February 26, 2013

Cardno MM&A

10988 Richardson Road
Ashland, VA 23005

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www.cardnomma.com

Ms. Amanda Hartman
Longwood University
Redford and Race Street
Farmville, Virginia 23909

Subject: Air Quality Assessment
Greenwood Library
Farmville, Virginia

Dear Ms. Hartman:

Cardno MM&A was contracted to conduct an inspection and air quality assessment for the basement area of the Greenwood Library located in Farmville, Virginia. It was reported that the HVAC system for a section of the basement was not operating for a period of time this past summer (2012). In the late fall, fungal growth was seen by several of the library staff when retrieving books from this section of the basement.

Cardno MM&A performed the inspection of the basement on February 19, 2013. The structure was examined by Mr. Joe B. Vance, a Cardno MM&A investigator and Certified Mold Inspector. A series of photographs were taken by Mr. Vance during the investigation and are available, upon request. During the inspection the following site conditions were observed within the basement area:

- The HVAC system was on and operating at the time of the inspection and doors to the area were all closed.
- There are no windows in this area and only one HVAC unit services this area.
- The floor and ceiling consist of finished concrete.
- There were no visible water stains or intrusions of water within this area.
- The average relative humidity within the basement was 21 percent at a temperature of 70 degrees. Outside the relative humidity was 49.3 at a temperature of 42 degrees.
- Stored in this section of the basement are metal shelves containing various types of books, newspapers and folders. Other items stored were filing cabinets and cardboard boxes.
- Dust was observed throughout the area.
- Fungal growth was visible on many of the book surfaces (cover, bindings and edges), particularly on the older cloth-type books.
- Inspection of several boxes with lids did not find any visible signs of fungal growth on the stored items.

During the February 19, 2013 inspection, four air samples and one tap lift sample were collected from the basement area to assess the air quality and determine the concentrations of fungal spores within and outside of the structure. The air samples were collected using Air-O-Cell spore traps and a high-volume sampling pump. The indoor sampling event was conducted according to standards prescribed by the Indoor Environmental Standards Organization (IESO) and American Conference of Governmental Industrial Hygienists (ACGIH) and normal fungal

sampling protocols. The air samples were submitted to SanAir Technologies Laboratory, Inc. for analysis. SanAir is accredited by the American Industrial Hygienist Association (AIHA) and the Environmental Microbiology Laboratory Accreditation Program (EMLAP). The following table illustrates the concentrations of spores found within the structure on February 19, 2013. The laboratory analytical results and chain of custody forms are attached to this report.

Sample Number	Location	Aspergillus/ Penicillium (Spores/m3)	Cladosporium (Spores/m3)	Total Fungal Spores (Spores/m3)
18712742	Outside	ND	13	40
18712744	Right Rear Basement	347	13	387
18712705	Right Middle Basement	3,920	ND	3,920
18712704	Left Front Basement	907	ND	907

ND-Not detected

As shown on the table above, elevated *Aspergillus/Penicillium* spore concentrations are present within the basement and visible mold was identified on many of the books stored on the shelves. A tape lift sample secured from a book cover that contained the fungal growth was tested and confirmed heavy for *Aspergillus* species. Items stored within the various sealed boxes did not show any signs of fungal growth. Based on the information gathered during this inspection, it appears the fungal growth was the result of lack of ventilation. There were no signs of water intrusion. Recommendations to abate the poor air quality within the structure and to remove the fungal growth from the various book covers are as follows:

- Install a Z-flap door system in the main door way entering into the basement area. Seal any other doors that lead out of this area.
- Install a sufficient number of air filtration devices (AFD) throughout the basement and internally scrub the air (no negative pressure) while remediation activities are being conducted.
- Set up a staging area where the books can individually be cleaned and boxed after cleaning.
- HEPA-vacuum the entire exterior surface areas of each book and lightly wet wipe the same area with an anti-microbial solution.
- Once a metal shelves are emptied of the book, the shelves should be HEPA-vacuumed and then wet wiped using an anti-microbial solution.
- After cleaning of the books, HEPA-vacuum the remaining items (boxes, filing cabinets, etc.) and floors in the basement.
- Internally recycle the air in the basement for a minimum of 24 hours after completion of the remediation actions, prior to clearance sampling.
- Call for a final visual inspection and clearance testing event.
- Cover and completely seal the filter area of each AFD with 6-mil plastic sheeting before removing from the residence at the completion of the remediation to prevent the spread or reintroduction of fungal spores into the indoor environment. Appropriate filter changing techniques should be implemented to prevent the spread or reintroduction of fungal spores into the indoor environment.
- Clean all HVAC ductwork using a HEPA vacuum and “air whip” (or similar) cleaning process.

The services provided for this assignment were performed with the skill and care ordinarily exercised by reputable members of the industrial hygiene profession practicing under similar conditions at the same time or similar locality. Any future or currently occurring moisture problems within or around the structure may create an environment that would allow for mold growth and affect the indoor air quality within the structure.

It should be understood that fungal spores are ubiquitous to our environment and that background fungal spore counts naturally occur in outdoor and indoor air and in the dust within occupied structures. The concentrations of these organisms are variable and depend on factors including climate, effectiveness of heating, ventilation, and air conditioning (HVAC) systems, general housekeeping and maintenance, original construction of the structure, among many others.

No expressed or implied warranty is made or intended by the rendition of these consulting services or by furnishing oral or written reports of the findings made. MM&A reserves the right to revise or amend our opinion in this report in the event new information, documentation, or evidence becomes available. If you need any additional information, please do not hesitate to give us a call.

Sincerely,

Joe Vance, CMA
Senior Vice President
for Cardno MM&A
Direct Line +1 804-201-4658
Email: joe.vance@cardno.com

Vince Alaimo, CMA
Senior Project Manager
for Cardno MM&A
Direct Line +1 804-201-9059
Email: vince.alaimo@cardno.com

Attachment: SanAir Laboratory Report

File: RHS809

SanAir Technologies Laboratory

Analysis Report

prepared for

Cardno MM&A

Report Date: 2/21/2013
Project Name: Greenwood Library
Project #: RHS809
SanAir ID#: 13003905

NVLAP LAB CODE 200870-0

AIHA LAP, LLC ACCREDITED LABORATORY ENVIRONMENTAL MICROBIOLOGY ISO/IEC 17025:2005 www.aihaaccreditedlabs.org LAB #162952

Virginia SBE Certification # 652931

Texas Licensed Mold Analysis Laboratory License # LAB0166

SanAir Technologies Laboratory

804.897.1177 www.sanair.com

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Cardno MM&A
Christy Johnson
10988 Richardson Road
Ashland, VA 23005

February 21, 2013

SanAir ID # 13003905
Project Name: Greenwood Library
Project Number: RHS809

Dear Joe Vance,

We at SanAir would like to thank you for the work you recently submitted. The 5 sample(s) were received on Wednesday, February 20, 2013 via FedEx. The final report(s) is enclosed for the following sample(s): 18712742, 18712744, 18712705, 18712704, S-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
- Analysis Pages
- Disclaimers and Additional Information

sample conditions:
5 sample(s) in Good condition

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SanAir ID Number

13003905

FINAL REPORT

Name: Cardno MM&A
Address: Christy Johnson
10988 Richardson Road
Ashland, VA 23005

Project Number: RHS809
P.O. Number:
Project Name: Greenwood Library

Collected Date: 2/19/2013
Received Date: 2/20/2013 10:00:00 AM
Report Date: 2/21/2013 9:36:37 AM
Analyst: Gibbs, Holly A.

