SanAir Technologies Laboratory

The Identification Specialists

Analysis Report
prepared for
Univ. of Tennessee Environmental Health & Safety

Report Date: 9/24/2018

Project Name: 9/ 19 South Carick [redacted]

Project #: 9/ 19 South Carick

SanAir ID#: 18042754

1551 Oakbridge Dr. Suite B | Powhatan, Virginia 23139-8061
888.895.1177 | 804.897.1177 | fax: 804.897.0070 | IAQ@SanAir.com | SanAir.com

SanAir ID Number
18042754
FINAL REPORT
9/24/2018 3:50:58 PM

Name: Univ. of Tennessee Environmental Health & Safety
Address: 1425 Tee Martin Dr, 414 East Stadium Hall
Knoxville, TN 37996
Phone: 865-974-5084

Project Number: 9/ 19 South Carick
P.O. Number:
Project Name: 9/ 19 South Carick [redacted]
Collected Date: 9/19/2018
Received Date: 9/21/2018 10:00:00 AM

Dear Keith Price,

We at SanAir would like to thank you for the work you recently submitted. The 2 sample(s) were received on Friday, September 21, 2018 via FedEx. The final report(s) is enclosed for the following sample(s): 2, 1.

These results only pertain to this job and should not be used in the interpretation of any other job. This report is only complete in its entirety. Refer to the listing below of the pages included in a complete final report.

Sincerely,

L. Claire Macdonald
Microbiology Laboratory Manager
SanAir Technologies Laboratory

Final Report Includes:
- Cover Letter
- Air Cassette Analysis
- Disclaimers and Additional Information

Sample conditions:
- 2 samples in Good condition.

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Analyst: Smith, Kiersten

Air Cassette Analysis

ND = None Detected. Blank spaces indicate no spores detected.

SanAir ID Number	18042754-001			18042754-002		
Analysis Using STL	105C			105C		
Sample Number	1			2		
Sample Identification	Room [redacted]			Outside		
Sample Type	Air Cassette - Air-O-Cell			Air Cassette - Air-O-Cell		
Volume	75 Liters			75 Liters		
Analytical Sensitivity	13 Count/M³			13 Count/M³		
Background Density	1+			1+		
Other	**Raw Count**	**Count/M³**	**%**	**Raw Count**	**Count/M³**	**%**
Dander	340	4533	n/a	65	867	n/a
Fibers	8	107	n/a			
Mycelial Fragments				9	120	n/a
Pollen				3	40	n/a
Fungal Identification	**Raw Count**	**Count/M³**	**%**	**Raw Count**	**Count/M³**	**%**
Alternaria species				21	280	3
Ascospores	4	53	6	98	1307	12
Aspergillus/Penicillium	17	227	25	12	160	1
Basidiospores	18	240	27	220	2933	27
Bipolaris/Drechslera				2	27	< 1
Cercospora species				147	1960	18
Cladosporium species	24	320	36	229	3053	28
Curvularia species	1	13	1	10	133	1
Epicoccum species				3	40	< 1
Fusarium species				15	200	2
Nigrospora species				12	160	1
Pithomyces species				4	53	< 1
Polythrincium species				1	13	< 1
Smuts/Myxomycetes	3	40	4	42	560	5
Torula species				1	13	< 1
TOTAL	**67**	**893**		**817**	**10893**	

Signature: K. Smith Date: 9/24/2018 Reviewed: L. Claire Macdonald Date: 9/24/2018

