Nauset Environmental Services, Inc.

an Air Quality Company

28 August 2015

NES Job #899
Report No. **NES**/IAQ-15/1779

Katherine Smiley
92 Main Street
Home Town, MA 02222

Re: Post-remediation verification (PRV) inspection and sampling
at 39 Easy Street (The Cape)

Dear Ms. Smiley:

Nauset **E**nvironmental **S**ervices, Inc. (**NES**) is pleased to submit this letter report on a PRV mold inspection and sampling at 39 Bayridge Drive. Following initial verbal authorization, **NES** sent William Vaughan, PhD, QEP, CIEC to this property on 25 August 2015. This report is CONFIDENTIAL and proprietary and can only be distributed by or with the approval of the Clients to whom it is addressed.

BACKGROUND: Reportedly, there was a pipe break in the left, rear bathroom in February that was not found (due in part to the harsh winter of weather, precluding easy visits) until April '15, caused extensive damage to the ranch house at this address. Some contractor selected by the insurance company carried out a water damage response, gutting the most of the left side of the main floor to the studs and also "treating the basement for mold." In light of recent observations of visible mold growth (VMG) in the kitchen and central bathroom, **NES** was authorized to carry out PRV mold inspection and sampling to prior to beginning reconstruction.

EXECUTIVE SUMMARY: This PRV sensory inspection by **NES** found readily observed visible mold growth (VMG), known as **Condition 3** contamination, in the kitchen, on a vanity from the central bathroom and on sill boards in the front part of the house. There was a slight biological/moldy odor in the house, mostly the basement since some openings on the main floor allowed ventilation.

The air sampling revealed **unacceptable total spore levels** as well as *Aspergillus/Penicillium* spore levels under both quiet and fan-disturbed conditions **on the main floor, indicating a marginal remediation effort**. **The basement exceeded NES's PRV goal for of 1,000 S/m^3 of *Asp/Pen* – like spores for the general population in both the quiet and disturbed sample with the disturbed sample 300x NES's PRV goal.**

Additional mold remediation using aggressive "air polishing" is called for in the house.

ON SITE ACTIVITIES – Dr. Vaughan arrived at 39 Easy Street 25 August 2015 at about 09:40 am. Part owner, Kathie Smiley was present during this inspection and sampling. During this inspection Dr. Vaughan used a digital Tramex MRH III non-penetrating moisture meter and a calibrated Extech Hygro-Thermometer Pen (Model 445580) to measure temperature and relative humidity that is periodically calibrated to two known humidities. Photographs taken during the inspection are found in Attachment A.

HYPOTHESIS TESTING
After inspecting the general conditions in the building, Dr. Vaughan determined that an air sampling strategy was needed to assess possible residual elevated mold spores on the main floor and the basement to address the following hypothesis regarding possible residual environmental issues:

> Hypothesis A There **are** spore levels of concern following remediation in the this house, especially under disturbed conditions when **Condition 2**, settled spores, and spores from hidden mold growth, **Condition 3**, are suspended into the air.

The airborne mold spore samples were taken under both quiet and fan-disturbed conditions. Air samples were collected on Cyclex-d™ cassettes for microscopic analysis. [The expiration dates for the Cyclex-d™ cassettes used was April 2016.]

After the sampling flow rates were confirmed for the pumps at 20 lpm using a rotometer transfer standard (traceable to NIST via a BIOS DryCal calibrator), the interior air samples were taken for a timed ten-minute interval using a digital timer. The sampling locations were documented with photographs seen in Attachment A. A log sheet documented the activity and conditions during the sampling. No outdoor reference sample was taken since the focus was on indoor conditions.

The "disturbed" samples were taken after disturbing the surfaces in each area using a 12" fan set on high speed for a couple of minutes. The drafts from the fan also suspend the mold spores from hard-to-reach areas where they have settled but would be dislodged by occupant activities as well as spores from latent (not yet visible) mold growth. The disturbed sampling began following at least a 3-5 minute calm period that allows larger particles/debris to settle out of the air and minimize interference/obscurance on the collecting surface in the cassette.

The exposed and labeled air sample cassettes were combined with a completed chain of custody form and shipped to EMLab P&K, LLC. (Marlton, NJ). The air samples were designated for "Fungi - Spore Trap Analysis." The following perspective indicates why EMLab P&K, LLC was selected:

- "Because there is currently no governmental certification for environmental microbiology laboratories (except for drinking water and wastewater microbiology), EMLab P&K, LLC is an active participant in the EMPAT (Environmental Microbiology Proficiency Analytical Testing) program sponsored by the American Industrial Hygiene Association (AIHA). P&K has been formally accredited by the AIHA in Environmental Microbiology since July 1300 with a laboratory identification number of 103005."
- EMLab P&K is one the largest commercial analytical laboratories and is unique in that all of their analytical employees are degreed analysts, the majority with Masters or Ph.D.'s in mycology, microbiology or a related field.

