

March 13th, 2017

**Limited Scope Fungal (Mold) Sampling & Physical/
Moisture Inspection Report**

**Lowcountry Apartments, #2F
71 Meandering Road
Spanish Moss, South Carolina 29000**



Prepared By:

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Executive Summary

Salem Environmental (“Salem”) was requested by XYZ Management, Inc. (“XYZ”) to perform a moisture inspection, physical survey, and Indoor Air Quality (IAQ)/surface sampling in Apt. 2F after recurring tenant complaints over the last 13+ months. In February 2016 Salem had inspected the same unit, and extremely poor housekeeping (aka “Occupant Behavior” - hereafter referred to as “OB”) had caused surface growth throughout the apartment.

As noted, active surface spore growth was confirmed in February 2016. IAQ sampling for fungal spores the same day indicated a “Normal Fungal Ecology” (“NFE”) IAQ environment before remediation by XYZ personnel. Post-remediation IAQ testing performed in April 2016 also confirmed “NFE” conditions.

On March 10th, 2017, the same inspector returned to the apartment to conduct the survey. Housekeeping had improved, but fungal growth of *Cladosporium* had returned on the daughter’s bedroom ceiling where it had been remediated in 2016. Minor growth was also present around the master bath’s exhaust fan, and there was still staining on windowsills and around all five windows. There was also dust buildup on insulation inside the air-handling unit (“AHU”).

Results from the IAQ testing indicated a “NFE” environment with the exception of one “raw” spore of *Stachybotrys chartarum* in the master bedroom sample.

Background, Site Description & Inspection Summary

As noted above, two visits were made to this unit in early 2016. In February 2016 OB included drying of towels on doors, failure to wipe condensate from windows (that settled on sills to amplify growth), and placement of furniture that blocked windows. Heavy growth was present in every room except the kitchen and bathroom.

The apartment is a 3BR/2BA unit. Carpet is present in the living room and bedrooms; vinyl is elsewhere. Housekeeping was adequate and much better than last year.

As was the case in 2016, discoloration remains around all windows and on sills (Photos #7520, 7523, 7524, 7526, 7528 & 7530). In the Master BR a brownish water stain was present on its sill that was not present in 2016, and the chest of drawers has only been moved out around 6-8” more from the window.

A stain of 4-5 sq in above the window on the daughter’s bedroom ceiling had recurred (#7511) and was larger than in 2016 (#2785). Infrared camera (“IRC”) imaging with a FLIR B-CAM™ showed a temperature differential of 3.0-3.9° F. in that area. When a variation of 3.0° F.+ is present, it suggests that a hidden moisture reservoir caused by plumbing leakage or water infiltration could be occurring. The discolored areas were then checked with a Extech MO-290® handheld moisture

meters with a 2-prong attachment. The relative materials moisture in the discolored areas ranged from 11.4-12.4%; 6" from the discoloration the range was 10.1-10.3%.

Going outside, the vented soffit at this window was viewed (#7517). There were no gaps or staining seen. Roughly 18" right of the window the HVAC system's insulated refrigerant line enters the soffit (#7518 & 7519). There appears to be a small gap around that line.

There was also discoloration around the master bath's exhaust fan (#7533); its area was <2 sq in. In the hall bath water staining that was present next to the exhaust fan in 2016 remained (#7539).

The air-handling unit (AHU) was inspected last. It has moderate dust buildup on insulation (#7535 & 7536). Filtration is a MERV-5 rated woven fiberglass element. Underneath the AHU and beside the water heater there was significant dust accumulation (#7538).

Sampling Protocol & Results

Air samples were collected and handled per standard industry procedures. Environmental Science Corp. (ESC), an American Industrial Hygiene Association EMLAP (Environmental Microbiological Laboratory Acceptance Program) certified facility, performed the analyses. Chains of Sample Custody were completed to document each event. Shipment to ESC was by next morning airfreight. The Chains of Sample Custody ("COSC") & Sample Results accompany this report. Both surface and air samples were analyzed by direct microscopy.

The two 2016 events are presented first with last week's results ensuing.

IAQ/SURFACE SAMPLING, 2/16/16

ESC assigned an ID of #L818086 to this event; reference photos are included in this report. Climate data were recorded at the time of IAQ sampling with the MO-290 meter, as follows:

Location	°F.	RH*	GPP/AH**
OUT	54	58%	36
2F - at AHU	71	48%	53

*- RH = Relative Humidity; **- GPP/AH = Grains Per Pound/Absolute Humidity (total water weight in air; 1 lb. = 7,000 Grains)

RH of >60% and AH >70 GPP will foster accreted mold spore growth when elevated for extended periods of 3+ days.

