Appendix M

Building Science Investigations, Inc.

Tuesday, December 11th, 2007

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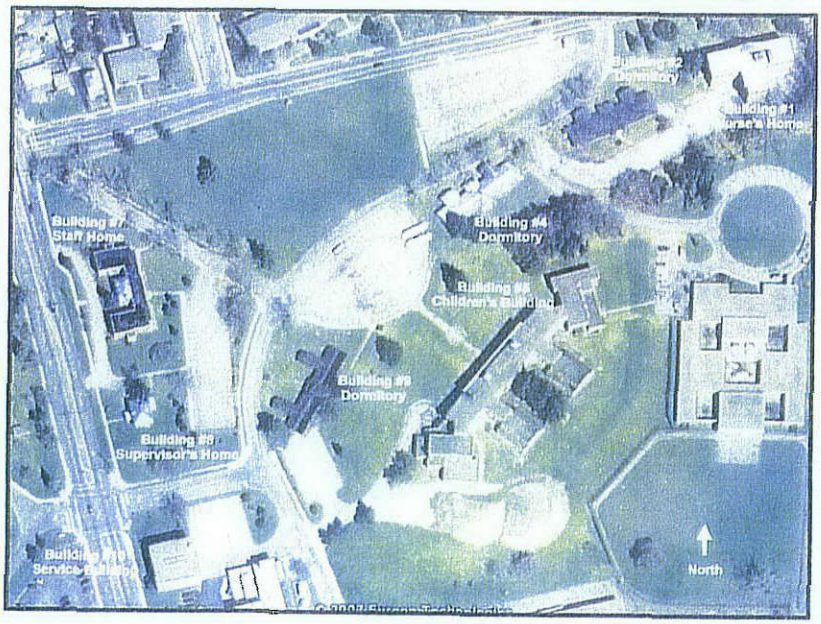
Forensic Building Science and Microbiological Investigative Executive Summary
Former Iola Campus in Rochester, New York

Background

On November 20th and 30th, 2007, Building Science Investigations, Incorporated ("BSI") performed a preliminary Forensic Building Science and Microbiological Investigation at the former Iola Campus on behalf of Anthony J. Costello & Son Development. The former Iola Campus is located on the corners of East Henrietta and Westfall Roads in Rochester, New York (lower satellite image). The Iola Campus was originally utilized as a Tuberculosis Center. Construction of the campus occurred between 1911 and 1931. After the Iola Campus was abandoned due to Pasteur's discovery of the Calmette-Guérin Bacillus antibiotic (mass vaccination occurred shortly after World Wart II), the County of Monroe took over many of the buildings for various county departments. The County of Monroe vacated the campus in 2000. This non-destructive investigation was performed to confirm or refute the presence of mold growth, evaluate the types/degree of affected building materials, estimate the physical extent of microbial growth, determine the source(s) of moisture that promoted the growth and provide recommendations to address any noted growth in accordance with industry guidelines. The scope of this investigation included Buildings #1, 2, 4, 5, 7, 8, 9 and 10. The purpose of this investigation and subsequent report was not designed to provide an exhaustive forensic evaluation of each structure but intended to provide a cursory assessment of the general building conditions. It should be noted that destructive testing should be performed in all cases to confirm or refute the preliminary findings of this investigation and the estimates outlined in this document.



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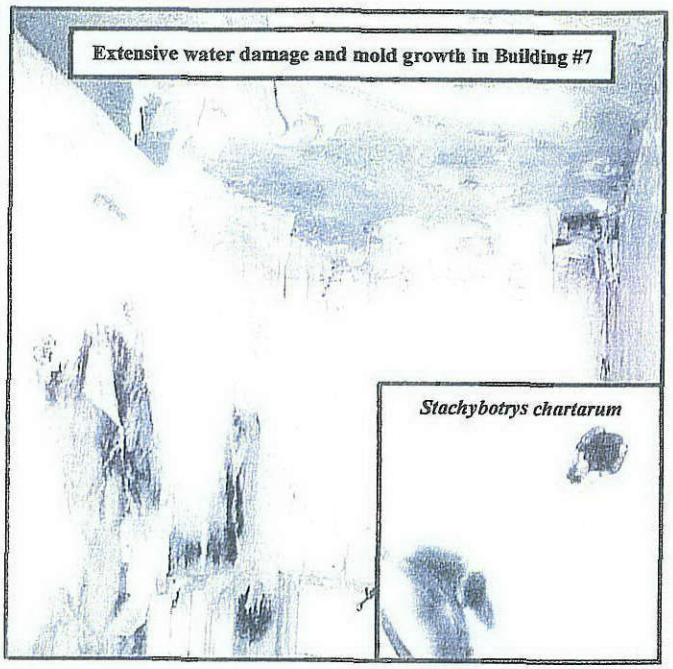
Executive Summary

The visual inspection identified the presence of mold growth in each of the structures (adjacent photograph). These visual observations were confirmed by microscopic examination of surface samples. Surface samples confirmed the growth of (in order of prevalence) *Cladosporium spp.*, *Penicillium spp.*, *Aspergillus spp.*, *Aureobasidium sp.*, *Stachybotrys sp.*, *Ulocladium sp.*, *Alternaria sp.*, *Eurotium sp.*, *Chaetomium sp.*, *Acremonium sp.*, *Epicoccum sp.* and *Fusarium sp.* Detailed descriptions of the organisms identified from the analysis are provided in Appendix - A to illustrate the general habitat, environmental conditions that support growth and the potential health implications associated with the presence of these organisms. The following table summarizes the location and estimated amount of mold growth.



Preliminary Estimate of Mold Growth at the former Iola Campus	
Building	**Estimated Mold Growth**
1 - Monroe County Community Service Building and former Iola Nurse's Quarters	680 ft^2
2 - Monroe County Grounds Maintenance and former Iola Dormitory	220 ft^2
4 - Monroe County Storage and former Iola Dormitory	426 ft^2
5 - Monroe County Traffic Control and former Iola Children's Building	90,880 ft^2
7 - Monroe County Office Records Storage and former Iola Staff Home	10,600 ft^2
8 - Monroe County Rat Control and former Iola Supervisor's Home	1,650 ft^2
9 - Monroe County Bridge Maintenance Storage and former Iola Dormitory	226 ft^2
10 - Monroe County Road Maintenance and former Iola Service Building	420 ft^2
	Total 105,102 ft^2

A total of approximately 105,102 ft^2 of growth is estimated based on the findings of this investigation. However, it should be noted that there will be additional growth concealed within the interior wall cavities and ceiling/floor assemblies based on historical and concealed water damage. This amount of growth would be classified as "extensive contamination" (i.e., greater than 100 ft^2) according to the guidelines provided by the New York City Department of Health ("NYCDOH") [(1)], "extensive contamination" according to the Occupational Safety and Health Administration ("OSHA") [(2)] or a "large area" according to the Environmental Protection Agency ("EPA") [(3)] in each building.

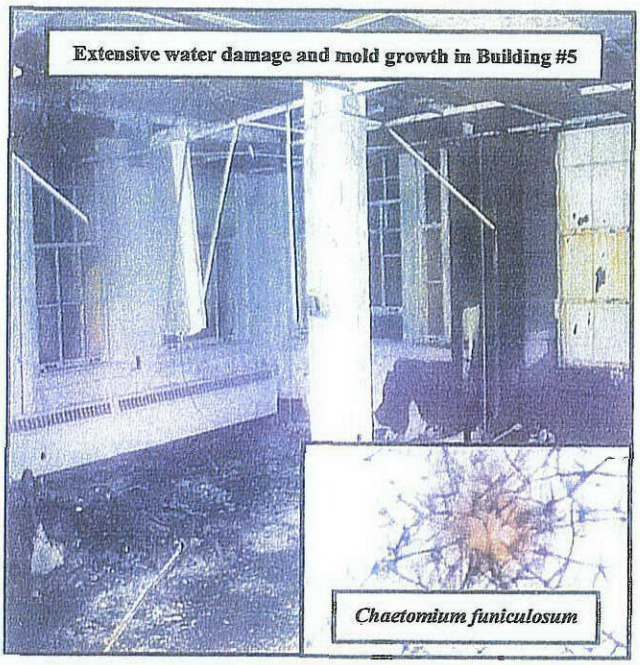
Non-culturable Burkard® air samples were collected to evaluate the relative airborne concentrations and types of mold spores in each building. There are currently neither established governmental nor institutional regulations pertaining to the acceptable levels of mold in indoor air or on miscellaneous surfaces. Due to the lack of government standards, the established industry practice involves comparative sampling to evaluate the relative concentrations and types of spores present in an indoor environment that may negatively impact air quality. In this report, an indoor vs. outdoor comparison is made to determine if there are significant sources of microbial organisms growing inside of the buildings. The indoor concentration of organisms is typically lower inside a non-problematic building, as compared to the concentration of the outdoor flora. The opposite would normally apply to a building that has sustained water damage and the subsequent growth of microbial organisms. The following table summarizes the airborne concentration of spores in each building.