- "EMLab P&K has modeled its quality control system after the ISO guidelines, one of the most stringent sets of international standards in the industry, to ensure that its customers receive the high standard of accuracy, reliability and impartiality that they have come to expect from a leader in the environmental industry."

OBSERVATIONS: Observations at 39 Easy Street during the 25 August site visit are provided below: [Directions - left-right and front-rear – refer to viewing the building from the street.]

General

- The weather was sunny and clear with light breezes. Temperature was about 80F with a high relative humidity at of essentially 100%.
- There was no noticeable biological/moldy odor noted on entering the building. However there was a slight moldy odor noted in the basement. [Moldy/biological odors come from *currently active* "microbial volatile organic compounds (MVOCs)" that are released from active colonies digesting the organic matter on which they are growing.] There was some ventilation on the main floor through a couple of sheathing openings and an open bathroom window in the left, rear near the leak.

Main floor

- Essentially all of the walls and ceiling had been removed from the left side of the house (see photos) exposing ceiling joists, studs and exterior sheathing.
- There was VMG at two locations in the kitchen (see photos) and on a vanity that had reportedly been removed from the central, "blue" bathroom BUT not the house (see photo)
- The flooring had been removed from most of this level exposing the plywood subflooring (see photos) except for the front living room area, where the hardwood flooring was still in place (see photos).
- The subfloor was barely "broom clean" as evidence by the high "4+" debris rating in the disturbed sample.
- The MM indicated unacceptably moist conditions (i.e. greater than 18% MC) in the subflooring across the floor with the following readings:
  - Kitchen readings of 20-22% moisture content (MC) on the wood scale.
  - Central, blue bathroom readings of 22-25% MC.
  - Left, front bedroom readings of 20-21% MC.

- Most contents had been removed to a PODS unit on the front lawn but with appliances and the vanity moved to the front half of the house (see photos).
- There were no containment barriers in place separating the main floor from the basement or areas of the main floor from one another.

Basement

- [This is where the remediator reportedly "treated" the basement as opposed to cleaning by physical mold removal – IICRC S520 (2008).]

- The basement was unfinished (see photos) with mostly hard goods still stored there.
- There was observable VMG remaining on many joists (see photos).
- There was a puddle on the floor in the left, rear cornet (see photo), reportedly from recent heavy rains.
- There was no dehumidifier in place in the basement.

- MM readings indicated elevated reading above 18% MC in joists tested (see photos).

Table 1 lists the sample locations for the total spore Cyclex-d™ air sampling for this round of PRV sampling. Table 2 summarizes the results of the microscopic analysis of air samples from this round of sampling. The EMLab P&K mold report is found in Attachment B. Attachment C describes the properties of the dominant spores and structures found.

Table 1 – Mold Spore Sampling Locations

(**Bold** sample numbers indicate disturbed air samples)

Sample #	Location	Comments
First floor		
899-1	Main floor left side (near leak)	quiet (T=76, RH=99%)
899-2	Main floor left side (near leak)	disturbed
899-3	Basement	quiet (T=73, RH=9%)
899-4	Basement	disturbed

DISCUSSION:

MOLD - There are several terms and concepts that should be explained before looking in detail at the data from these samples:

- CONTAMINATION -The terms Condition 2 and 3 used describe mold contamination are part of the August 2008 Institute for Inspection Cleaning and Restoration Certification (IICRC) S520-2008, "Standard and Reference Guide for Professional Mold Remediation." **Condition 2** involves evidence of settled spores from a contaminated area, a condition documented to some extent by "disturbed" air samples. **Condition 3** refers to "actual mold growth and associated spores … active or inactive, visible or hidden."

- OUTDOOR SPORES - While ALL molds ultimately originate in nature, outdoors, there are some molds that are referred to as "outdoor fungi." This term means that that they are found only outdoors because they depend on plants, other fungi or animals to complete their life cycle. Others need a complex ecosystem to complete their life cycle. These outdoor spores *may* be found indoors because they were transported there but hardly ever develop colonies indoors. These include the ascospores, basidiospores (some coming from mushrooms that develop in the wild) and rusts. When found indoors these "outdoor" spores indicate the space has been experienced air exchange with the outdoors, not growth in response to moist conditions.

