuperTuff-14-in-x-28-in-Paint-Shield-06135/202061355)

2) Mold needs air movement to move from the growth site. (Mold along an external wall is going to have air currents when the wind blows on the outside of the structure using Bernoulli's law to explain the chimney effect.)

3) Mold needs to dry to produce the microbial fragments.

4) These particular beta glucans were measured for the particle because they are thought to comprise 60% of the cell wall structure for mold while being unique to mold. There are only so many ways to identify mold. Particles of mold often times can't be identified with a microscope unless they are large particles with specific shapes or take a special dye used in mycology. Mold also has other inflammagens, allergens and possible mycotoxins in the particles.

I am giving some background to show where the confusion between environmental science, microbiology and medicine exists. Some people suffer from allergic reactions with mold for various reasons. Health effects from mold commonly accepted can be found in *Guidance for Clinicians for the Recognition and Management of Health Effects Related to Mold Exposure and Moisture Indoors* (funded by the US EPA):

http://oehc.uchc.edu/clinser/mold%20guide.pdf

Various authorities from the National Academy of Sciences Institute of Medicine, the American College of Occupational & Environmental Medicine and others consider mycotoxin exposure from indoor environments ranging from more research needed to questionable. The ACOEM states:

When produced, mycotoxins are found in all parts of the fungal colony, including the hyphae, mycelia, spores, and the substrate on which the colony grows. Mycotoxins are relatively large molecules that are not significantly volatile36,37; they do not evaporate or "off-gas" into the environment, nor do they migrate through walls or floors independent of a particle. Thus, an inhalation exposure to mycotoxins requires generation of an aerosol of substrate, fungal fragments, or spores. Spores and fungal fragments do not pass through the skin, but may cause irritation if there is contact with large amounts of fungi or contaminated substrate material.38 In contrast, microbial volatile organic compounds (MVOCs) are low molecular weight alcohols, aldehydes, and ketones.39 Having very low odor thresholds, MVOCs are responsible for the musty, disagreeable odor associated with mold and mildew and they may be responsible for the objectionable taste of spoiled foods.39,40 - See more at: http://www.acoem.org/AdverseHumanHealthEffects_Molds.aspx#sthash.atDnLQJ3.dpuf

Spores, mycelial or hyphal fragments are not the main vector for mold causing illness with inhaled myctoxins. They settle with gravity. However, mold can produce exudates or guttates which may contain high levels of mycotoxins. *Mycopathologia* is the oldest peer-reviewed science journal specific to mold starting in 1938 or t 76 years ago. *Mycologia* is the other journal of note specific for mold. This particular study from Manfred Garies in Germany shows the exudate or guttate is where the mycotoxins are highly concentrated rather than the spores/conidia, mycelia or hyphae. Allergens and imflammagens (beta

glucans) can be found in these solid parts of mold colonies. The ACOEM statement "*Mycotoxins are relatively large molecules that are not significantly volatile36,37; they do not evaporate or "off-gas" into the environment*" from 2011 is nullified with these words from the 2007 study:

Results of our study demonstrate that the strains investigated are able to produce up to 110 ll guttation droplets per culture within 10–14 days of cultivation on CYA. Although not all droplets could be collected with the microliter syringe and therefore many of the tiny droplets remained on the mycelium, HPLC analyses demonstrated very high levels of OTA and OTB in the exudate as compared with the underlying mycelium.

http://www.springer.com/life+sciences/microbiology/journal/11046

These guttate or exudate droplets will rise to the surface of growth areas just like they do in a petri dish in a laboratory setting when there is high water activity. Water activity or A_w is the measure of available water on the growth surface rather than the measure of available water in the air known as relative humidity or RH. The droplets start small and get larger as growth occurs under high water activity as long as there are no air currents to dislodge them.