NON-CULTURABLE AIR SAMPLING SUMMARY AT THE FORMER IOLA CAMPUS	
BUILDING	**AIRBORNE CONCENTRATION**
1 - Monroe County Community Service Building and former Iola Nurse's Quarters	3,099 spores/m^3
2 - Monroe County Grounds Maintenance and former Iola Dormitory	13,455 spores/m^3
4 - Monroe County Storage and former Iola Dormitory	16,034 spores/m^3
5 - Monroe County Traffic Control and former Iola Children's Building	37,145 spores/m^3
7 - Monroe County Office Records Storage and former Iola Staff Home	14,610 spores/m^3
8 - Monroe County Rat Control and former Iola Supervisor's Home	23,288 spores/m^3
9 - Monroe County Bridge Maintenance Storage and former Iola Dormitory	10,488 spores/m^3
10 - Monroe County Road Maintenance and former Iola Service Building	722 spores/m^3
Average concentration of airborne mold spores	**14,855 spores/m^3**
Outdoor Reference Sample	**222 spores/m^3**

Extensive water damage and mold growth in Building #5

The analytical results from the non-culturable air samples indicated that there are relatively high airborne concentrations of mold inside almost all of the buildings. The average indoor concentration of spores was 14,855 spores per cubic meter (spores/m^3) of air sampled. The outdoor concentration was 222 spores/m^3. On average, the indoor concentration of spores was approximately 67 times higher than the outdoor concentration and the types of indoor spores were not consistent with the outdoor flora in every case. Based on these results and generally accepted industry standards, there is clearly an airborne mold problem in each of the buildings. The complete analytical results are presented in Appendix – B.

Based on the results of the moisture mapping and examination of the mold growth (i.e., the degree/location of growth, types of organisms and the patterns of growth), the sources of moisture that promoted the growth of mold are related to a combination of moisture migration through the foundations/slabs, moisture migration through the exterior envelopes, plumbing leaks, roof leaks and a resulting high relative humidity level combined with a lack of air circulation.



BSI has performed more than 2,600 Forensic Building Science and Microbiological Investigations. Based on our experience, site observations, testing, the analytical results from this investigation and information provided by others, it is our opinion that there is extensive [1,2] mold growth in all of the structures and extremely high airborne concentrations of mold spores in almost all of the structures. In addition, chronic water damage has caused moisture accumulation in the majority of building materials causing structural decay, extensive corrosion and complete deterioration of building systems. Based on generally accepted industry guidelines, no one should enter these buildings without appropriate respiratory protection due to the high airborne concentrations of mold spores. A brief structural description and investigative summary is provided in the following section for each building.

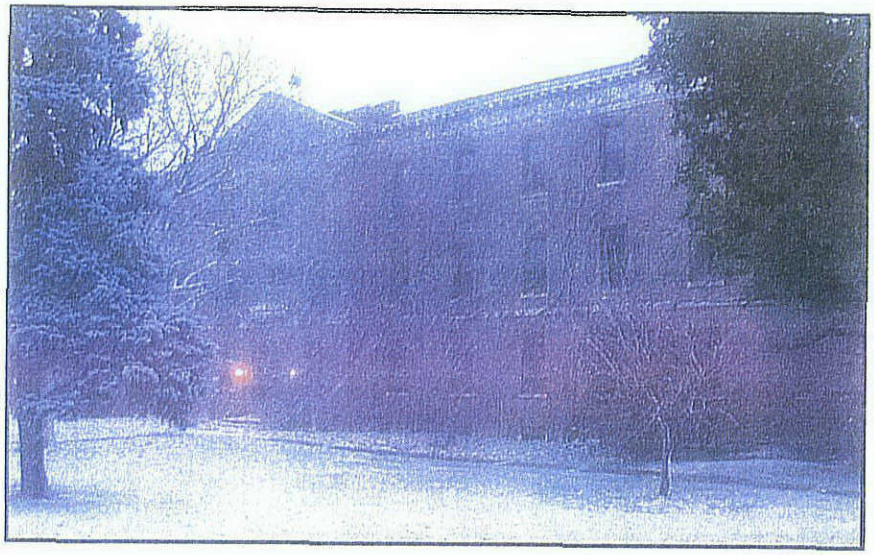
According to the emergency provisions identified in the Charter and Code of the City of Rochester, New York (v.14 Updated 06-15-2007, under Chapter 47A, Demolition Regulations), an emergency is defined as any "condition when a building or structure is an imminent danger to life, health or safety as a result of structural instability, fire or any other dangerous or hazardous situations or as a result of substantial violations of any code, ordinance or regulation enforced by the Department of Community Development of the City of Rochester." Due to the chronic nature and extent of water/mold damage in these buildings (with the exception of Building #1), it is our opinion that these buildings should be demolished based on this emergency definition. There are clearly hazardous conditions present in these buildings related to water and mold growth that continue to become more dangerous with time.

A *preliminary budgetary estimate* to abate the mold growth in these structures is $1,387,346 in the event that demolition is not granted. This figure is based on an $8/ft^2 unit rate with an additional 10% for project management. This estimate does not include water damaged building materials that cannot be repaired/restored or the presence of regulated environmental hazards (i.e., asbestos-containing materials, lead-based paint, etc.) that will require further abatement in full accordance with all applicable regulations. If you have any questions or comments, please contact me at 716-628-4618.

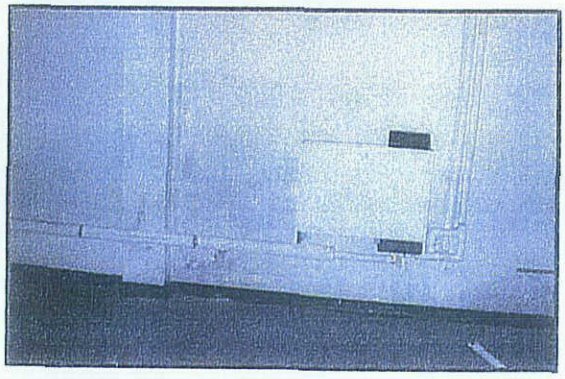
Sincerely,
Building Science Investigations, Incorporated.

Jonathan Solomon, B.Sc. Eng., BSSO
Structural Mycologist – AIHA EMPAT #158773, IICRC #87485.

Building #1 – Monroe County Community Service Building and former Iola Nurse's Quarters



General Structural Description – The 23,800 ft^2 T-shaped building faces north on Westfall Road. This three story structure with a finished basement was constructed in 1927. There are nine rooms in the basement, 21 rooms on the first floor, 25 rooms on the second floor and 22 rooms on the third floor. It has a brick façade with a poured concrete foundation. There are stairwells located on the west and east sides of the building with a central elevator. Interior wall construction includes concrete block, plaster with metal lath and ⅝" gypsum wallboard on steel studs. Floor finishes include concrete, vinyl floor tile and carpet. The structure is supported by steel beams and columns. The building is conditioned by a combination of radiant heat, air handlers and unit ventilators. Several of the building's systems have been upgraded since the original construction.