A surface swab sample (**#2F-SW**) was collected from a discolored area (#2795). The swab was removed from a sealed, sterile packet and rolled over a 2 sq in area. It was then inserted into a sterile, self-locking tube with moistened cotton in its end to prevent detachment of particulates. The following table supplies its location & results:

Location	Spore Type	Concentration
Master BR Door	Yeasts	Moderate
"	Cladosporium	Light
"	Chaetomium	Very Light

Collection of air samples was done with a Buck BioAire® sampling pump that was calibrated to 15 liters/minute before sample collection (#2778). Sampling media were Allergenco-D® biocassettes. Sample duration was 5 minutes (75 liters/sample). After collection, all IAQ cassettes were placed into protective bubble wrap packets and labeled for shipment. As samples were not cultured, results are reported in combined live and dormant counts as spores per cubic meter (s/M3). Air sample locations were the following:

- **#OUT: Outside, behind Office**
- **#2F: Next to AHU (#2779)**

The IAQ sample was collected with the HVAC system operating at least 5 minutes before starting. Notable IAQ spore counts and most common types were the following, expressed in s/M3*:

Parameter	OUT	2F
Ascospores	480	-
Basidiospores	930	150
Chaetomium	-	-
Cladosporium	13	180
Penicillium/Aspergillus	13	130
Stachybotrys chartarum	-	-
TOTAL SPORES	1,400	600

*- Per EMLAP guidelines ESC can round to the nearest 10, 100 or 1,000

IAQ SAMPLING, 4/1/16

ESC assigned an ID of #L827137 to this event; reference photos are in this report. It had rained heavily overnight (0.5"+), stopping minutes before sampling. Climate data were recorded at the time of IAQ sampling with the MO-290 meter, as follows:

Location	°F.	RH	GPP/AH
OUT	73	91%	88
2F - at AHU	72	69%	79

Collection of air samples was done with a Buck BioAire® sampling pump that was calibrated to 15 liters/minute before sample collection. Sampling media were Allergenco-D® biocassettes. Sample duration was 5 minutes (75 liters/sample). After collection, all IAQ cassettes were placed into protective bubble wrap packets and labeled for shipment. As samples were not cultured, results are reported in combined live and dormant counts as spores per cubic meter (s/M3). Air sample locations were the following:

- **#OUT: Outside, behind Office**
- **#2F: Next to AHU**

The IAQ sample was collected with the HVAC system operating at least 5 minutes before starting. Notable IAQ spore counts and most common types were the following, expressed in s/M3*:

Parameter	OUT	2F
Ascospores	4,100	13
Basidiospores	9,500	910
Chaetomium	-	-
Cladosporium	-	53
Penicillium/Aspergillus	53	67
Stachybotrys chartarum	-	-
TOTAL SPORES	14,000	1,000

*- Per EMLAP guidelines ESC can round to the nearest 10, 100 or 1,000

IAQ/SURFACE SAMPLING, 3/10/17

ESC assigned an ID of #L895451 to this event. Climate data were recorded during sampling with the MO-290 meter, as follows:

Location	°F.	RH	GPP/AH
OUT	61	74%	60
Near hall in LR	70	56%	61

The thermostat was set on 71° F. at the time of sample collection. It had rained around 1/4" overnight and quit approximately two hours before outdoor air sample collection.

A surface swab sample (**#2F-SW**) was collected from a discolored area on the ceiling of the daughter's bedroom (#7516). The swab was removed from a sealed, sterile packet and rolled over a 2 sq in area. It was then inserted into a sterile, self-locking tube with moistened cotton in its end to prevent detachment of particulates. The following table supplies its location & results:

Spore Type	Concentration
Cladosporium	Heavy

Collection of air samples was done with a Buck BioAire® sampling pump that was calibrated to 15 liters/minute before sample collection (#7506). Sampling media were Allergenco-D® biocassettes. Sample duration was 5 minutes (75 liters/sample). After collection, all IAQ cassettes were placed into protective bubble wrap packets and labeled for shipment. As samples were not cultured, results are reported in combined live and dormant counts as spores per cubic meter (s/M3). ESC assigned a project ID of #L817806 to these samples. Air sample locations were the following:

- **#OUT: Outside, behind building (#7515)**
- **#LR: Living Room (#7507)**
- **#MBR: Master BR (#7514)**
- **#DBR: Daughter's BR (#7509)**

All IAQ samples were collected with the HVAC system operating at least 5 minutes before starting. Notable IAQ spore counts and most common types were the following, expressed in s/M3*:

Parameter	OUT	LR	MBR	DBR
Ascospores	1,800	13	67	160
Basidiospores	10,000	240	93	250
Chaetomium	-	-	-	-
Cladosporium	200	53	360	370

Parameter	OUT	LR	MBR	DBR
Penicillium/Aspergillus	13	80	80	13
Stachybotrys chartarum	-	-	13	-
TOTAL SPORES	12,000	490	820	980

*- Per EMLAP guidelines ESC can round to the nearest 10, 100 or 1,000

In addition there were five spore types present in IAQ that were not in the outdoor baseline. None had a spore count higher than 110 s/M3.