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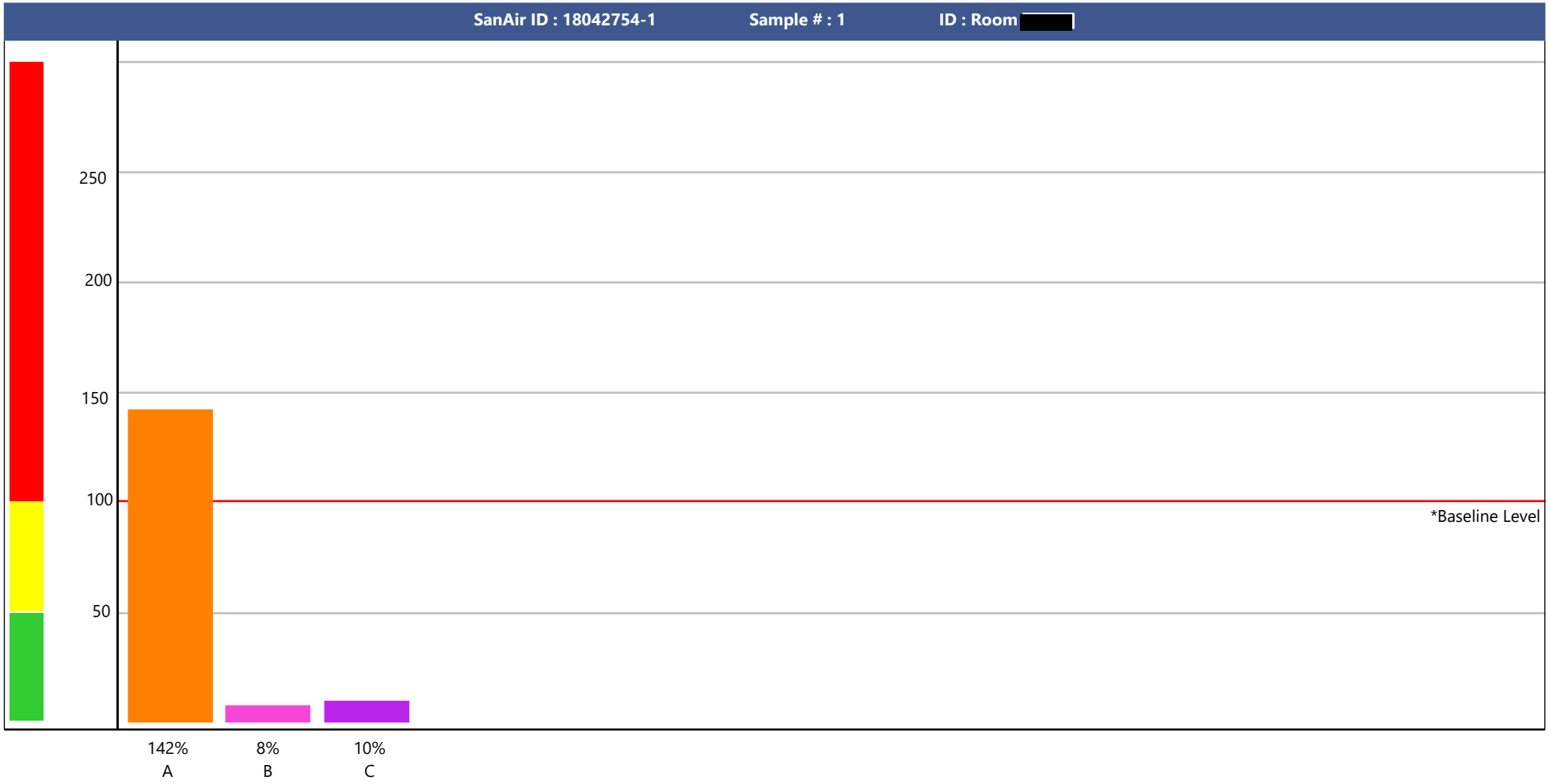
Analyst: Smith, Kiersten

Air Cassette Analysis - Spores % of Outside Air



*The Baseline Level (100%) represents the average baseline sample counts. Counts above the baseline may indicate higher than expected levels of a given result.

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Organism Descriptions

The descriptions of the organisms presented are derived from various reference materials. The laboratory report is based on the data derived from the samples submitted and no interpretation of the data, as to potential, or actual, health effects resulting from exposure to the numbers of organisms found, can be made by laboratory personnel. Any interpretation of the potential health effects of the presence of this organism must be made by qualified professional personnel with first hand knowledge of the sample site, and the problems associated with that site.

Dander - Comprised of human and/or animal skin cells. Counts may be higher in carpeted rooms and in rooms with more traffic.
Health Effects: May cause allergies.