Air Cassette Analysis

ND = None Detected

SanAir ID Number	13003905-001			13003905-002			13003905-003			13003905-004		
Analysis Using STL:												
Sample Number	18712742			18712744			18712705			18712704		
Sample Identification	Outside			Right Rear Basement			Right Middle Basement			Left Front Basement		
Sample Type	Air Cassette - Air-O-Cell			Air Cassette - Air-O-Cell			Air Cassette - Air-O-Cell			Air Cassette - Air-O-Cell		
Volume	75 Liters			75 Liters			75 Liters			75 Liters		
Limit of Detection	13 Count/M^3			13 Count/M^3			13 Count/M^3			13 Count/M^3		
Background Density	1			1+			1+			1+		
Fungal Identification	**Raw Count**	**Count/M^3**	**%**	**Raw Count**	**Count/M^3**	**%**	**Raw Count**	**Count/M^3**	**%**	**Raw Count**	**Count/M^3**	**%**
Agrocybe/Coprinus												
Alternaria species				1	13	3						
Arthrinium species												
Ascospores												
Aspergillus/Penicillium				26	347	90	294	3920	>99	68	907	>99
Basidiospores	1	13	33	1	13	3						
Bipolaris/Drechslera												
Botrytis species												
Chaetomium species	1	13	33									
Cladosporium species	1	13	33	1	13	3						
Curvularia species												
Epicoccum species												
Fusarium species												
Ganoderma species												
Memnoniella species												
Nigrospora species												
Pithomyces/Ulocladium species												
Polythrincium species												
Rusts												
Smuts/Myxomycetes												
Stachybotrys species												
Torula species												
Unclassified Conidia												
Total Fungi	**3**	**40**		**29**	**387**		**294**	**3920**		**68**	**907**	
Other	**Raw Count**	**Count/M^3**	**%**	**Raw Count**	**Count/M^3**	**%**	**Raw Count**	**Count/M^3**	**%**	**Raw Count**	**Count/M^3**	**%**
Dander	2	27	33	154	2053	97	33	440	94	80	1067	98
Fibers				5	67	3	2	27	6	2	27	2
Mycelial Fragments	2	27	33									
Pollen	2	27	33									