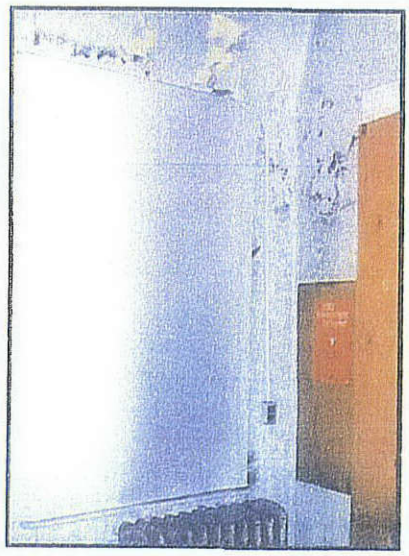


Building Science and Microbiological Investigation – This structure is clearly in the best condition of the remaining buildings. Recent renovations have improved the overall condition and performance of this assembly. The roof and all structural elements appeared to be in good condition. However, extensive [1,2] mold growth was observed in the basement due to a combination of moisture migration through the front foundation leading to relatively minor flooding and a high humidity. There is approximately 680 ft^2 of mold growth estimated in the building. The scope of mold impacted building materials includes (but is not limited to) ⅝" gypsum wallboard, plaster and carpet. The concentration of airborne mold spores is 3,099 spores/m^3.

Building #2 – Monroe County Grounds Maintenance and former Iola Dormitory

General Structural Description – The 4,840 ft^2 structure faces north on Iola Circle Drive. This single story timber and wood framed structure was constructed in 1911. There are 12 rooms and a large open L-shaped rear area. It has a brick façade with a slab-on-grade foundation. Interior wall construction includes concrete block and plaster with metal lath supported by a combination of wood/brick columns. There is a conventional wood framed roofing assembly. Floor finishes include concrete and 9" asbestos-containing vinyl floor tile. The building is heated by radiant heat.

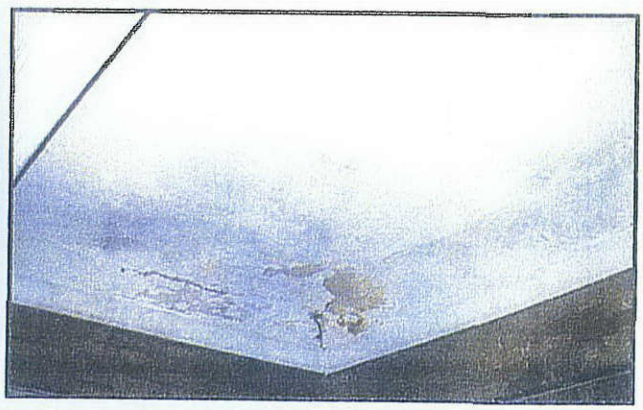
Building Science and Microbiological Investigation – Portions of the structure have been impacted by water damage and the subsequent growth of extensive [1,2] mold contamination. The sources of moisture that promoted the growth of mold include a combination of roof leaks, moisture migration through the floor slab and a high relative humidity level combined with a lack of air circulation. The 3" floor slab has heaved in several locations. An inspection of the roof framing illustrated the growth of wood rot fungi and deteriorated wooden members due to chronic roof leaks. The roof on the east side of the structure has failed and is supported to prevent collapse. There is approximately 220 ft^2 of mold growth estimated in the building. The scope of mold impacted building materials includes (but is not limited to) plaster, wooden roof framing, wooden doors and wooden window/door trim. The concentration of airborne mold spores is 13,455 spores/m^3.



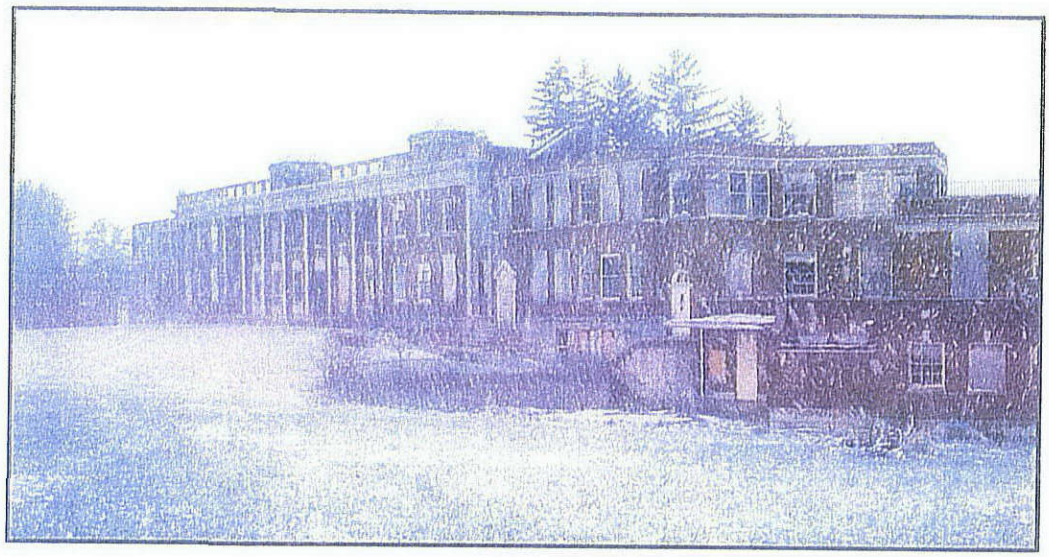
Building #4 – Monroe County Storage and former Iola Dormitory

General Structural Description – The 4,840 ft^2 structure faces north on Iola Circle Drive. This single story timber and wood framed structure was constructed in 1911. There are 12 rooms and a large open L-shaped rear area. It has a brick façade with a slab-on-grade foundation. Interior wall construction includes concrete block and plaster with metal lath supported by a combination of wood/brick columns. There is a conventional wood framed roofing assembly. Floor finishes include concrete and 9" asbestos-containing vinyl floor tile. The building is heated by radiant heat.

Building Science and Microbiological Investigation – Portions of the structure have been impacted by water damage and the subsequent growth of extensive [1,2] mold contamination. The sources of moisture that promoted the growth of mold include a combination of roof leaks, moisture migration through the floor slab and a high relative humidity level combined with a lack of air circulation. The 3" floor slab has heaved in several locations. An inspection of the roof framing illustrated the growth of wood rot fungi and deteriorated wooden members due to chronic roof leaks. There is approximately 426 ft^2 of mold growth estimated in the building. The scope of mold impacted building materials includes (but is not limited to) plaster, wooden roof framing, wooden doors and wooden window/door trim. The concentration of airborne mold spores is 16,034 spores/m^3.