Fibers - This category can include clothing, carpet, and insulation fibers.

Mycelial Fragments - A mycelium (plural = mycelia) is the "body" of a fungus. It is a collective term for hyphae (singular = hypha), which are the tubular units of the mycelium usually composed of chitin. The terms hyphae and mycelial fragments are used interchangeably. [This information was referenced from the mycology text "The Fifth Kingdom"]In some cases a fungal identification cannot be obtained due to lack of sporulation. Only the mycelial fragments are present, and cannot be identified without the distinguishing characteristics of the spores or the structures they grow from.
Health Effects: Allergic reactions may occur in the presence of spores (conidia) or mycelial/hyphal fragments.

Pollen - Produced by trees, flowers, weeds and grasses. The level of pollen production can depend on water availability, precipitation, temperature, and light. Pollen is usually dispersed by either insects or the wind.
Health Effects: Mostly effects the respiratory tract with hay fever symptoms but has also been shown to trigger asthma in some people.

Alternaria species - This genus compromises a large number of saprobes and plant pathogens. It is one of the predominate airborne fungal spores indoor and outdoor. Outdoors it may be isolated from samples of soil, seeds, and plants. It is one of the more common fungi found in nature, extremely widespread and ubiquitous. Conidia are easily carried by the wind, with peak concentrations in the summer and early fall. It is commonly found in outdoor samples. It is often found in indoor environments, on drywall, ceiling tiles, in house dust, carpets, textiles, and on horizontal surfaces in building interiors. Often found on window frames.
Health Effects: In humans, it is recognized to cause type I and III allergic responses. Because of the large size of the spores, it can be deposited in the nose, mouth and upper respiratory tract, causing nasal septum infections. It has been known to cause Baker's asthma, farmer's lung, and hay fever. It has been associated with hypersensitivity pneumoniti, sinusitis, deratomycosis, onychomycosis, subcutaneous phaeohyphomycosis, and invasive infection. Common cause of extrinsic asthma (immediate-type hypersensitivity: type I). Acute symptoms include edema and bronchiospasms, chronic cases may develop pulmonary emphysema.
References: Flannigan, Brian, Robert A. Samson, and J. David Miller, eds. Microorganisms in Home and Indoor Work Environments: Diversity, Health Impacts, Investigation, and Control. London and New York: Taylor & Francis, 2001.

Ascospores - From the fungal Subphylum Ascomycotina. Ascospores are ubiquitous in nature and are commonly found in the outdoor environment. This class contains the "sac fungi" and yeasts. Some ascospores can be identified by spore morphology, however; some care should be excercised with regard to specific identification. They are identified on tape lifts and non-viable analysis by the fact that they have no attachment scars and are sometimes enclosed in sheaths with or without sacs. Ascomycetes may develop both sexual and asexual stages. Rain and high humidity may help asci to release, and dispurse ascospores, which is why during these weather conditions there is a great increase in counts.
Health Effects: This group contains possible allergens.

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Aspergillus/Penicillium - These spores are easily aerosolized. Only through the visualization of reproductive structures can the genera be distinguished. Also included in this group are the spores of the genera Acremonium, Phialophora, Verticillium, Paecilomyces, etc. Small, round spores of this group lack the necessary distinguishing characteristics when seen on non-viable examination.
Health Effects: Can cause a variety of symptoms including allergic reactions. Most symptoms occur if the individual is immunocompromised in some way (HIV, cancer, etc). Both Penicillium and Aspergillus spores share similar morphology on non-viable analysis and therefore are lumped together into the same group.

Basidiospores - From the Subphylum Basidiomycotina which contains the mushrooms, shelf fungi, and a variety of other macrofungi. They are saprophytes, ectomycorrhizal fungi or agents of wood rot, which may destroy the structure wood of buildings. It is extremely difficult to identify a specific genera of mushrooms by using standard culture plate techniques. Some basidiomycete spores can be identified by spore morphology; however, some care should be exercised with regard to specific identification. The release of basidiospores is dependant upon moisture, and they are dispersed by wind.
Health Effects: Many have the potential to produce a variety of toxins. Members of this group may trigger Type I and III fungal hypersensitivity reactions. Rarely reported as opportunistic pathogens.