- INDOOR SPORES - There are some molds that have adapted to a variety of food sources - organic debris, processed wood (i.e. cellulose, paper, etc.) and more - that are commonly found indoors - loosely referred to as "indoor spores," even though they initially came in from outdoors. With the proper level of damp to wet conditions some of them amplify/grow indoors and serve as moisture/leak indicators. In our area of southern New England, **NES** has found that the primary moisture/leak-indicators are the *Aspergillus* and

Penicillium molds (referred to as "*Asp-Pen* like" when their spores are counted under a microscope since their spores are indistinguishable). Less often **NES** has found that *Cladosporium*, the most abundant spore type found in outdoor air samples, can also amplify under moist conditions indoors and may serve as a secondary moisture/leak indicator.

- STANDARDS - Many people look for standards to compare mold readings to with the desire to define a healthy or unhealthy space. Obviously very high spore readings found by counting spores/structure in a collected sample under a microscope (**S/m^3** - spores/structures per cubic meter sampled) or colony readings found by counting the colonies that develop/grow on a nutrient media after sampled air has impacted that nutrient media (**CFU/m^3** - colony forming units per cubic meter) are undesirable. Because of the wide range of human sensitivities or allergic reactions to the irritants in/on mold spores AND the limited scientific research linking spore levels to various immune system reaction, no scientifically-based "standards" have yet been developed by medical or governmental agencies.

  [One medical commentary was issued in May 2004 by the Institute of Medicine (part of the National Academy of Sciences) in its report on "Damp Indoor Spaces and Health," in which they state, "there are no generally accepted health-based standards for acceptable concentrations of fungal (mold) spores, hyphae or metabolites in the air." However, there is informal guidance from industrial hygienists and some allergists to try to keep indoor spore levels below 1,000 S/m^3 in order to minimize the irritation for the *general* population. Some have suggested that a "healthy" level be considered at 500 CFU/m^3 or 500 S/m^3. **NES** uses 1,000 S/m^3 of *Asp/Pen* like spores as its informal guideline for the general population (see explanatory note at www.NausetEnvironmental.com) and 500 S/m^3 of *Asp/Pen* like spores for sensitized individuals. Sensitized or allergic individuals may well be irritated and react at levels well below that guideline level. More information can be found on mold and health at the Centers for Disease Control and Prevention website - http://www.cdc.gov/mold/dampness_facts.htm.]

- DEBRIS RATING - This column in the Attachment B data report for the Cyclex-D spore trap results is an evaluation of the "non-biological debris on the impact area examined by the microscopist." As more non-biological debris is plated on the impact area during the sampling, it coats and covers spores laid down earlier so that the microscopist cannot see/count the spores. Hence, higher debris ratings indicate difficulty in determining the number/type of spores collected on the sticky surface of the impact area. In addition, the more debris, the greater the chance that a spore would miss a sticky area and NOT even be collected. Hence, higher debris ratings lead to *under counting* of spores actually in the air.

Looking at the data from Attachment B extracted into Table 2, one sees that

- The quiet sample in the main floor (#899-1) had a total mold spore concentration of 2,300 S/m^3. 28% of this reading were common outdoor spores – ascospores (1%), basidiospores (24%) and Cladosporium (3%). Asp-Pen-like spores were elevated at 1,600 S/m3 –160% of NES's informal guideline (see above) for the general population and also the goal for satisfactory PRV conditions. [Asp-Pen like spores are irritating to

allergic or sensitized individuals. They are also a common indicator of indoor mold growth in response to **wet/moist conditions; so NES** looks for trends/patterns in those values in particular to see what the indications and implications are for the occupied space.] **Hence this reading indicates a failure of NES's PRV goal.**

Table 2 – Airborne Spore Levels (see Attachment B)
(**Disturbed sample numbers and results** are indicated by **bold** type.
Concentrations are expressed as spores/structures per cubic meter, S/m^3.)
(Highlight indicates unacceptable levels above **NES**'s goal for successful remediation)

Sample #	Total	Breakdown of dominant species (~80%)
Main floor		
899-1	2,300	Ascospores (20) –1%, ***Asp-Pen* like (1,600) – 70%,** basidiospores (560) – 24%, *Cladosporium* (80) –3%
899-2	**5,200**	Ascospores (40) – 1%, ***Asp-Pen* like (4,800) – 92%,** basidiospores (260) –5%, *Cladosporium* (80) – 2%
Basement		
899-3	140,000	Ascospores (NONE) – 0%, ***Asp-Pen* like (140,000) – 100%,** basidiospores (NONE) – 0%, *Cladosporium* (NONE) – 0%
899-4	**300,000**	Ascospores (NONE) – 0%, ***Asp-Pen* like (300,000) – 100%,** basidiospores (NONE) – 0%, *Cladosporium* (NONE) – 0%

NOTE: "*Asp-Pen* like" refers to *Aspergillus* and *Penicillium* spores that are indistinguishable under the light microscope. The symbol "<1%" is read as "less than 1%."