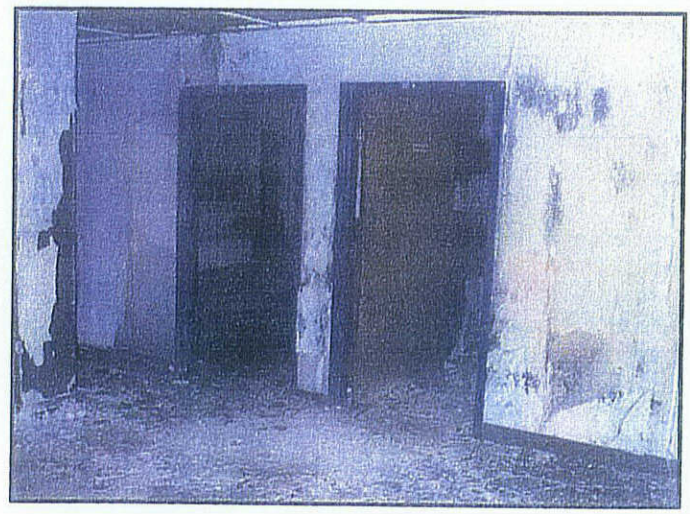


Building #5 – Monroe County Traffic Control and former Iola Children's Building

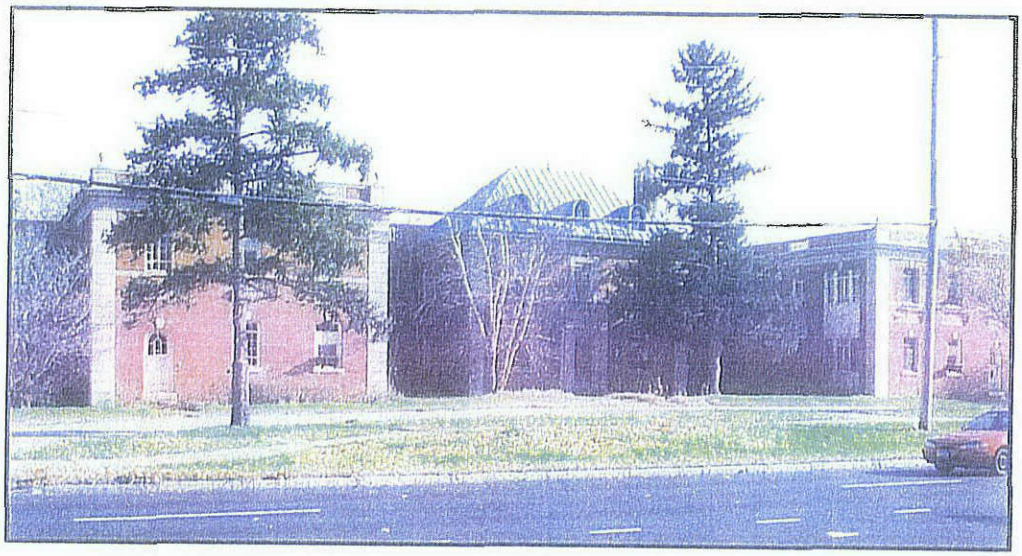


General Structural Description – The 64,430 ft^2 irregular shaped structure faces northwest and is located on Iola Circle Drive. This two and three story structure was constructed in 1926 and has been reportedly vacant since 2000. It has a brick façade with a finished basement and unfinished sub-basement. Interior wall construction includes concrete block, plaster with metal lath and ½ - ⅝" gypsum wallboard on steel/wooden studs. The floors are constructed with concrete forms on open web steel joists with additional steel column/beams for structural support. Floor finishes include concrete, hardwood, vinyl floor tile, ceramic tile and carpet. The building is heated by radiant heat.

Building Science and Microbiological Investigation – The entire structure has been impacted by water damage and the subsequent growth of extensive [1,2] mold contamination. The mold growth has occurred due to a combination of high humidity combined with a lack of air circulation, plumbing leaks, window leaks and roof leaks. Missing/damaged windows have promoted wind driven precipitation to migrate into the structure. The vast majority of walls and floors are completely saturated from roof/window leaks. There is approximately 90,880 ft^2 of mold growth estimated in the building. The scope of mold impacted building materials includes (but is not limited to) ½ - ⅝" gypsum wallboard, 2"×4" wooden studs, plaster, asbestos-containing pipe wrap, cellulose-based ceiling tiles, vinyl floor tile, window/door frames, door/window/base cove trim and carpet. The concentration of airborne mold spores is 37,145 spores/m^3.

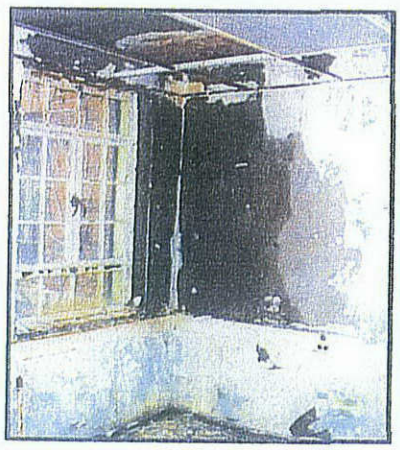


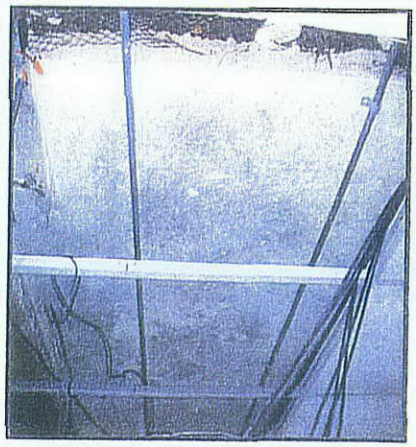
Building #7 – Monroe County Office Records Storage and former Iola Staff Home



General Structural Description – The 10,900 ft^2 E-shaped structure faces west and is located on the corner of East Henrietta Road and Iola Circle Drive. This two story structure was constructed in 1931. It has a brick and clay tile façade with an unfinished basement. There are 13 caged holding cells and several storage areas in the basement, 20 rooms on the first floor and 20 rooms on the second floor. There are two stairwells located at each end of the building and one central stairwell. The foundation walls and floor are constructed using poured concrete. Interior wall construction includes concrete block, plaster with metal lath and ⅝" gypsum wallboard on steel studs. The floors are constructed with concrete forms on open web steel joists with steel column/beams for structural support. Floor finishes include concrete, vinyl floor tile, ceramic tile and carpet. The building is heated by radiant heat.

Building Science and Microbiological Investigation – The entire first and second floors have been impacted by water damage and the subsequent growth of extensive [1,2] mold contamination. The mold growth has occurred due to a combination of high humidity combined with a lack of air circulation and roof leaks. The vast majority of walls and floors are completely saturated. There is approximately 10,600 ft^2 of mold growth estimated in the building. The scope of mold impacted building materials includes (but is not limited to) ⅝" gypsum wallboard, plaster, wooden planking, asbestos-containing pipe wrap, cellulose-based ceiling tiles, vinyl floor tile and carpet. The concentration of airborne mold spores is 14,610 spores/m^3.





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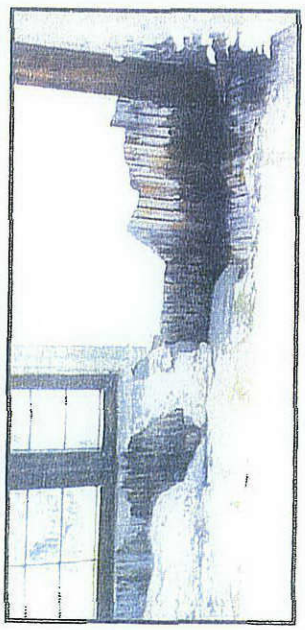
Building #8 – Monroe County Rat Control and former Iola Supervisor's Home

General Structural Description – The 2,610 ft^2 residence faces west and is located on the corner of East Henrietta Road and Stan Yale Drive. This two story wood-framed structure was constructed in 1924. It has a brick façade with an unfinished basement. There are four rooms in the basement, six rooms on the first floor and six rooms on the second floor. There is a central stairwell leading to the second floor and basement. The foundation walls are constructed using concrete block with a poured concrete floor. Interior wall construction includes concrete block, plaster with wooden lath and ½" gypsum wallboard on standard wooden studs. The floors are constructed with a 2-5½" wooden tongue-and-groove planking sub-floor on 2"×10" wooden joists. Floor finishes include concrete, 1" maple hardwood, vinyl floor tile and carpet. The building is heated by radiant heat.