Bipolaris/Drechslera - Found on grasses, grains, various plants, and decaying food. May grow in semi-dry environments. Some species are found in indoor environments. Because of the microscopic similarities between the two genera, they are grouped together on non-viable analyses.
Health Effects: Can occasionally cause corneal infection of the eye. This group of fungi constitutes the most commonly reported causes of allergic fungal sinusitis. They produce type I fungal hypersensitivity in humans.
References: St-Germain, Guy, and Richard Summerbell. Identifying Filamentous Fungi: A Clinical Laboratory Handbook. California: Star Publishing Co., 1996.

Cercospora species - Plant pathogen. Cercospora tends to grow on leaves. (Genera of Hyphomycetes, 1980)
References: J.W. Carmichael, W. Bryce Kendrick, I.L. Conners, Lynne Sigler Genera of Hyphomycetes University of Alberta Press, 1980

Cladosporium species - The most commonly identified outdoor fungus. The outdoor numbers are reduced in the winter and are often high in the summer. Often found indoors in numbers less than outdoor numbers. It is commonly found on the surface of fiberglass duct liner in the interior of supply ducts. A wide variety of plants are food sources for this fungus. It is found on dead plants, woody plants, food, straw, soil, paint and textiles. Often found in dirty refrigerators and especially in reservoirs where condensation is collected, on moist window frames it can easily be seen covering the whole painted area with a velvety olive green layer.
Health Effects: It is a common allergen. It can cause mycosis. Common cause of extrinsic asthma (immediate-type hypersensitivity: type I). Acute symptoms include edema and bronchiospasms, chronic cases may develop pulmonary emphysema. Illnesses caused by this genus can include phaeohyphomycosis, chromoblastomycosis, hay fever and common allergies.
References: Flannigan, Brian, Robert A. Samson, and J. David Miller, eds. Microorganisms in Home and Indoor Work Environments: Diversity, Health Impacts, Investigation, and Control. London and New York: Taylor & Francis, 2001.

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Curvularia species - Curvularia is found on plant material and is considered a saprobe. It has also been isolated from dust samples and from wallpaper.
Health Effects: It has been reported to cause type I hypersensitivity and to be a cause of allergic fungal sinusitis. It may cause corneal infections, mycetoma and infections in immune compromised hosts.
References: De Hoog, G.S., J. Guarro, J. Gene, and M.J. Figueras. Atlas of Clinical Fungi, 2nd Edition. The Netherlands: CBS, 2000.

Epicoccum species - It is found in plants, soil, grains, textiles, and paper products. Frequently isolated from air and occasionally occurs in house dust. Is a saprophyte and considered a weakly parasitic secondary invader of plants, moldy paper and textiles. Epicoccum is usually isolated with either Cladosporium species or Aureobasidium species.
Health Effects: A common allergen. It also has the potential to produce type I fungal hypersensitivity reactions.
References: Flannigan, Brian, Robert A. Samson, and J. David Miller, eds. Microorganisms in Home and Indoor Work Environments: Diversity, Health Impacts, Investigation, and Control. London and New York: Taylor & Francis, 2001.

Fusarium species - A common soil fungus and plant pathogen. Fusarium is frequently isolated from plants and grains. It is often found in humidifiers and requires wet conditions to grow.
Health Effects: A type I allergen. Frequently involved in eye, skin and nail infections. Fusarium is the most common cause of mycotic keratitis and has been isolated from patients with a variety of infections. Some species produce mycotoxin. Food safety issues are related to some species of this genus.
References: Flannigan, Brian, Robert A. Samson, and J. David Miller, eds. Microorganisms in Home and Indoor Work Environments: Diversity, Health Impacts, Investigation, and Control. London and New York: Taylor & Francis, 2001.

Nigrospora species - Has been isolated from air and soil samples. Usually found in plant material as a saprobe.
Health Effects: It has been associated with type I allergic responses. No reported cases of infection.
References: St-Germain, Guy and Richard Summerbell. Identifying Filamentous Fungi: A Clinical Laboratory Handbook. California: Star Publishing Company., 1996.