The best analogy in biology to explain guttates (exudates) is the maple trees that produce maple syrup (guttate). When there is a lot of rainfall: There is a lot of maple syrup due to high water activity in the soil. When there is a less water: there is less maple syrup or guttate. One of the prevailing theories is root pressure drives the guttate upwards. A nice picture of exudate or guttate can be seen on the cover of *Guidance for Clinicians for the Recognition and Management of Health Effects Related to Mold Exposure and Moisture Indoors:*

http://oehc.uchc.edu/clinser/mold%20guide.pdf

Mold colonies in Petri dishes produce visible exudate droplets after the colony starts to produce spores in the older part or the middle of the colony. In Petri dish cultures, the moisture will get too low to produce guttates (exudates) as the mold grows outward. This can be measured since Petri dishes with nutrient agar have a known amount of water. This is where risk assessments are based for mycotoxin production. However, nobody can tell you how much water activity leading to mycotoxin production can occur from soil in a crawlspace, leaking basement, moldy HVAC coil, leaking window, etc.

So the take away is simple. The exudate droplets will aerosolize as droplets or crystalline structure when pressurized such as a leaking window, water damaged exterior wall, HVAC coil, humidifier, crawlspace, etc. As the growth surface dries, the exudate droplets will shrink in size from evaporation. The potential mycotoxin content will then be concentrated as an air current lifts or aerosolizes the crystallized particles that were formerly droplets.

This is very similar to a nebulizer or atomizer used to dispense medication or fragrance. You have a liquid that is pressurized to be aerosolized into the air. The droplets will also contain some slow evaporating compounds such as ergosterol and polysaccarides to act as surfactants which are common to many extracellular biofilms produced by organisms. Bacteria produces a different sterol or lipid that functions the same. Polysaccarides are used commercially to product Listerine® breath strips that dissolve on the tongue.

http://blog.mycology.cornell.edu/2012/07/04/i-ate-fungus-slime-and-it-made-my-breath-minty-fresh/

The exudate is the problem just like pathogenic bacteria produces exudates with exotoxins that cause the real health problems in the human body. The only difference is bacterial exudates in the body are not airborne for inhalation. Macrophages in the lungs have solvent action to carry the particles into the blood stream.

Many known mycotoxins are not water soluble and require a solvent for extraction in chemical analysis such as methanol or acetonitrile for chemical analysis. This also means fogging water will have very limited impacts for removing these types of crystalline droplets from the air since the chemical constituents have low water miscibility.

Dust from contaminated building material may also become airborne contaminants when demolition activities are done in a sloppy manner or contractors don't understand the limitation of air cleaning devices. There have also been studies with Fusarium mold on corn plants where the mycotoxins are excreted into the substrate through the roots or hyphae. The same thing happens with mold growing on surfaces such as paper-gypsum board removed with electrical cutting tools to produce high dust levels. This is why you hear more complaints after remediation when the quiescent spore trap air samples look acceptable.

Spores settle with gravity. People normally don't live on the floor so, air sampling for spores can only tell you what type of mold may exist. Some think it is best if you go to the genus and species level and take many samples at a high cost in lab fees. People who take air samples for dose response relationships generally don't understand the limitations due to Stokes Law, Reynolds number, curvilinear motion or gravity. The same people believe air cleaning devices actually solve the problem as they cite government or industry guidelines or standards. Just remember the industry standard or legal standard of care once held the theory that Earth was flat based on circumstantial evidence with little to no understanding of physics.

I filmed this quick video to show how anyone can see the extremely limited capture zone for air scrubber devices including negative air machines (NAMs). This device is manufactured by Honeywell with claims to clean a 390 square foot room. It exhausts from the top or outer edge. In reality, it does than than 10 cubic feet of air space.

http://www.youtube.com/watch?v=zpxLCZEJmpA

I have done the same thing with professional 2,000 CFM machines. If the filter is on the side, it cleans from 2 to 8 feet from the filter depending on filter loading. The largest NAM used by the industry really only cleans about 50 cubic feet of air. I took this testing technique from cleanroom engineering. This is similar to one of the methods used to test fume hoods (ASHRAE Standard 110) or biosafety cabinets (NSF/ANSI Standard 49) for worker safety along with an anemometer to measure wind speed or velocity. This test method was repeated with a real negative air pressure differential containment in an average room measuring 180 square feet or 1,440 cubic feet with negative pressure differentials well in excess of the minimum -0/02 inches of water column. We had extreme pressure differential as high as -0.15 inches of water column:

http://www.youtube.com/watch?v=zpxLCZEJmpA

I use a child's toy because it is harmless. This can be done easily for a court or classroom. You have to wonder why no one has stepped forwards from all the organizations that have mold remediation guidelines or standards. I'm sure there are many industrial hygienists and engineers who have knowledge of these test methods and deal with mold remediation.