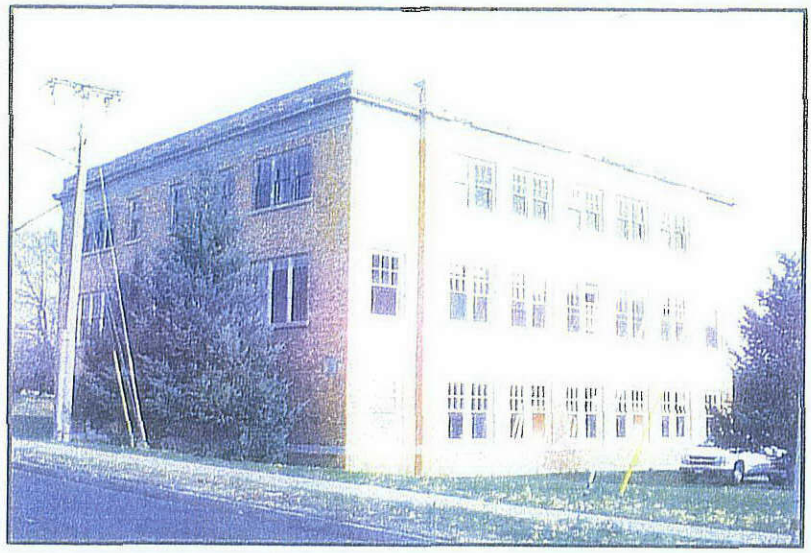
Building Science and Microbiological Investigation – The entire basement and significant portions of the remainder of the residence have been impacted by water damage and the subsequent growth of extensive [1,2] mold contamination. The mold growth in the basement has occurred due to a high humidity level (vapor migration through the foundation and flooding) combined with a lack of air circulation. The growth on the upper floors has been caused by a combination of humidity migrating from the basement, plumbing leaks and roof leaks. There is approximately 1,650 ft^2 of mold growth estimated in the building. The scope of mold impacted building materials includes (but is not limited to) ½" gypsum wallboard, plaster with wooden lath, wooden planking, asbestos-containing pipe wrap and carpet. The concentration of airborne mold spores is 23,288 spores/m^3.

Building #9 – Monroe County Bridge Maintenance Storage and former Iola Dormitory

General Structural Description – The 5,620 ft^2 structure faces northwest on Iola Circle Drive. This single story timber-framed structure was constructed in 1911. It has a brick façade with a slab-on-grade foundation and a smaller 770 ft^2 central basement. There is a central basement stairwell. The foundation walls and floor are constructed using poured concrete. Interior wall construction includes concrete block, plaster with wooden lath and ⅝" gypsum wallboard on wooden studs. The floor is constructed with a 2½" wooden tongue-and-groove plank sub-floor on 2"×10" wooden joists above the basement. Floor finishes include concrete and 2" hardwood. The building is heated by radiant heat.

Building Science and Microbiological Investigation – Portions of the first floor have been impacted by water damage and the subsequent growth of extensive [1,2] mold contamination. The mold growth has occurred due to a combination of high humidity combined with a lack of air circulation, moisture migration through the basement walls, plumbing leaks and roof leaks. There is approximately 226 ft^2 of mold growth estimated in the building. The scope of mold impacted building materials includes (but is not limited to) ⅝" gypsum wallboard, plaster, wooden planking, 2"×10" wooden joists, cellulose-based ceiling tiles, pressboard sheathing and hardwood flooring. The concentration of airborne mold spores is 10,488 spores/m^3.

Building #10 – Monroe County Road Maintenance and former Iola Service Building



General Structural Description – The 12,675 ft^2 square building is located on the corner of East Henrietta Road and Stan Yale Drive. This three story structure was constructed in 1924. There are nine rooms on the first floor including a large working bay and a shower/locker area, 14 rooms on the second floor and 24 rooms on the third floor. There are stairwells located on the west and east sides of the building. The original structure had a 210 ft^2 centrally sunken roof with clerestory windows to provide central lighting and ventilation. This feature has been subsequently covered with ¾" plywood and 2"×10" wooden joists. It has a brick façade with a slab-on-grade foundation. Interior wall construction includes concrete block, brick, plaster with metal lath and ⅝" gypsum wallboard on steel studs. Floor finishes include cast-in-place concrete ("T-Beam" construction), vinyl floor tile and carpet. The structure is supported by a combination of steel/concrete beams and columns. The building is heated by a combination of radiant heat (primarily) and forced-air furnace.

Building Science and Microbiological Investigation - Large portions of the third floor ceiling have collapsed (adjacent photograph) due to the weight of moisture accumulation from the failed roof. The formed concrete is completely saturated with an advanced degree of corrosion noted at many of the structural supports. This moisture has migrated through the structure promoting extensive [1,2] mold growth on the second and third floors. Additional mold growth has occurred on the first floor due to plumbing leaks. There is approximately 420 ft^2 of mold growth estimated in the building. The scope of mold impacted building materials includes (but is not limited to) ⅝" gypsum wallboard, plaster, wooden wall paneling and carpet. The concentration of airborne mold spores is 722 spores/m^3.

References

1. New York City Department of Health Bureau of Environmental and Occupational Disease Epidemiology. January 2002. Guidelines on Assessment and Remediation of Fungi in Indoor Environments. New York, New York. 17 p.

2. Occupational Safety and Health Administration. U.S. Department of Labor. October 2003. A Brief Guide to Mold in the Workplace. SHIB 101003. 14 p.

3. United States Environmental Protection Agency. Office of Air and Radiation, Indoor Environments Division (6609-J). March 2001. Mold Remediation in Schools and Commercial Buildings. EPA 402-K-01-001. 38 p.

Statement of Limitations

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Professional judgment was exercised in gathering and analyzing the information obtained and in the formulation of the conclusions. Like all professional persons rendering advice, we do not act as absolute insurers of the conclusions reached but commit ourselves to a level of care. This document has been prepared in accordance with generally accepted building science and industrial hygiene principles in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing under similar conditions. No other warranties, either expressed or implied, are made as to the professional services provided.

This Executive Summary is intended to provide an assessment of select buildings on the former Iola Campus based on an authorized scope of work. The information provided in this document is based on information provided by others, visual observations, testing and analysis as identified herein. The data, although comprehensive with respect to scope, does not complete an exhaustive sampling of each structure. The purpose of this assessment is to screen the affected areas for mold growth and water damaged building materials. This information is specific to the time of the assessment and therefore could change with time.

Achieving the objectives stated in this document has required us to arrive at conclusions based upon the best information presently known to us. No investigative method can completely eliminate the possibility of obtaining partially imprecise or incomplete information; it can only reduce the possibility to a reasonable level. Therefore, the results and conclusions of this report should be in no way construed as a warranty that all of the mold growth and subsequent sources of moisture have been identified. Should additional information become available, BSI requests that the information be brought to our attention so that we may reassess the information.

Appendix A
Fungal Descriptions

1. ***Acremonium***

Ecology — *Acremonium* is a common, ubiquitous soil fungus that grows rapidly (typically within 5 days) on wet building materials such as ceiling tiles, cellulose-based pipe wrap, fiberglass liners, foodstuffs, gypsum wallboard, hay, plant debris, sewage and soil. There are approximately 90 species. Many species of *Acremonium* produce slimy spores, a characteristic that is often associated with moisture-loving fungi. The most common indoor species are *Acremonium kiliense* and *Acremonium strictum*. Acremonium is very common in indoor environments, however, these species are under estimated because they are white, slightly pink or non-pigmented and extremely hard to see with the naked eye. Spores are often missed on spore trap samples due to their small size and non-distinctive pigmentation. They are best isolated from bulk samples as tape samples may not be effective if the substrate is wet.

Growth — Colonies are generally white or pale gray with an optimum growth temperature of 25°C. The growth rate is fairly rapid, generally maturing within 5 days. It requires wet conditions for growth.

Health — This group of fungi is considered allergenic (Type I and Type III hypersensitivity reactions) and a causative agent of invasive opportunistic human skin infections (Larone, 1995). *Acremonium* is known to produce citrinin and trichothecene mycotoxins. There are three species implicated in infections of immunocompromised individuals: *A. falciforme*, *A. kiliense* and *A. recifei*. This fungi has also been documented to colonize on contact lenses.

2. ***Alternaria***

Ecology — *Alternaria* is very commonly isolated from outdoor air samples (seasonally varied in late summer with a worldwide distribution). They are either parasites on living plants or saprophytes on organic substrates. They have been commonly isolated from both indoor and outdoor environments on acrylic paint, air, bread, carpet, cheese, decaying plant material, eggs, fridge gaskets, leather, plants, soil, textiles, water-damaged building materials, window caulking/frames and wood. There are close to 50 species from this genus. Spores are readily distinguishable in spore trap samples.

Growth — Spores are formed in the dark with a high relative humidity and released during the daylight hours through photo-mechanisms and warmth. The optimum temperature range for growth is 25-28°C. Growth is fairly rapid with full maturity at 7 days. They are readily recognizable from non-culturable air samples due to their relatively large spore sizes and club-like appearance.