Pithomyces species - Grows on dead grass in pastures and decaying plant material.
Health Effects: Causes facial eczema in ruminants.
References: St-Germain, Guy, and Richard Summerbell. Identifying Filamentous Fungi: A Clinical Laboratory Handbook. California: Star Publishing Co., 1996.

Polythrincium species - This fungus is often associated with leaves and other plant material. There are no reports of any clinical significance or allergenic properties.
References: Ellis, Martin B., Ellis, Pamela, Microfungi on Land Plants: An Identification Handbook. England, The Richmond Publishing Co. Ltd., 1997.

Smuts/Myxomycetes - Smuts and Myxomycetes are parasitic plant pathogens. They are typically grouped together due to their association with plants, the outdoors and because they share similar microscopic morphology.
Health Effects: Can produce type I fungal hypersensitivity reactions.
References: Martin, G.W., C.J. Alexopoulos, and M.L. Farr. The Genera of Myxomycetes. Iowa City, Iowa: University of Iowa Press, 1983.

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Torula species - Torula is a saprophyte and therefore often found on plant material. It may be found on wood-containing products/materials.
Health Effects: Reported to produce type I fungal hypersensitivity.
References: Ellis, Martin B., Ellis, Pamela, Microfungi on Land Plants: An Identification Handbook. England, The Richmond Publishing Co. Ltd., 1997.

Additional Information

Air Cassette Analyses

Air cassette reports indicate the genus and concentration of viable (living) and non-viable mold spores detected on the slide (A2 Analysis). Whether or not these spores are viable cannot be determined using this type of analysis. However, keep in mind that spores can remain allergenic even after cellular death. Other possible allergens include dander, pollen and fibers which are included in air cassette reports for the A1 Analysis. A1 and A2 analyses are performed on several types of air cassettes. Light microscopy at a 400 to 1000x magnification is used for air cassette sample analysis. SanAir always analyzes 100% of the impacted slide.

Explanation of Background Densities

The background density of an air cassette aids in the overall interpretation of results as it indicates the level of background debris present (e.g. dander, pollen, fibers, insect parts, soot, fly ash, etc.). Excessive background debris may mask the presence of fungal spores thereby reducing the accuracy of the count. It may also serve as an alert that the volume of air pulled was too high or too low. The following table explains background densities.

Air Cassette Density	Amount of Particulate on Slide	Explanation
1	Insignificant	Should not skew any counts
1+	Low	Should not skew any counts
2	Low to Moderate	Should not skew any counts
2+	Moderate to High	May cause occlusion of small spores
3	High	May cause occlusion of small to medium spores
3+	Very High	Will cause occlusion of spores
4	Overloaded	Level of particulate too high to perform analysis

A Note About the Fungal Spores

In some instances certain groups of fungi cannot be identified due to a lack of distinguishing characteristics. These fungi will be categorized as ñunknown sporesò on the final report.

The genera *Aspergillus* and *Penicillium* are typically composed of small, round spores that are difficult to distinguish from each other; therefore, they are grouped into the category *Aspergillus* / *Penicillium*. Other fungi that produce spores of similar characteristics may also be placed into this category, including *Paecilomyces*, *Gliocladium*, and *Trichoderma*, among others.

Stachybotrys and *Memnoniella* spores are coated with a sticky ñslimeò layer that may inhibit aerosolization.

Any genus of fungi detected on an air cassette with a high raw count (i.e. exceeding 500 spores) may be estimated. Any estimate higher than 12,000 spores will be reported as >12,000.

Understanding the Air Cassette Report

Each sample has 3 columns of information provided. The left is the raw count which is the number of spores for that fungal type detected on the trace. The middle column is the count per cubic meter (Count/m^3) which is the raw count converted based on the total volume pulled for that sample. It represents the number of spores that should be expected in a cubic meter of air from the location in question *if* the spores were distributed evenly throughout the air. This column is helpful for interpreting results when the samples were pulled at different total volumes. In other words, the raw count of a cassette pulled at 75 liters should not be compared to the raw count of a cassette pulled at 150 liters because there may be higher counts associated with the higher volume. By comparing the ñCount/m^3ò columns the difference in volumes are accounted for.