Findings & Conclusions

These are based on our March 10th, 2017 inspection with reference to the two 2016 events. IAQ and surface sampling is done to assure that an “NFE” environment exists. To that end certain criteria must be met or a definite trend must be established to indicate that NFE will be achieved before occupancy. Salem presents the following with regard to those items:

1. Ideally, Total Spores in IAQ should be 10-12% of the baseline; the range was from 4.1 to 8.2%.
2. *Penicillium/Aspergillus* should not exceed the outdoor count; however, “NFE” is generally considered present if less than 700-750 s/M3. This was achieved in all three IAQ samples.
3. *Chaetomium* was not trapped but *Stachybotrys chartarum* was in #MBR at a trace level of 13 s/M3. These are “water-loving” molds that can produce toxins. As well, one of the five spore types not in the baseline was *Ulocladium*, another “water-loving” mold. But, it is neither a toxin producer nor notable allergen.
4. All other spore types and counts in IAQ are at “NFE” conditions, being either fewer than the outdoor baseline or at counts considered historically low.
5. All three IAQ sampling events exhibited “NFE” conditions.
6. The RH & AH levels indoors were slightly below thresholds that will amplify spore growth but not spore types that are notable allergens.
7. The surface swab sample confirmed “Heavy” relative levels of *Cladosporium*. It is an allergen that requires higher than normal water activity.
8. IRC screening was positive for excess materials moisture on the ceiling area in the daughter’s bedroom. However, testing with the MO-290 was negative for excess moisture.
9. There is still staining around windows and sills. In the master bedroom there is a brownish water stain that was not present in 2016.
10. Moderate particulate accumulation is present on insulation inside the AHU. Filtration used is a low efficiency element.

In the daughter’s bedroom it is likely that insulation is not spread thick enough above the area of fungal growth. This creates a direct interface between damp outdoor air and warm indoor air that fosters the growth confirmed by ESC. In the master bath

tenant could not be operating the exhaust fan during shower use. However, both areas of growth are minuscule, and materials moisture levels are “normal” where staining is present.

The water staining on the master bedroom windowsill indicates that condensate is not being wiped by tenant. This has led to a recurrence of dark growth on sills and around the windows.

The only slightly deficient sample result, *Stachybotrys chartarum*, is at a trace level. Water source is unknown. It must have 90%+ humidity for 8-20 days to germinate.

Recommendations

Scrape the popcorn ceiling where discolored. Clean and coat the areas of growth with sanitizer, growth retardant and stain blocker paint. Tenant MUST wipe accumulated condensate from windows and sills or growth will recur.

HEPA vacuum the interior of the AHU and apply a growth retardant after cleaning with a sanitizer wipe. Fog the duct system for 5-6 minutes with sanitizer. Place a MERV-11 or 12 quality element in the AHU.

Disclaimer, Warranty & Limitations

This report is intended to be read in its entirety. Unread portions are at the discretion and choosing of the person(s) reading this document.

Salem Environmental warrants that this limited scope fungal/moisture inspection and sample collection survey was conducted with adherence to standard industry procedures and protocol. Our Scope of Work was based on site conditions at the time of inspection on March 10th, 2017 and referencing conditions/data from 2016, as well as information supplied by XYZ.

No medical, engineering or legal opinions as defined under South Carolina Statutory Law or Administrative Code are stated or implied herein. The Project Manager’s SOQ accompanies.

Salem assumes that ESC correctly identified, calculated and transposed spore types and counts to the best of their professional ability. If they alter their data in any form after the date of this report, Salem reserves the right to change this report to reflect such alterations.

Health effects from fungal spores vary widely individually. There are no federal, local or state threshold limit values for exposure to spore types. Consultation with an experienced medical professional is recommended if there are concerns with the spore types and counts collected in the surface and IAQ samples .

This report is the exclusive property of XYZ Management, Inc. once payment in full is received; reliance on and release of this report is at their discretion. Salem will not release to any third party without XYZ's approval prior to that time. Please contact the undersigned at 704/737-0407 or via email with any questions or comments.