Health — *Alternaria spp.* are associated with hypersensitivity pneumonitis and are known to be highly allergenic due to their significant protein content; causing asthma and/or rhinitis in some individuals (Samson et al., 1994). *Alternaria* spores can readily penetrate the nose, mouth and upper respiratory tract (20-200 μm × 7-18 μm). This organism is known to produce several mycotoxins including altenuene, altenusin, alternariol, altertoxin and tenuazonic acid. *A. chartarum*, *A. dianthicola*, *A. geophilia*, *A. infectoria*, *A. stemphyloides*, and *A. teunissima* have been isolated from infections (Vartivarian, 1993).

3. ***Arthrinium***

Ecology — There are more than 20 species of this ubiquitous cosmopolitan organism. *Arthrinium* is typically isolated from decaying wood, forest litter, plant material, plant seeds, soil and trees. This organism has been infrequently isolated from indoor environments. Its main mode of dissemination is by wind or precipitation.

Health — Only one species has been reported to have potential allergenic effects - *Arthrinium sphaerospermum*. Some *Arthrinium* species can produce the mycotoxin nitropropionic acid. They are very rarely associated with infections in humans.

4. **Ascospore**

Ecology — This is a large class of fungi (15,000 species in 1,950 genera) whose reproductive spores (ascospores) are contained in a sac-like structure known as the ascus. They are plant pathogens and saprobes (organisms that thrive on decaying organic matter) commonly found in decaying vegetation and soil. Spores are typically dispersed during periods of high humidity, wind or precipitation. They typically reach their highest outdoor levels in August. The most common indoor genus are *Ascotricha sp.* and *Chaetomium sp.*

Growth — These organisms are commonly associated with plants but can be frequently isolated from moist indoor environments. Examples of these types of organisms include the sexual state of *Penicillium*, *Aspergillus* and *Chaetomium*.

Health — Ascospores are generally considered potential allergens with their health effects dependant on species type. The potential for mycotoxin production is also dependant on the species. The vast majority of these spores are not typically associated with disease.

5. *Aspergillus*

Ecology *Aspergillus* has a very common worldwide distribution, consisting of approximately 175 species in both indoor and outdoor environments. It has been isolated from a wide variety of substrates including cotton, decaying vegetation, grains, gypsum wallboard, nuts, plants, soil, stored foodstuffs, vegetables and wood-based products. It is commonly isolated from water-damaged indoor environments. *Aspergillus versicolor* is one of the most common indoor isolates from water damaged building materials. This fungus can produce large amounts of spores that are easily dispersed and have the ability to survive in dry environments for relatively long periods of time. The confirmed presence of these organisms in hospital environments or around immunocompromised individuals warrants immediate and extremely careful risk management decisions.

Growth The general temperature range necessary for growth is 20 - 47°C. Some species are thermotolerant. There are 21 species of *Aspergillus* that can grow at 37°C (body temperature) and have the potential to produce mycotoxins (Beneke & Rogers, 1996).

Health *Aspergillus spp.* are one of the most common causes of systemic fungal disease in humans and animals, often leading to acute or chronic respiratory tract infections. In particular, *A. fumigatus* and *A. flavus* are frequent causative agents of pulmonary aspergillosis – an invasive, allergic or asthmatic condition of the lungs (de Hoog et al., 2000). Cases of sinusitis are also frequent (de Hoog et al., 2000). *Aspergillus* species are notoriously known for producing mycotoxins including aflatoxin, Austin, citrinin, cytochalasin, fumitoxin, nidulotoxin, ochratoxin, patulin, sterigmatocystin, tremorgenic mycotixins, viomellein, vioxanthin and xanthomegnin (Macher, 1999). Some species not only cause allergic reactions but are also considered opportunistic pathogens. *Aspergillus* can infect various sites in immunocompromised individuals (de Hoog et al., 2000).

6. ***Aspergillus / Penicillium* group**

Ecology The spores in the *Aspergillus / Penicillium* group are very common small, round to ovoid, unicellular and essentially non-pigmented. They cannot be distinguished in spore trap or tape samples without fruiting structures. Some fungal spores (e.g., *Acremonium* and *Paecilomyces*) appear very similar to *Aspergillus* and *Penicillium* and may be reported in this group. *Aspergillus* and *Penicillium* are very common spore in both indoor and outdoor air. They can produce large amounts of spores that are easily dispersed and have the ability to survive in dry environments for relatively long periods of time. They have been isolated from decaying vegetation, plants, cellulose-based building materials, household dust, carpet, wallpaper, wood products, stored foodstuffs and grains. Elevated levels of these organisms are often routinely indicative of wet building conditions. Airborne chains of these spores (a series of attached spores) are indicative of active mold growth.

Health *Aspergillus spp.* are one of the most common causes of systemic fungal disease in humans and animals, often leading to acute or chronic respiratory tract infections. In particular, *A. fumigatus* and *A. flavus* are the causative agents of aspergillosis in susceptible individuals including sinusitis (de Hoog et al., 2000). *Penicillium* is frequently associated with asthma and hypersensitivity pneumonitis in susceptible people (Carlson, 1998). Mycotoxins have been widely studied from both of these fungi (Macher, 1999).

7. *Aureobasidium*

Ecology There are approximately 15 species from this genus that are characterized by a black yeast-like appearance. It has a worldwide distribution in temperate zones. *Aureobasidium* spores are wet and principally distributed by the wind. The identification of these organisms in a non-culturable matrix is distinguished by irregular septated clumps of dark brown structures. This fungus is a saprobe (an organism that thrives on decaying organic matter) with its primary habitat on the surface of plant leaves. Relatively common isolation has been documented from agricultural areas, caulking, damp window frames, exterior siding, foodstuffs, fresh water, refrigerator seals, soil, weathered/painted wood and windows seals. The most common indoor isolate is *A. pullulans*.

Growth The optimum growth for this fungus is 25°C.

Health It is known as a common allergen causing Type I and Type III hypersensitivity reactions. *Aureobasidium* is not known to produce mycotoxins. This species is rarely documented as pathogenic but has been infrequently associated with dermatitis, nail and invasive pulmonary infections (Gravesen et al., 1994).

8. **Basidiospore**

Ecology This ubiquitous group of organisms includes approximately 1,350 genera primarily consisting of mushrooms, toadstools, puffballs, rusts, shelf fungi and smuts. They are typically associated with forests and are common saprophytes and plant pathogens associated with dry rot. Spores are generally dispersed during periods of high humidity, wind or precipitation. Basidiospores typically reach their highest outdoor levels in September and October.

Growth Basidiomycetes can be associated with dry rot and the degradation of wooden structural materials in buildings. Laboratory isolates utilizing viable techniques will typically form sterile hyphae.

Health Basidiospores have been associated with Type I and Type III hypersensitivity reactions. *Cryptococcus neoformans* (a yeast typically found in the guano of pigeon and bat droppings) has been associated with infection. Certain mushrooms in this group are recognized to produce mycotoxins but are only considered a potential health hazard if ingested.

9. ***Cercospora***

Ecology — *Cercospora* is a well documented plant-pathogenic fungus composed of approximately 2,000 species. *Cercospora* leaf spot is one of the most widespread, destructive and economically significant diseases to vegetable crops in the world. The most common plants affected by *Cercospora* are bananas, beets, cedar, celery, grains and tobacco. This organism is generally isolated by wind. It does not typically associated with indoor environments.

Health — Human pathogenicity of *Cercospora* is estimated as extremely low.

10. ***Chaetomium***

Ecology — This genus is composed of approximately 200 different species with a worldwide distribution. *Chaetomium* is frequently isolated from air, cellulose based materials, compost, cotton, decaying plant material, deteriorated wood products and soil. It is commonly identified on water-damaged drywall, fire proofing material and wood. It is known to produce musty odors.

Growth — Optimum temperature range for growth is 16-25°C.