Certification

Signature: Holly A. Gibbs Date: 2/21/2013

Reviewed: L. Claire Macdonald Date: 2/21/2013

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SanAir ID Number

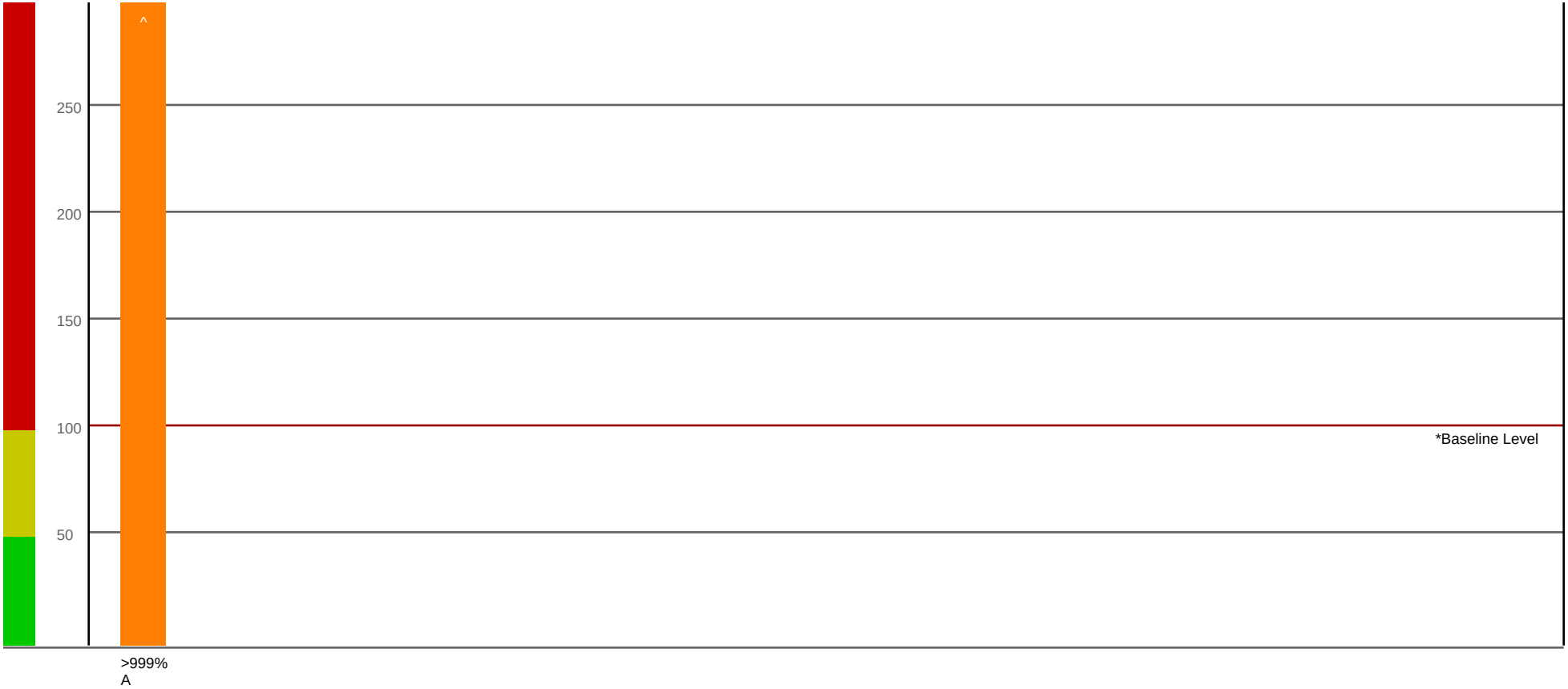
13003905

FINAL REPORT

Name:	Cardno MM&A	**Project Number:**	RHS809	**Collected Date:**	2/19/2013
Address:	Christy Johnson	**P.O. Number:**		**Received Date:**	2/20/2013 10:00:00 AM
	10988 Richardson Road	**Project Name:**	Greenwood Library	**Report Date:**	2/21/2013 9:36:37 AM
	Ashland, VA 23005			**Analyst:**	Gibbs, Holly A.

Air Cassette Analysis - Spores % of Outside Air

SanAir ID : 13003905-2 Sample # : 18712744 ID : Right Rear Basement



Probable mold amplification

Possible mold amplification

No evidence of mold amplification

A Aspergillus/Penicillium

*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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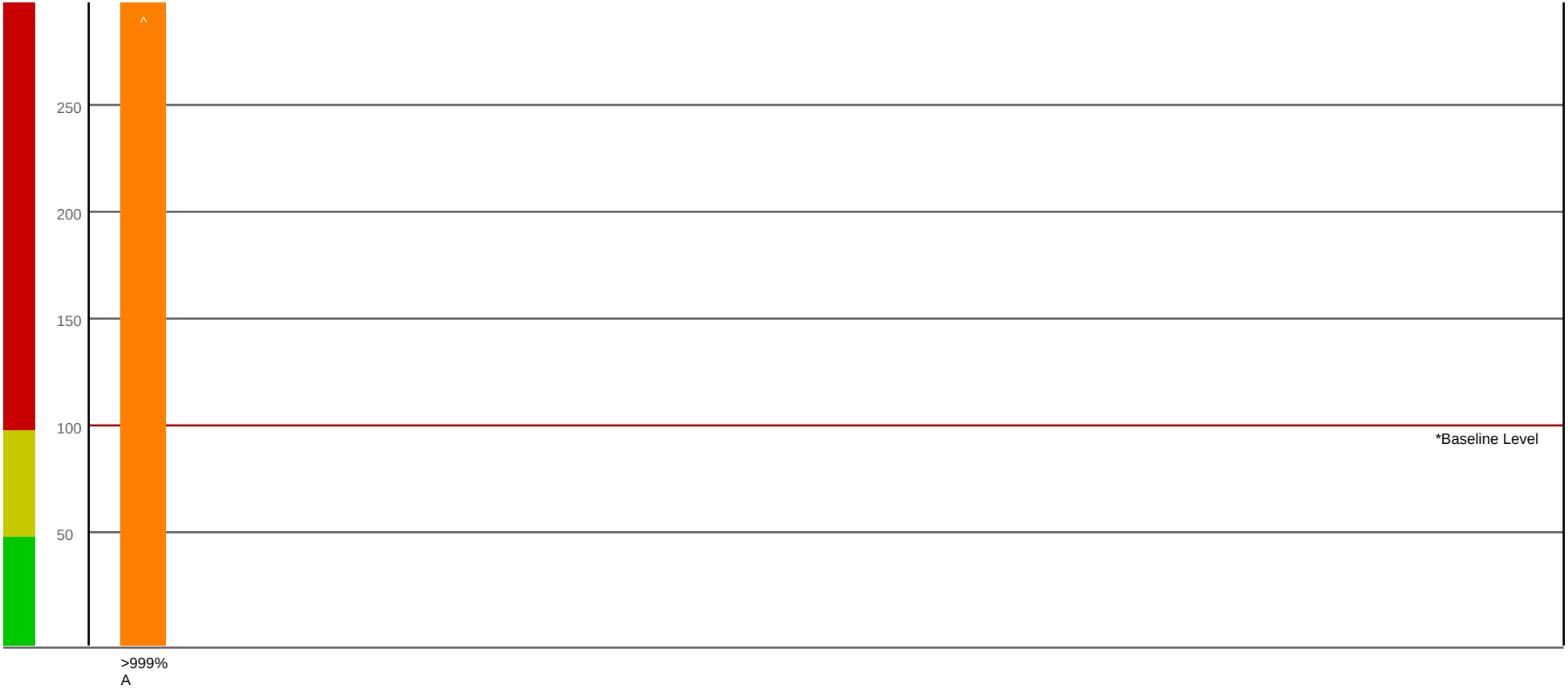
	10988 Richardson Road	**Project Name:**	Greenwood Library	**Report Date:**	2/21/2013 9:36:37 AM
	Ashland, VA 23005			**Analyst:**	Gibbs, Holly A.