- The total spores in the disturbed, worst case sample in the **main floor** (#899-2) increased 2.25-fold to 5,200 S/m^3. Now 92% of this higher reading were *Asp-Pen*-like spores at 4,800 S/m^3 – 4,800% of **NES**'s informal guideline (see above) for the general population and also the goal for satisfactory PRV conditions. **This disturbed sample also fails NES's PRV goal**. The 3-fold increase in *Asp/Pen*-like spores is an indication of the presence of **Condition 2**, settled spore contamination.

- The quiet sample in the **basement** (#899-3) had an extremely elevated total mold spore concentration of 140,000 S/m^3, all of which were *Asp-Pen*-like spores – 1,400 % of **NES**'s informal guideline (see above) for the general population and also the goal for satisfactory PRV conditions. **This quiet sample definitely fails NES's PRV goal**.
- In the disturbed, worst case sample in the **basement** (#899-4) **the *Asp-Pen*-like spores more than doubled to an extremely unsatisfactory 300,000 S/m^3**. A very strong indication of **high levels of Condition 2 settled spores** and a **GROSS FAILURE** of any earlier remediation.

There were no *Stachybotrys* spores detected during this sampling. *Stachybotrys* is the "toxic black mold" mentioned heavily in the media.

NOTE also: The "debris rating" was "2+" for three of these air samples. It was **"4+" for the "disturbed" sample on the left side** of the main floor. As noted above, this rating is an indication of non-biological matter that has plated on the collection slide during the sampling, covering up some of the surface and preventing the microscopist to view/count some spores (see header for Attachment B). The rating of "2+" indicates "up to 25% obscurance of those sample slides, meaning that the actual values were not affected significantly by the debris and the numbers reported should be considered representative. The **"4+" debris rating indicates that 76-90% of the sample trace was obscured, leading to a likely undercount of spores present in #899-2.**

SUMMARY & DISCUSSION

The sensory/instrumental inspection of this house indicate biological growth at this time, **Condition 3 contamination**.

The moisture readings indicated **unacceptably damp conditions** in the subflooring on the main floor and in basement structures, calling for additional structural drying

The hypothesis testing by air sampling ***CONFIRMED* hypotheses A for these samples, especially in the basement** (meaning PRV conditions were UNACCEPTABLE).

> Hypothesis A There **are** spore levels of concern following remediation in this house, especially under disturbed conditions when **Condition 2**, settled spores, and spores from hidden mold growth, **Condition 3**, are suspended into the air.

The hypothesis **testing indicates that post-remediation spore levels in this house show elevated presence of the moisture indicator *Asp/Pen* like spores, especially in the basement, calling for additional remediation activity throughout the house.**

RECOMMENDATIONS:

It is important to realize that moisture and biological growth are intimately linked. Moisture/leak control is essential since **even a 99.9+% effective mold remediation effort will leave spores behind that will multiply and produce new colonies if additional water/moisture is provided**! Hence this SOW includes moisture-control items as a priority as well as possible mold remediation measures.

MOISTURE

- Operate at least two commercial dehumidifiers on *each* level to dry the structure till the wood frame, sub flooring, and joists read at least 18% MW at several locations, particularly the bedrooms and kitchen. DO NOT RELY ON RELATIVE HUMIDITY TO INDICATE ADEQUATE STRUCTURAL DRYNESS.
- Once returned to occupancy, see dehumidifier recommendation below.

SEQUENCE OF STEPS IN REMEDIATION AND AIR POLISHING:

In light of the Condition2 and Condition 3 contamination in this house, it and its contents should be cleaned by a professional mold mitigator. An appropriate mold remediation

professional would be one with remediation training and individual credentials recognized by the American Council on Accredited Certification (www.acac.org) and/or the IICRC (www.iicrc.org).