Revision Date: 2/5/2018

The limit of detection is the lowest spore count detectable with reasonable certainty, and it is calculated this way using a raw count of one. Keep in mind there are 1,000 liters in a cubic meter.

1 x (1,000 / Total Volume in Liters)

How to calculate the count per cubic meter:

Raw Count x (1,000 / Total Volume in Liters)

The last column on the right shows the percentage for which each spore type comprised the total spore count.

Understanding the Air Cassette Graph (If included in the final report)

The graph is a visual representation of the baseline sample (usually the outdoor air sample) compared individually against each indoor sample. Each spore type found on the indoor sample is compared to what was found outdoors per cubic meter.

The graph shows the percentile representation of each indoor spore count derived by dividing the indoor Count/m^3 by the outdoor Count/m^3. If the percentage is below 50% of the outside count, then the bar is below 50 on the chart, which corresponds to ñWithin 50% of Baseline Count/m^3.ò If the percentage is between 50 and 100%, then the bar on the chart will stop between 50 and 100, which corresponds to ñCount/m^3 comparable to Baseline.ò If the percentage is greater than 100%, then the bar will be above 100 on the chart, which corresponds to ñCount/m^3 higher than Baseline.ò

Each organism is given a threshold level for the Count/m^3. If this threshold level is not met in an inside sample, then the organism will not be graphed on the chart. This is used to prevent the graph from showing every spore type that is commonly found outside and doesnôt typically indicate a possible moisture problem inside. For example, most common outdoor spores (e.g. ascospores, basidiospores, and *Cladosporium*) have a threshold level of 100. Therefore, in order to show up on the chart, the inside Count/m^3 must be above 100. On the other hand, fungi that may indicate water damage (e.g. *Stachybotrys*, *Ulocladium*, *Chaetomium*, *Memnoniella*, etc.) are given lower threshold levels. These fungi have a higher water activity value and therefore require more moisture to grow. *Stachybotrys* and *Chaetomium* have threshold values of 14 and 30, respectively, as even a low count of those types of spores may indicate an issue with excess moisture.

Keep in mind that this graph is to be used only as a tool in the inspection of a building. Visual examination and knowledge of water damage, past remediation, and weather conditions, among other elements, is essential in the decision regarding the indoor air quality of a building.

Assistance with Remediation Projects

more information pertaining to interpretation of results is available on our website www.sanair.com

For assistance in a remediation project you may consult the Institute of Inspection, Cleaning and Restoration Certificationôs (IICRC) S500 and S520 protocols. The S500 is a reference guide for water-damage restoration and the S520 pertains specifically to mold remediation. Other standards and guidelines regarding Indoor Air Quality that may assist in remediation projects:

AIHA (Recognition, Evaluation, and Control of Indoor Mold)
AIHA (The Facts About Mold)
NADCA (ACR 2006)
IESO (Standards of Practice for the Assessment of Indoor Air Quality)
EPA (Mold Remediation in Schools and Commercial Buildings)
New York City Department of Health and Mental Hygiene (Guidelines on Assessment and Remediation of Fungi in Indoor Environments)

Disclaimer

SanAir Technologies Laboratory does not make contamination corrections to reports based upon analysis of laboratory and/or field blanks.

This report is the sole property of the client named on the SanAir Technologies Laboratory chain-of-custody. Neither results nor reports will be discussed with or released to any third party without our client's written permission. The information provided in this report applies only to the samples submitted and is relevant only for the date, time and location of sampling. SanAir assumes no responsibility for the method of sample procurement. Evaluation reports are based solely on the sample(s) in the condition in which they arrived at the laboratory and on the information provided by the client on the COC. SanAir will not provide any opinion on the safety of a building as visual inspection and knowledge of water damage, past remediation and weather conditions during sampling, among other elements, is essential in this decision. All samples are disposed of after 90 days unless otherwise requested by the client. SanAir is accredited by AIHA-LAP, LLC in the EMLAP program. Refer to our accreditation certificate or www.aihaaccreditedlabs.org for an up to date list of the Fields of Testing for which we are accredited.