Air Cassette Analysis - Spores % of Outside Air

SanAir ID : 13003905-3 Sample # : 18712705 ID : Right Middle Basement



Probable mold amplification

Possible mold amplification

No evidence of mold amplification

A Aspergillus/Penicillium

*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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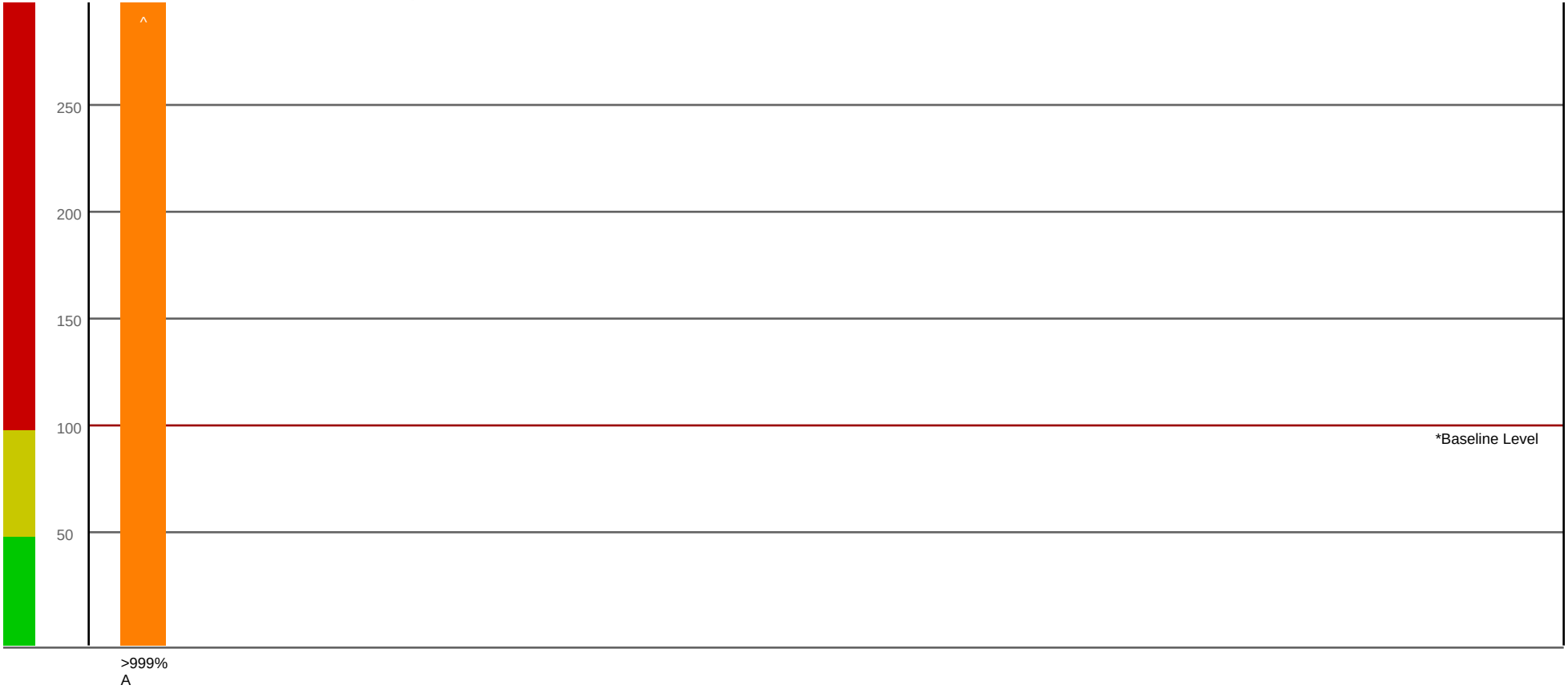
	10988 Richardson Road	**Project Name:**	Greenwood Library	**Report Date:**	2/21/2013 9:36:37 AM
	Ashland, VA 23005			**Analyst:**	Gibbs, Holly A.