In particular:

- The two levels should be isolated from one another by a plastic containment barrier at the stairs to allow of separate evaluation of the remediation effort on each level.
- Any workers in the house should wear respiratory and clothing protection per the general guidance of IICRC S520-2008 Section 8 and Chapter 6.
- **All air scrubbers should be cleaned from the previous job** AND, *most importantly*, checked (preferably using a particle counter to document its collection efficiency) to be sure that the HEPA filter in each unit is seated/sealed properly to ensure that particles are being captured and NOT recirculated!

- The few contents on the main floor are appliances and should be removed and stored elsewhere and blown off with an air hoes and wiped down IF they will be retained. The vanity should be discarded.
- The contents in the basement are mostly hard goods as well. Those that will be retained should be HEPA vacuumed and wiped down before being stored under plastic sheeting to protect them during cleaning activities.

- Each level should be contained under negative pressure before being cleaned under the general guidance of IICRC S520-2008 Section 12 and Chapter 14.including,
    - In the kitchen, all the remaining drywall should be removed, bagged and discarded.

    - HEPA vacuum ALL surfaces on each level.
    - Wipe down with moldicide and seal the more impacted areas as appropriate.

Take a final step to remove settled spores by "polishing the air." This step is especially important for areas that are contaminated with settled spores, as this basement is, and the goal is to significantly reduce these settled spores. The "air polishing" steps are:

- TURN OFF NEGATIVE AIR so that spores are not drawn in from adjacent, uncleaned areas.
- Set up two - four air scrubbers on each level, as opposed to operating in the negative air mode. This work can proceed in sequence on each level to allow efficient use of equipment. [NOTE: Continuing the use of negative air at this time can draw in spores from adjacent uncleaned areas, reducing the effectiveness of the prior cleaning effort.]
- Set up 6-8 oscillating fans *across each half of each level* to minimize stagnant air zones. Direct them to sweep the floor and other horizontal surfaces to minimize settling.
- Periodically, 1-2 times a day, use a leaf blower to stir up the settled spores left over after the remediation activities above so that they can eventually be moved to the air scrubbers on drafts from the fans and be filtered out of the air. **BE CAREFUL NOT TO DAMAGE THE INTEGRITY OF THE ISOLATION BARRIERS WITH THE STRONG DRAFTS SINCE THAT WOULD SPREAD CONTAMINATION, defeating the purpose of this entire effort.** At the same time,

re-orient the oscillating fans to sweep new areas and re-direct the exhaust from the air scrubber to blow over different surfaces.
    - Operate the oscillating fans and air scrubbers for at least 48-60 hours on each, periodically revisiting the areas for leaf blower mixing and **ALSO** repositioning the smaller fans and scrubber exhaust.
    - Operate the oscillating fans and air scrubbers **an ADDITIONAL 24 HOURS AFTER the last aggressive leaf blowing** to reduce the cloud of stirred-up spores.

- Turn off all fans/scrubbers at least 12 hours before any post-remediation air sampling is scheduled to allow particles to settle into a "normal" quiet state.

Post-remediation sampling - To confirm the success of the remediation effort, post-remediation verification air sampling *could* be carried out in the basement *BEFORE removing any containment* per IICRC S520. [This post-remediation verification (PRV) sampling also needs to be carried out in a timely fashion, preferably within a few days to a week of the effort, so that ensuing moisture/humidity does not have a chance to mask an acceptable effort by regrowth. IF the space is kept dehumidified, the PRV effort can extend to a week or two.] The PRV effort *should be carried out BEFORE any remodeling/renovation* to minimize the likelihood of enclosing residual spores behind new surfaces. The goal for a successful remediation would be that that the moisture/leak indicator spores, *Aspergillus/Penicillium* like spores, are below 1,000 S/m^3 for the disturbed samples and preferably closer to 500 S/m^3 to protect sensitized individuals and that *Stachybotrys* is found at no more than single digit spore levels in a single sample

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To avoid problems with mold in the future, be attentive to any and all water intrusion or condensation issues, taking general advice from The Mold Survival Guide for Your Home and for Your Health by Jeff and Connie May (2004). In particular:

- Respond quickly to correct any leaks that may develop or become evident.
- Turn off the water to the washing machine ANY TIME you leave for several days since rubber hose failure can occur in any season and cause massive water damage! **Better still**, treat the water valve as if it were a "switch" and turn off the water after each washing.
- Operate an Energy Star-rated dehumidifier on the floor of the basement throughout the year with adequate separation from solid objects and in conjunction with a small bilge pump in the collection bucket or a condensate pump outside the unit that discharges the collected water to a suitable drain. The goal is to lower the humidity below 60%, so a modest dry setting is usually sufficient. Periodically clean the unit's filter following the manufacturer's instructions.