The methods used today came from cleanrooms during the Eisenhower administration with the only change being a portable HEPA filtration device. This includes asbestos abatement which is where a technology transfer occurred for mold remediation. The industry is using "turbulently controlled cleanrooms" when they erect containments rather than "unidirectional cleanrooms". It is next to impossible to control small particles that float in the air with Brownian motion (0.5 micrometers or less in diameter) if you use the turbulent or conventional cleanroom approach. It can be done to a degree if the personnel are highly trained and understand how to use smoke pencils, anemometers and laser particle counters.

It is important to note unidirectional cleanrooms create laminar flow with air so the wind speed measures between 60 and 120 feet per minute or 0.3 to 0.6 meters per second. This is due to some basic physics concepts for fluid dynamics that will also explain why the airscrubbers and NAMs don't work too well:

1) Particles have a resistance or drag force as they travel through the air. Just because the air is moving does not mean the particles in Brownian motion are moving at the same rate of speed. This is partially explained with Stokes Law:

http://en.wikipedia.org/wiki/Stokes%27_law

2) There is turbulence for air as it passes over a particle to predict turbulent or laminar flow. This is predicted with Reynold's number which is basic to Stokes Law. This is one reason why unidirectional cleanroom operate between 60 and 120 feet per minute or 0.3 to 0.6 meters per second. Reynolds number is part of the Stokes equation. Most particle are not aerodynamic and have high Reynolds numbers which slows their travel in the air:

http://en.wikipedia.org/wiki/Reynolds_number

3) Some particles have aerodynamic shapes that make it hard to travel a straight path. This is called curvilinear motion and the reason you need a minimum air speeds for air filtration devices to have any impact for cleaning the air. The perfect analogy is a glider which needs a certain speed to fly but loses control at higher speeds and follows the inertia.

http://web.mst.edu/~reflori/be150/FloriNotes/curvilinear_motion_intro.htm

4) Most people think they do a good job based on spore trap air samples which are used for particles measuring 2 micrometers in diameter (smallest conidia or spore from mold) or larger. This means it does not tell you about smaller particles that don't settle with gravity. A 2.4 micrometer (aerodynamic diameter) conidia (spore) from Aspergillus versicolor will settle in approximately 96 minutes per meter (3 feet and 3 1/3 inches). We generally don't crawl around on the floor so; the information from spore traps is not useful as far as estimating dose. Spore traps and culturable air samples are good for see rank order issues or marker organisms.

Our air cleaning method is based on US Patent #7,951,227 with other pending patents in the same area. AeroSolver Pure (www.AeroSolver.com) is formulated for chemically sensitive people and those who don't want odors or fragrances. It is mostly water with food grade glycerol and sodium borate (Borax). It is used to clean the air after demolition without negative air machines or air scrubbers running. It is fogged with a B & G flexalite fogger (common to the industry) with approximately 50 micrometer droplets for the sake of gravity when supersaturation or 101% RH is met just like rain. The main physics principles to explain airborne particle capture is *gradient* or *shear coagulaiton* which is also used in industrial smoke stack with venturi wet scrubbers. The slow, sweeping motion of the fogger creates a more complex form of *gradient* or *shear coagulaiton* called *turbulent coagulation* which is also how small droplets collide in clouds to create larger rain drops that rapidly settle.

After demolition with or without containment, the contractor will fog diluted AeroSolver Pure with a slow, sweeping motion for 2 minutes per 100 square feet. The contractor will move around in a manner like a lawn sprinkler rotating. The fogging plume will visually seem to grow longer as the humidity increases. The goals is to clean the air not blast the walls, moving farther away from walls will occur so the plume just reaches the walls.