Air Cassette Analysis - Spores % of Outside Air

SanAir ID : 13003905-4 Sample # : 18712704 ID : Left Front Basement



Probable mold amplification

Possible mold amplification

No evidence of mold amplification

A Aspergillus/Penicillium

*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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Project Number: RHS809
P.O. Number:
Project Name: Greenwood Library

Collected Date: 2/19/2013
Received Date: 2/20/2013 10:00:00 AM
Report Date: 2/21/2013 9:36:37 AM
Analyst: Gibbs, Holly A.

Direct Identification Analysis

SanAir ID: 13003905-005 Sample #: S-1 ID: Book Sample

D1-Direct ID Analysis on Tape using STL 104
Direct ID of Mold

Fungi	Estimated Amount
Aspergillus species	Heavy

Certification

Signature: Holly A. Gibbs Reviewed: L. Claire Macdonald

Date: 2/21/2013 Date: 2/21/2013

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Project Number: RHS809
P.O. Number:
Project Name: Greenwood Library

Collected Date: 2/19/2013
Received Date: 2/20/2013 10:00:00 AM
Report Date: 2/21/2013 9:36:37 AM

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"]

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.

ASPERGILLUS SPECIES - A genus of fungi containing over 180 recognized species. Members of this genus have been recovered from a variety of habitats, but are especially common as saprophytes on decaying vegetation, soils, stored food, and feed products in tropical and subtropical regions. Some species are xerophilic. Some species are parasitic on insects, plants and animals, including man. Some species are reported mycotoxin producers. Both Penicillium and Aspergillus spores share similar morphology on non-viable analysis and therefore are lumped together into the same group. Only through the visualization of reproductive structures can the genera be distinguished. *Health Effects:* Can produce type I and III fungal hypersensitivities. All of the species contained in this genus should be considered allergenic. Various Aspergillus species are a common cause of extrinsic asthma (immediate-type hypersensitivity: type I). Acute symptoms include edema and bronchiospasms. Chronic cases may develop pulmonary emphysema. Members of this genus are reported to cause a variety of opportunistic infections of the ears and eyes. Severe pulmonary infections may also occur.
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.

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

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ORGANISM DESCRIPTIONS

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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.