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The above discussion and recommendations are related to background information provided and the conditions visually observable at the time of **NES**'s site visit on 25 August 2015 and are thus limited to these activities and timeframe. Future events and changes in the condition and operation of the building may well alter the conditions for biological activity/growth, especially moisture. Such changes will alter the relative significance of these recommendations and the effectiveness of their implementation. Thus the impact of such changes and cannot be considered part of the scope of this report/work.

I trust the above information is sufficient for your current needs. Please call us with any questions or to clarify points.

Very truly yours,

William M. Vaughan, PhD, QEP, CIEC
President, Senior Scientist
QEP=Qualified Environmental Professional (since 1994)
CIEC=Council-certified Indoor Environment Consultant (#0608142)

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Attachment A

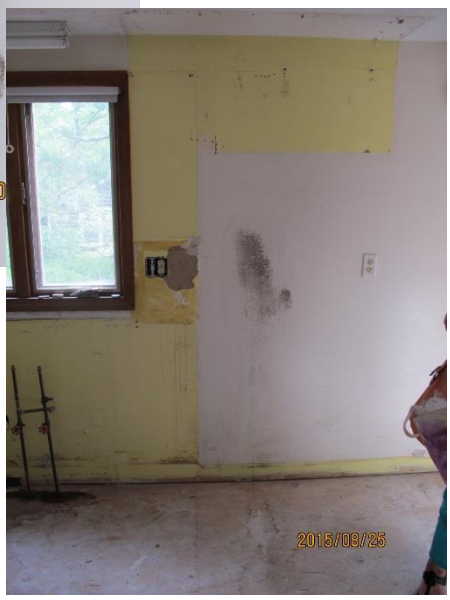
Photographs Taken During the Inspection & Sampling

Inspection photos

39 Easy Street

Main Floor

Kitchen



Looking into left, front bedroom over vanity from central bathroom

VMG on rear of vanity and on sill board

Left, rear bedroom off bathroom with leak

Bathroom where leak occurred at rear sink

Sub floor in kitchen reading22+% MC

Subfloor in bathroom reading 24+ MC

MM reading of 21+% MC in left, from bedroom

Basement

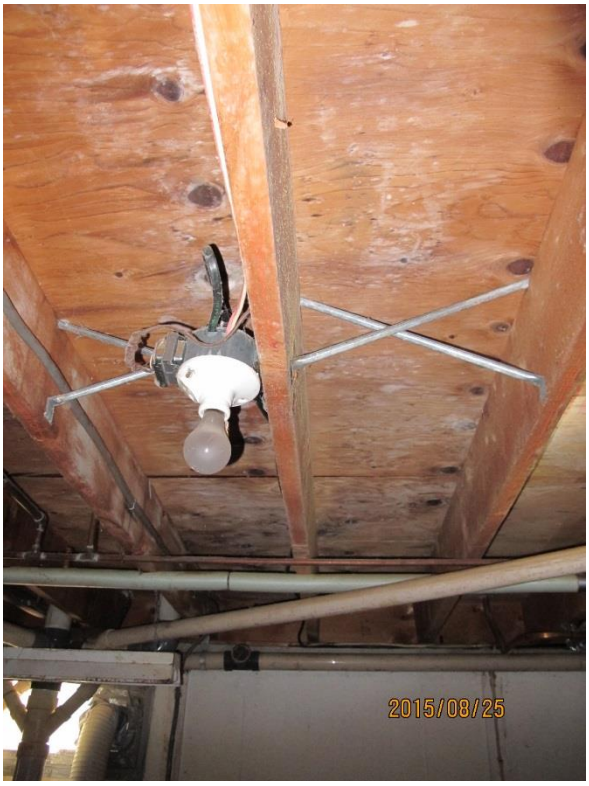
Basement – front wall

Basement – rear wall

Puddle in Left, rear corner

Right, rear corner under kitchen

Visible mold growth



Unacceptable MM reading of 20.y% MC in joist

Elevated RH reading of 99.7% at 25F

Sampling Locations


2015/08/25


2015/08/25

ATTACHMENT B

Laboratory results from EMLab P&K, LLC

The "Debris Rating" column in the data report is an evaluation of the "non-microbial debris on the impact area examined by the microscopist. Here is a summary of the meaning/significance of those codes.