Health — This genus is known to cause allergic type responses (Carlson, 1998). *Chaetomium* is also known to produce several mycotoxins including chaetoglobosin, chaetomin, chaetochromin, chaetosin, cochliodinol and sterigmatocystin. *C. atrobrunneum*, *C. funicola*, *C. globosum* and *C. strumarium* are rare etiological agents of subcutaneous dermal infections (St-Germain & Summerbell, 1996).

11. ***Cladosporium***

Ecology — *Cladosporium* is the most frequently identified genus of fungi in outdoor air in temperate climates (predominantly *C. herbarum*). There are more than 500 species that are found in both indoor and outdoor environments. This fungi has the ability to rapidly invade many different habitats and easily disperse large numbers of spores. *Cladosporium* has been isolated from air, concrete, fiberglass duct liner, food crops, paint, plants (decaying or alive), silicone, soil, textiles and wood products. *Cladosporium* is also often encountered in dirty refrigerators, on moist window frames, roof sheathing and anywhere condensation can occur. It has a water activity range of 0.84-0.88. *Cladosporium* reaches peak levels in July and August with much lower counts during the winter months. The most common indoor species are *Cladosporium cladosporioides* and *Cladosporium sphaerospermum*.

Growth — *Cladosporium* has an optimum growth rate at a temperature range of 18-28°C.

Health — *Cladosporium* is well documented to be allergenic (at least 10 antigens have been identified) with only four rare species identified to be pathogenic. The truly human pathogenic species, *C. bantianum*, *C. carrionii*, *C. devriesii* and *C. trichoides* have been reclassified in the genus *Cladophialophora* (de Hoog et al., 2000). Some species of *Cladosporium* are known to produce mycotoxins such as cladosporic acid (Scott, 1986).

12. ***Epicoccum***

Ecology — *Epicoccum* is a common (but seasonally variable) outdoor airborne organism consisting of approximately 60 species. This fungus is considered a secondary invader and is commonly isolated from substrates such as corn (causing red streaks), paper products, paint, plants (alive or decaying), soil and textiles. Colonies can produce a wide variety of colors depending on the food source. *Epicoccum* is a common causative agent of leaf spots on various plants. The most common indoor species is *Epicoccum nigrum*.

Growth — Temperature range for growth is 23-28°C (min. 4°C; max. 45°C) with a relative humidity of at least 92% for germination.

13. ***Eurotium***

Ecology — *Eurotium* has a worldwide distribution especially in tropical and subtropical regions. It can be naturally found in dried fruit, moldy hay, nuts, seeds, grains and various types of soil. *Eurotium* is a widespread bio-deteriogen that degrades materials such as cotton, fabrics (especially leather) and furniture coated with resins/lacquers. *Eurotium*, together with *Emericella*, is the sexual state (anamorph) of *Aspergillus*.

Growth — This organism is well-known as a xerophilic organism (i.e., prefers dry conditions) with an optimum growth range of 25-35°C.

Health — *Eurotium* is rarely identified as a human pathogen. It has not been documented to produce significant mycotoxins.

14. ***Fusarium***

Ecology — *Fusarium* is rarely isolated from air (sporation is often sparse and its spore size is not compatible with most air sampling devices). There are approximately 70 species in this genus. This genus has a worldwide distribution and is commonly isolated from various cereals, corn, cotton, dead/living plants (causes root/stem rot), grain, grass, potatoes, soil, standing water and tomatoes. Most *Fusarium* species produce spores in such environments as cooling water towers, drainage outlets, humidifiers, HVAC systems, standing water in crawlspaces and water baths. It has a water activity level of 0.90 and requires wet conditions for growth. Spore distribution occurs by insect vectors, splashing water or through the air (when air currents distribute dry spore masses). The macroconidia can be identified in a spore trap, however, the microconidia are not distinctive any could be classified as colorless.

Health *Fusarium* species are very common plant pathogens while others produce toxins in grains or animal feeds (Macher, 1999). It is well documented that *Fusarium* species are causative agents of superficial and systemic infections in humans (de Hoog et al., 2000). It has recently been associated with eye infections related to the use of eye drops. Infection due to *Fusarium* is known as fusariosis Outbreaks of nosocomial fusariosis have been reported. *Fusarium* may exist in hospital water distribution systems and in soil of potted indoor plants (Squier et al., 2000). These conditions constitute a hazardous mycotic reservoir for nosocomial fusariosis (Summerbell et al., 1989). *Fusarium* also produces several mycotoxins (e.g., fumonisin, fusaric acid, fusarin, fusarochromanone, moniliformin, trichothecene and zearalenone). Three of the five internationally regulated mycotoxins are produced by *Fusarium* species (Samson et al , 2000).

15. ***Ganoderma***

Ecology *Ganoderma* is a rare mushroom found in nature. It is typically identified on stumps and roots of dead hardwood (e.g., oak). *Ganoderma lucidum* (a.k.a., Reishi) is the most common species.

Health *Ganoderma* is an inedible mushroom. Human health risk of this fungus or its spores is unknown.

16. **Hyphal fragment**

Ecology This diverse group of fungi is common to both indoor and outdoor air. These fungi (also called *Mycelia sterilia*) produce vegetative growth but yield neither spores nor conidia, thus making identification impossible. Their presence will promote the growth of all other fungal species. Hyphal fragments typically reach their highest outdoor levels in August.

17. ***Leptosphaeria***

Ecology *Leptosphaeria* is a pigmented filamentous fungus generally found in soil. This genus currently has three defined species: *Leptosphaeria coniothyrium*, *Leptosphaeria senegelansis* and *Leptosphaeria thompkinsii*.

Health *Leptosphaeria* is an occasional cause of human infection (de Hoog et al., 2000).

18. **Myxomycete**

Ecology *Myxomycetes* are usually not ranked among fungi, but are classified between fungi and animals. The almost 500 species form a unique group of slime molds that are distinguished from all other life forms. They are mushroom-like in appearance and progress through a multi-stage life pattern.

Health Human health risk of this fungus or its spores is unknown.

19. ***Oidium***

Ecology *Oidiodendron* is widespread throughout temperate regions of the world. Frequent isolation occurs from various soil and organic debris such as garden compost, decaying wood & bark, timber, pulp and paper. The most common species are *Oidiodendron griseum* and *Oidiodendron tenuissimum*.

Growth Good growth and sporulation occurs at 25-30°C.

Health *Oidiodendron* species are not well documented in the literature but are considered nonpathogenic.

20. ***Periconia***

Ecology *Periconia* has been isolated from herbaceous stems, leaves of plants, grains, grasses, root rot, soil and wood. In general, this genus is not well documented in the literature.

Health *Periconia* is primarily a plant pathogen and there have been no reports of human infection.

21. **Rust**

Ecology These ubiquitous and cosmopolitan organisms are comprised of 14 families with 105 genera and more than 5000 species. Five general spore types have been identified. Rusts do not grow in indoor environments unless they are isolated from plants. They are plant pathogens and have been isolated from a variety of grasses, flowers and trees. They produce both wet and dry spores that are usually dispersed by the wind. They typically reach their highest outdoor levels in June.

Health These organisms are known to produce Type I allergic reactions. They are not associated with toxic properties or human infection.

22. ***Penicillium***

Ecology — *Penicillium* is one of the most common genera of fungi isolated from the environment. There are approximately 200 species from this genus, many of which are found in aerosol samples. The spores of this fungus have been reported to survive for decades. It predominates in regions of temperate climate and is found in carpet, cellulose-based building materials, compost, fiberglass duct liner, foodstuffs, grains, household dust, paint, wallpaper and wood products. It has a water activity between 0.78–0 88. Elevated levels of these organisms are typically used as an indicator of wet building conditions.

Growth — This fungus can survive and grow on substrates with minimal nutrients. Most *Penicillium* species are unable to grow at 37°C

Health — *Penicillium* is frequently associated with asthma and hypersensitivity pneumonitis in susceptible individuals (Carlson, 1998). Mycotoxins (approximately 21 types) have also been widely studied (Macher, 1999). *Penicillium marneffei* is the only species recognized to be a human pathogen (de Hoog et al., 2000).