CHAETOMIUM SPECIES - It is an ascomycete. It is found on a variety of substrates containing cellulose including paper and plant compost. It can be found on the damp or water damaged paper in sheetrock after a long term water damage. Several species have been reported to play a major role in decomposition of cellulose made materials. These fungi are able to dissolve the cellulose fibers in cotton and paper, and thus cause these materials to disintegrate. The process is especially rapid under moist conditions. *Health Effects:* Chaetomium can produce type I fungal hypersensitivity and has caused onychomycosis (nail infections).
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.

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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Microbiology Chain of Custody

SanAir ID Number: 1303905

Company: Cardno Marshall Miller & Associates	Project Number: RHS809	Phone #: 804-798-6525
Address: Christy Johnson	Project Name: Greenwood Library	Phone #: 804-240-1352
City, State, Zip: Ashland, VA 23005	Date Collected: 2-19-13	Fax #: 804-798-5907
Samples Collected By: JOE VANCE	P.O. Number:	Email: joe.vance@cardno.com

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	
18712742	OUTSIDE	AC	A1	STD.	75L		
18712744	Right Rear Basement	AC	A1	STD.	75L		
18712705	Right Middle Basement	AC	A1	STD.	75L		
18712704	Left Front Basement	AC	A1	STD.	75L		
S-1	Book Sample	T	D1	STD.			

Special Instructions

Relinquished by	Date	Time	Received by	Date	Time
Joe Vance	2-19-13	4:00 PM		FEB 20 2013	1000

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.

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 “unknown spores” 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 “slime” 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 “Count/m^3” columns the difference in volumes are accounted for.

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

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 "No evidence of mold amplification." If the percentage is between 50 and 100%, then the bar on the chart will stop between 50 and 100, which corresponds to "Possible mold amplification." If the percentage is greater than 100%, then the bar will be above 100 on the chart, which corresponds to "Probable mold amplification."

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 doesn't 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 Certification's (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

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 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.*** *SanAir is accredited by AIHA in the EMLAP program for Direct Examination of air samples.*

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

Additional Information

Direct Identification Analyses

Direct identification analyses can be performed on tape, bulk, dust and swab samples. Direct identification reports indicate the evidence of possible active growth for each genus of fungi present. Whether or not these spores are viable or nonviable cannot be determined using this type of analysis; the sample would have to be cultured in order to determine viability. Keep in mind that this report can only be inferred for the exact spot in which the sample was taken. Light microscopy at a 400 to 1000x magnification is used for direct identification analysis.

It is encouraged to include a blank tape sample in order to check for contamination during sampling or shipment. Be sure to check the expiration date of any tape. It is recommended not to use expired tapes as the gel on the slide deteriorates thereby losing the tackiness necessary to retain fungi.

The genera *Aspergillus* and *Penicillium* are typically composed of small, round spores that are difficult to distinguish from each other without the presence of intact conidiophores (structures from which spores are formed and released). In this case, they are grouped into the category *Aspergillus* / *Penicillium*. Other fungi that produce spores of similar characteristics to *Aspergillus* and *Penicillium* may also be placed into this combined category in the absence of intact conidiophores (e.g. *Paecilomyces*, *Gliocladium*, *Trichoderma*, etc.).

D1 Analysis: Fungal Identification with "Evidence of Growth" Description

Results for the direct identification analysis describe the amount of evidence indicating possible fungal growth. The presence of associated mycelial fragments and conidiophores help the analyst to determine which description to use: rare, light, moderate, or heavy. Please refer to the following table for interpretation of direct identification results.

Estimated Amount	Indication of Growth	Evidence of Mycelial Fragments / Conidiophores
Rare	Not Likely	None
Light	Possible	Some, 10 to 25% of Tape Covered
Moderate	Probable	Abundant, 25 to 50% of Tape Covered
Heavy	Significant	Throughout, 50 to 100% of Tape Covered

NOTE: Swabs are not the best media to use for direct analyses as all organisms may not be recovered intact, if at all, when analyzed.

NOTE: Tapes should not be overloaded with debris as that may occlude fungi.

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