Non-Microbial Particulate Debris Rating	Description	Interpretation
0	No particles detected in impaction line area.	No particulates on slide in impaction line area. The absence of particulates could *indicate improper sampling or a blank sample*, as most air samples typically contain some particulates
1	Minimal non-microbial debris present.	Reported values are *not affected by debris*.
2	Up to 25% of the trace occluded with non-microbial particulates.	Non-microbial particulates can mask the presence of fungal spores. As a result, *actual values could be higher than the numbers reported*. Higher debris ratings increase the probability of this bias.
3	26% to 75% of the trace occluded with non-microbial particulates.	
4	76% to 90% of the trace occluded with non-microbial particulates	
5	Greater than 90% of the trace occluded with non-microbial particulates.	Sample *could not be read due to excessive debris*. Reported concentrations are estimations calculated from the number of spores observed on the perimeter of debris. The sample should be collected at shorter time interval, or other measures taken to reduce the collection of non-microbial debris.

The Limit of Detection is the product of a raw count of 1 and 100 divided by the percent read. The analytical sensitivity (counts/m3) is the product of the Limit of Detection and 1000 divided by the sample volume.

*All AIHA accredited laboratories are required to provide raw counts of fungal structures in spore trap reports. These counts are defined by AIHA as "Actual count without extrapolation or calculation". The number in parentheses next to the fungal type represents the exact number (or raw count) of fungal structures observed.

‡ A "Version" greater than 1 indicates amended data.

§ Total has been rounded to two significant figures to reflect analytical precision.

EMLab P&K
3000 Lincoln Drive East, Suite A, Marlton, NJ 08053
(866) 871-1984 Fax (856) 489-4085 www.emlab.com

Client: **NAUSET ENVIRONMENTAL SERVICES**
C/O: William M. Vaughan
Re: 899; **Smiley PRV**

Date of Sampling: 08-25-2015
Date of Receipt: 08-26-2015
Date of Report: 08-27-2015

SPORE TRAP REPORT: NON-VIABLE METHODOLOGY

Lab ID-Version‡ Location	Air vol. (L)	Background Debris	Counts of Fungal Structures	Fungal Structures/m3	Presumptive Fungal ID (raw counts*)	Percentage
6514631-1 08/27/2015 **899-1** **Rear bedroom - Quiet**	200	**2+**	3 4 112 1 16 1 328 1	15 20 560 5 80 5 **1,600** 5 § **Total: 2,300**	Alternaria (3) Ascospores (1) **Basidiospores** (28) Chaetomium (1) Cladosporium (4) Curvularia (1) **Penicillium/Aspergillus** types (82) Pithomyces (1)	1 1 **24** < 1 3 < 1 **70** < 1
Comments:						
6514632-1 08/27/2015 **899-2** **Rear bedroom - Disturbed**	200	**4+**	1 8 52 1 16 1 1 960 4 1	5 40 260 5 80 5 5 **4,800** 20 5 § **Total: 5,200**	Alternaria (1) Ascospores (2) **Basidiospores** (13) Chaetomium (1) Cladosporium (4) Epicoccum (1) Myxomycetes (1) **Penicillium/Aspergillus** types (240) Pithomyces (4) Rusts (1)	< 1 1 **5** < 1 2 < 1 < 1 **92** < 1 < 1
Comments:						
6514633-1 08/27/2015 **899-3** **Basement - Quiet**	200	**2+**	3 28,200	15 **140,000** § **Total: 140,000**	Chaetomium (3) **Penicillium/Aspergillus** types (282)	< 1 **100**
Comments:						
6514634-1 08/27/2015 **899-4** **Basement - Disturbed**	200	**2+**	59,400	**300,000** **§ Total: 300,000**	**Penicillium/Aspergillus** types (594)	**100**
Comments:						

Background debris indicates the amount of non-biological particulate matter present on the trace (dust in the air) and the resulting visibility for the analyst. It is rated from 1+ (low) to 4+ (high). Counts from areas with 4+ background debris should be regarded as minimal counts and may be higher than reported. It is important to account for samples volumes when evaluating dust levels.

The analytical sensitivity is the spores/m3 divided by the raw count. The limit of detection is the analytical sensitivity multiplied by the sample volume divided by 1000.

*All AIHA accredited laboratories are required to provide raw counts of fungal structures in spore trap reports. These counts are defined by AIHA as "Actual count without extrapolation or calculation". The number in parentheses next to the fungal type represents the exact number (or raw count) of fungal structures observed.

‡ A "Version" indicated by -"x" after the Lab ID# with a value greater than 1 indicates a sample with amended data. The revision number is reflected by the value of "x".
§ Total has been rounded to two significant figures to reflect analytical precision.