This report does not constitute endorsement by AIHA-LAP, LLC/NVLAP and/or any other U.S. governmental agencies; and may not be certified by every local, state and federal regulatory agency.

SanAir Technologies Laboratory, Inc.

1551 Oakbridge Drive, Suite B - Powhatan, VA 23139
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www.sanair.com

Microbiology Chain of Custody

SanAir ID Number 18042754

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1425 Tee Martin Dr, 414 East Stadium Hall	Project Name: 9/19 South Carick [redacted]	Phone #: **865-974-5084**
Knoxville, TN 37996	Date Collected: 09/19/18	Fax #: **865-974-0094**
Samples Collected By: B. Keith Price	P.O. Number:	Email: [redacted]

Sample Types		Analysis Types	Turn Around Time
AC	Air Cassette	**A1** - Identification and Enumeration of Fungal spores, plus total dander, fiber, and pollen count	**Hours 3/6/24/48-Std**
		A2 - Identification and Enumeration of Fungal spores only	**Hours 3/6/24/48-Std**
T **B** **S***	Tape Bulk Swab*	**D1** - Direct Identification of Fungi	**Hours 3/6/24/48-Std**
		D2 - Direct Identification of Mites, Insects, Pollen, etc.	**Hours 3/6/24/48-Std**
AP	Air Plate	**C1** - Culture Identification and Enumeration of Fungi only	**5-10 Days**
B	Bulk	**C2** - Culture Identification and Enumeration of Bacteria only	**2-4 Days**
S	Swab	**C3** - Culture Identification and Enumeration of Fungi and Bacteria	**5-10 Days**
		C4 - Culture Identification and Enumeration of Thermophilic Bacteria with C2 or C3 analysis	**2-4 or 5-10 Days**
W	Water	**L1 –** Culture Identification and Enumeration of *Legionella sp.*	**7-10 Days**
D	**Dust**	**M1 –** Dust Mite Allergen Test	**Hours 3/6/24/48-Std**

SanAir Technologies Laboratory offers speciation by PCR. Please call for details and pricing.

Sample #	Sample Identification	Sample Type	Analysis Type(s)	Turn Around Time	Total Volume (L) or Area (in^2)	Time Start – Stop	
1	Room [redacted]	AC	A1	48 hours	75 L	5 min	
2	Outside	AC	A1	48 hours	75 L	5 min	

Special Instructions	

Relinquished by	Date	Time	Received by	Date	Time
B. Keith Price	09/19/18	1200 hours	MC	SEP 2 1 2018	10:00AM

Unless scheduled, the turn around time for all samples received after 3 pm Friday will begin at 8 am Monday morning. Weekend or Holiday work must be scheduled ahead of time and is charged 150% of analytical rate.

*Although we allow Direct Identification from a swab sample, best results are received from tape samples.

Maria E. Coker

From: Jennifer L. McGee
Sent: Thursday, September 20, 2018 4:06 PM
To: Hunter E. Leslie; Maria E. Coker; Aaron M. Goodwin; Claire MacDonald
Subject: FW: Rush on samples

-----Original Message-----
From: Case, April Walls <[redacted]>
Sent: Thursday, September 20, 2018 4:05 PM
To: IAQ Forward <iaq@sanair.com>
Subject: Rush on samples

I just mailed some mold samples to you all today. You have not received them yet. I need a rush on these (I didn't realize it when we completed the chain of custody). Please complete as soon as possible (within 24 hours vs. 48 hours).

This is for the University of Tennessee Knoxville. Keith Price signed the COC.

The project name is Carrick Hall

Our address is below.

If you have any questions, please feel free to contact me.

Thanks,

April W. Case CSP, CHMM, CET
Team Leader- General Safety and Environmental Groups Environmental Health and Safety University of Tennessee
1425 Tee Martin Drive
Knoxville, TN 37922
Phone #: 865-974-5084
safety@utk.edu