Sincerely yours,

Harvey C. Danner, Jr.
President/Project Manager

Lowcountry Apts 2F_insp 03-13-17.pdf

03/14/17 Photos



Living Room, left window

IMG_7542



daughter's bedroom ceiling

IMG_7544



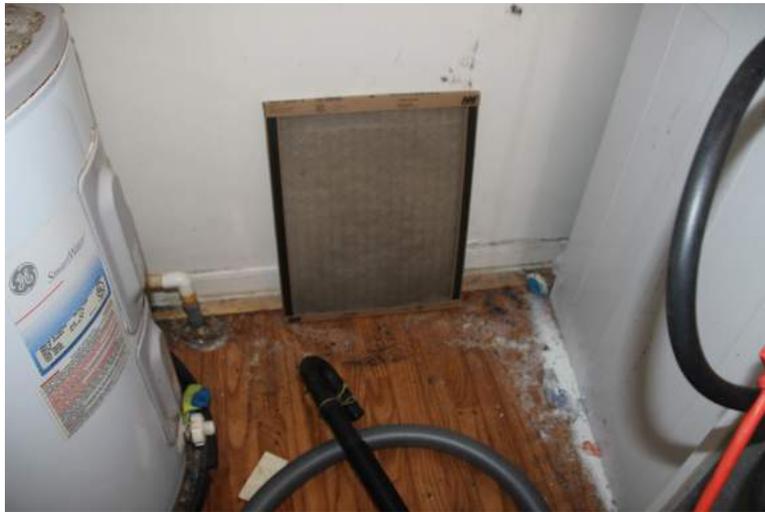
Daughter's bedroom window

IMG_7546



Damaged AHU coil

IMG_7547



Floor under washing machine

IMG_7549



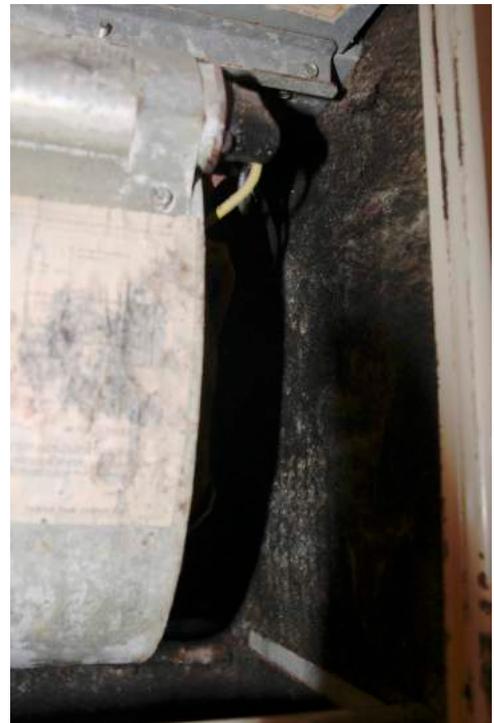
IMG_7552

Insulation after treatment



IMG_7553

Insulation after treatment



IMG_7556

Insulation after treatment



Master bedroom sill staining

IMG_7558



Master bedroom window after treatment

IMG_7562



Master bedroom window after treatment

IMG_7565



#LR-R

IMG_7566



#DBR

IMG_7567



#SBR

IMG_7568



#MBA

IMG_7569



IMG_7571

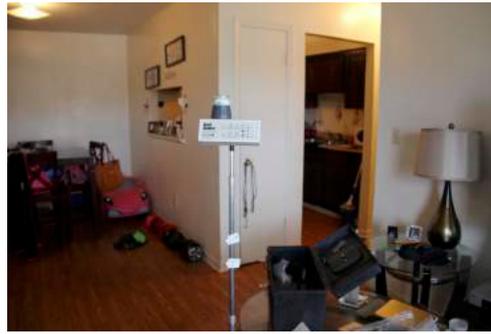
#MBR

03/10/17 Photos



Pump calibrated to 15 L/min

IMG_7506



#LR

IMG_7507



#DBR

IMG_7509



Discoloration on Daughter's BR ceiling

IMG_7511



#MBR

IMG_7514



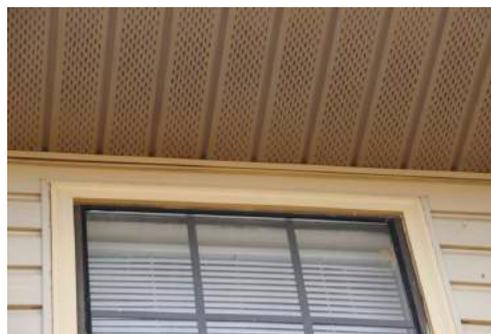
#OUT

IMG_7515



#SW-D

IMG_7516



Window/soffit, Daughter's BR

IMG_7517



With insulated refrigerant through soffit

IMG_7518



Closeup of refrigerant line

IMG_7519



Right LR window

IMG_7520



Left LR window

IMG_7523



Daughter's window

IMG_7524



Daughter's window

IMG_7526



Son's window

IMG_7528



Master BR window

IMG_7530



Master Bath exhaust fan

IMG_7533



Right side, AHU interior

IMG_7535



Left side, AHU interior

IMG_7536



Left of water heater under AHU

IMG_7538



Old staining in Hall Bath exhaust fan

IMG_7539