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Attachment C

Ecology and Pathology of Species Reported

NOTE: Characteristics of the major species found at levels above 10% and listed above have been collected from the University of Minnesota, Dr. Fungus and EMLab P&K, LLC websites.

ascospores

ECOLOGY - A general category of spores that have been produced by means of sexual reproduction. Many ascospores can germinate and later produce asexual spores (conidia). To further complicate matters, some asexual fungi can also become sexual under specific conditions, these are considered ascomycetes.

PATHOLOGY - This generalized group contains potential opportunistic pathogens and toxin producers. They are suspected allergens, though not yet proven.

Aspergillus species

ECOLOGY – Spores from this genus are commonly found in outdoor air, but less frequently than *Cladosporium, Penicillium,* Basidomycetes or yeasts. (Their spores are difficult to differentiate from *Penicillium* spores hence they are reported with those spores when only microscopic identification is requested, rather than culturing.)

PATHOLOGY – Of the more than 150 species and varieties of *Aspergillus*, some are known to cause diseases in animals and humans. Several species are commonly isolated in buildings. Many *Asp.* Species can produce mycotoxins depending on the substrate on which they are growing. Antigens of *Asp.* species are available commercially.

basidiospores

ECOLOGY - Sexual spores from a variety of molds that do not thrive in the indoor environment.

PATHOLOGY - Some basidiospores have been shown to cause allergies and asthma.

Cladosporium sp.

ECOLOGY - They are the most commonly identified outdoor fungus (48-60 species). The most common ones include *Cladosporium elatum*, *Cladosporium herbarum*, *Cladosporium sphaerospermum*, and *Cladosporium cladosporioides*. *C. herbarum* is the most frequently found species in outdoor air in temperate climates. Since it is a "dry" spore formed in very fragile chains, it is easily dispersed, hence often found in air samples. The outdoor numbers are reduced in the winter and are often high in the summer. While often found indoors their numbers are less than outdoor numbers, implying that the outdoor environment is the source of these spores. Indoor *Cladosporium* sp. are commonly found on the surface of fiberglass duct liner in the interior of supply ducts, on windows with occasional condensation and on wall surfaces in high humidity conditions or occasional condensation. A wide variety of plants serve as food sources for this fungus. It is found on dead plants, woody plants, food, straw, soil, paint and textiles. They are common in soils, dead organic matter and the air. These fungi can decompose cellulose and are considered "ubiquitous."

PATHOLOGY - The ability to sporulate heavily, ease of dispersal, and buoyant spores makes this fungus the most important fungal airway allergen; causes asthma and hay fever in the Western hemisphere. They are a rare human pathogen. They can cause mycosis and produce greater than 10 antigens (initiators of allergic response) available commercially. They are a common cause of extrinsic asthma (immeadiate-type hypersensitivity: Type I allergen), Type III hypersensitivity pneumonitis: hot tub lung, moldy wall hypersensitivity, etc. Acute symptoms include edema and bronchiospasms, chronic cases may develop pulmonary emphysema.

***Penicillium* sp**.

ECOLOGY - A wide number of organisms have placed in this genus and they are well studied because of their value as producers of antibiotics. Identification to species, among the 200 or so identified to date, is difficult and expensive. They are often found in aerosol and soil samples. They are a ubiquitous saprophyte (meaning they live on dead or decaying organic matter) and "are found everywhere." They are commonly found in temperate regions in soil, food, cellulose and grains as well as on living vegetation. They are also found in paint and compost piles and soils. They are commonly found in water-damaged dry wall, damp latex paint, carpet, wall paper, and on interior fiberglass duct insulation. (Their spores are difficult to differentiate from *Aspergillus* spores hence they are reported with those spores when only microscopic identification is requested, rather than culturing.)

PATHOLOGY - They may cause hypersensitivity pneumonitis and/or allergic alveolitis in susceptible individuals. They are reported to be allergenic (skin). Some species can produce mycotoxins. They are a common cause of extrinsic asthma (immeadiate-type hypersensitivity: type I). Acute symptoms include edema and bronchiospasms, chronic cases may develop pulmonary emphysema. Can cause allergic reactions to sensitized people and are associated with mycotic keratosis in humans.

Molds - www.epa.gov/iaq/molds [provides link to mold resources]

Building Sciences - http://www.buildingscience.com/resources/more-topics/mold/

Centers for Disease Control**:** http://www.cdc.gov/mold/dampness_facts.htm

Minnesota Department of Health: Mold in Homes
http://www.health.state.mn.us/divs/eh/indoorair/mold/index.html