The contractor will immediately follow with the same time period with plain water since the dry air infiltrating will cause the RH to fall below supersaturation or 101% RH. This causes the droplets to shrink in size since the water molecules are leaving the droplets faster than re-

attaching (Kelvin Kohler effect) which lead to droplets with higher concentration of glycerol and sodium borate or Borax floating in the air once below 40 micrometers in diameter. This is how people get poisoned by EPA registered disinfectants and other products since EPA risk assessments did not take droplet evaporation into consideration with inhalation toxicology studies required under FIFRA. This is how fogging with a product with a small percentage of thymol becomes a problem. Thymol is not that different from phenol with neurotoxicity. Fogging oxidizing compounds is even less brilliant.

This also explains how mycotoxins (SVOC), ergosterol (lipid or oil) and polysaccharides (surfactants) can remain airborne particles after the water molecules evaporate. Unfortunately, these particles need more than water

Adding the second step fogging with water allows the droplets to grow again as RH passes 101% so they rapidly settle with gravity leaving air and water molecules. In dry or winter heating climates the contractor will need to fog with water for 2 minutes per 100 square feet to temporarily raise the RH to 50% before fogging the AeroSolver Pure. These fogging steps with water would dilute any antimicrobial activity if not violate EPA label directions for the few products that can be fogged. It is also not possible to kill or sanitize mycotoxins, allergens or inflammagens. However, it is known you need something organic to bind to many mycotoxins if you look at how extraction is performed in chemistry. Fogging water will not do the trick if you have particles that don't absorb water. Mold is primarily composed of (1-3) beta glucans and chitin which are also water resistant. This means the recommendations by New York City to mist water to suppress mold is scientifically questionable.

One gallon of AeroSolver Pure 8X concentrate can clean a 5,000 square feet in structure with 8 feet tall ceilings in 4 to 6 hours with a couple of workers and foggers that retail for approximately $350 to $425. How many airscrubbers and/or NAMs would you need for a 5,000 square foot structure? What would that cost? Normally, insurance contractors charge from 4 to 6 cents per cubic foot for a single pass. This process has 2 foggings so you should expect 8 to 12 cents per cubic foot depending on quantity and frequency. The contractor will need a P-100 fitted respirator rated to protect against organic vapors (glycerol) by NIOSH. Washable clothing can be used for protective clothing since the formulation is just soapy water softer

than baby shampoo. Eye protection should not inhibit the ability to see since this may create tripping hazards.

The process has no odor when done correctly. If the workers do the process incorrectly, there will be a bakery like odor since glycerol is like sugar and Borax is like salt. It becomes easy for supervisors and IHs to quickly detect the problem so it can be fixed without lab testing. The process becomes a diagnostic tool so hidden reservoirs can be found. The product is not fogged in walls where a growth area may be hidden from a leaking window or replaced window no longer leaking. In my experience, the nose is almost as good as PCR testing when you remove the background odors that compete with each other. At this point, the contractor uses wet wiping followed by electrostatic wiping (dry Swiffer cloth) on smooth surfaces. Porous surfaces are sealed with an appropriate sealing agent ranging from floor wax to penetrating encapsulent depending on the substrate. I ask contractors not to use HEPA vacuums or airscrubbers after the air cleaning unless they can prove they don't leak according to the PHEAF book by Bob Brandys:

http://www.oehcs.com/

I peer-reviewed this book and gave some photos of air samples I took from the exhaust port of a highly respected manufacturer of a HEPA vacuum. I have a $4,000 microscope that I can attach a digital camera and feed the images to a video monitor for getting the best focus before taking a picture. PCR or ERMI testing can really show how bad the problem is with contractor or homeowner equipment.

I leave you with a sobering thought. No matter how clean we think we are, we still have the same dust cloud that surrounds Pigpen from Peanuts comic strip. You can dress in a cleanroom suit and the dust cloud will be attracted to you and follow wherever you go until the air is clean. Every time you move, the cloud moves. The cloud may contain particles you don't want to inhale.

Please call or email for any questions.

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