23. ***Stachybotrys***

Ecology — *Stachybotrys* is an extensively studied black mold that is comprised of approximately 15 species. It is most commonly observed as symmetrical carbon black circles on saturated gypsum wallboard. This organism grows preferentially in moist areas containing cellulose-based materials (with low nitrogen content) such as ceiling tiles, gypsum wallboard, hay, leaf litter, straw, wallpaper, water-damaged building materials and wood. It has a water activity level of 0.94 with optimal growth at 0.98.

Growth — Appropriate substrates for growth have a high cellulose content. Optimum growth temperature range is 23-27°C. Areas with relative humidity above 55% are ideal for mycotoxin production (Croft et al., 1986).

Health — *Stachybotrys* produces a series of harmful toxins including griseofulvin, macrocyclic trichothecenes (isosatratoxin, satratoxins G & H, roridin E, trichodermol and trichoverrol) spirocyclic lactones and a variety of other compounds affecting the immune system (Croft et al., 1986; Samson et al., 1994; Macher, 1999). These mycotoxins accumulate within fungal spores and hyphal fragments (Macher, 1999). Dead spores are still allergenic and toxigenic (Croft et al., 1986). These toxins may be acquired by ingestion of food products contaminated with the fungus, handling of contaminated materials or via direct inhalation of spores. In particular, satratoxin H is highly poisonous by inhalation (i.e., it interferes with protein synthesis at DNA level) (Carlson, 1998). It has been documented that exposure to *Stachybotrys* toxins can lead to sore/burning throat, inflammation of the conjunctiva around the eye, hemorrhaging lesions of the nasal passages & upper airways and vesicular skin lesions (e.g., contact dermatitis) (Fung et al., 1998).

24. ***Ulocladium***

Ecology — *Ulocladium* is frequently isolated from air, cellulose materials, dust (especially mattress dust), gypsum wallboard, OSB/particleboard, textiles, humidifier water, wood and decaying or dead plant materials. Its presence in indoor air samples is generally a good indicator of water-damaged building materials. This genus has two active species – *U. chartarum* and *U. botrytis*.

Growth — *Ulocladium* is a tertiary colonizer (i.e., it only appears on materials with a high water activity of 0.90–0.95) and may develop visually unnoticeable fungal colonies. *Ulocladium* spores are very large. Temperature range for growth is 5-34°C with very good resistance to UV irradiation.

Health — *Ulocladium* is considered nonpathogenic (St-Germain & Summerbell, 1996).

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Appendix - B
Certificate of Laboratory Analysis

Client	Anthony J. Costello & Son Development	**Sample Date**	Friday, November 30th, 2007
Contact	Mr. Dominick Caroselli	**Analysis Date**	Monday, December 3rd, 2007
Project	Iola Campus Microbiological Assessment	**Lab Reference**	UMI071122

Sample #	Burkard Air Sample Location	# spores	Spores Identified	Count	spores/m^3	Percent
22-1130-01	Building #1 Sampled for 9 minutes at 10 L/min. or 90 liters of air The entire trace was analyzed at 600x magnification The analytical detection limit is 11 Spores/m^3 Particulate: **Elevated Levels**	279	Ascospore	49	544	17.6
			Aspergillus / Penicillium group	86	956	30.8
			Aureobasidium	4	44	1.4
			Basidiospore	4	44	1.4
			Cladosporium	95	1,056	34.0
			Ganoderma	3	33	1.1
			Hyphal fragment	4	44	1.4
			Oidium	5	56	1.8
			Periconia	2	22	0.7
			Stachybotrys	8	89	2.9
			Ulocladium	1	11	0.4
			Unknown	18	200	6.5
					3,099	

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Sample #	Burkard Air Sample Location	# spores	Spores Identified	Count	spores/m^3	Percent
22-1130-02	Building #2 Sampled for 9 minutes at 10 L/min. or 90 liters of air The entire trace was analyzed at 600x magnification The analytical detection limit is 11 Spores/m^3 Particulate: **Elevated Levels**	1,211	*Alternaria*	3	33	0.2
			Arthrinium	3	33	0.2
			Ascospore	32	356	2.6
			Aspergillus / Penicillium group	588	6,533	48.7
			Aureobasidium	4	44	0.3
			Basidiospore	5	56	0.4
			Cercospora	1	11	0.1
			Cladosporium	512	5,689	42.3
			Ganoderma	4	44	0.3
			Hyphal fragment	16	178	1.3
			Oidium	6	67	0.5
			Periconia	7	78	0.6
			Rust	1	11	0.1
			Stachybotrys	12	133	1.0
			Ulocladium	1	11	0.1
			Unknown	16	178	1.3
					13,455	

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Sample #	Burkard Air Sample Location	# spores	Spores Identified	Count	spores/m^3	Percent
22-1130-03	Building #4 Sampled for 9 minutes at 10 L/min. or 90 liters of air The entire trace was analyzed at 600x magnification The analytical detection limit is 11 Spores/m^3	1,443	*Alternaria*	1	11	0.1
			Ascospore	26	289	1.8
			Aspergillus / Penicillium group	689	7,656	47.8
			Aureobasidium	8	89	0.6
			Basidiospore	9	100	0.6
			Chaetomium	1	11	0.1
			Cladosporium	673	7,478	46.7
			Epicoccum	2	22	0.1
			Ganoderma	5	56	0.3
			Hyphal fragment	5	56	0.3
			Oidium	2	22	0.1
			Periconia	3	33	0.2
			Ulocladium	1	11	0.1
			Unknown	18	200	1.2
	Particulate: High Levels				16,034	

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Sample #	Burkard Air Sample Location	# spores	Spores Identified	Count	spores/m^3	Percent
22-1130-04	Building #5 Sampled for 9 minutes at 10 L/min. or 90 liters of air The entire trace was analyzed at 600x magnification The analytical detection limit is 11 Spores/m^3	3,343	Ascospore	21	233	0.6
			Aspergillus / Penicillium group	2,256	25,067	67.5
			Basidiospore	5	56	0.2
			Chaetomium	5	56	0.2
			Cladosporium	974	10,822	29.1
			Fusarium	10	111	0.3
			Ganoderma	2	22	0.1
			Hyphal fragment	10	111	0.3
			Myxomycete	1	11	0.0
			Periconia	3	33	0.1
			Stachybotrys	34	378	1.0
			Ulocladium	8	89	0.2
			Unknown	14	156	0.4
	Particulate: High Levels				37,145	

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Sample #	Burkard Air Sample Location	# spores	Spores Identified	Count	spores/m^3	Percent
22-1130-05	Building #7 Sampled for 9 minutes at 10 L/min. or 90 liters of air The entire trace was analyzed at 600x magnification The analytical detection limit is 11 Spores/m^3	1,315	Ascospore	18	200	1.4
			Aspergillus / Penicillium group	1,232	13,689	93.5
			Chaetomium	10	111	0.8
			Cladosporium	13	144	1.0
			Fusarium	1	11	0.1
			Hyphal fragment	8	89	0.6
			Leptosphaeria	2	22	0.2
			Myxomycete	1	11	0.1
			Periconia	2	22	0.2
			Stachybotrys	12	133	0.9
			Ulocladium	1	11	0.1
			Unknown	15	167	1.1
	Particulate: Moderate Levels				14,610	

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Sample #	Burkard Air Sample Location	# spores	Spores Identified	Count	spores/m^3	Percent
22-1130-06	Building #8 Sampled for 9 minutes at 10 L/min. or 90 liters of air The entire trace was analyzed at 600x magnification The analytical detection limit is 11 Spores/m^3	2,096	*Arthrinium*	1	11	0.1
			Ascospore	12	133	0.6
			Aspergillus / Penicillium group	1,495	16,611	71.2
			Chaetomium	12	133	0.6
			Cladosporium	534	5,933	25.4
			Hyphal fragment	8	89	0.4
			Leptosphaeria	1	11	0.1
			Stachybotrys	12	133	0.6
			Ulocladium	6	67	0.3
			Unknown	15	167	0.7
	Particulate: Moderate Levels				23,288	

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Sample #	Burkard Air Sample Location	# spores	Spores Identified	Count	spores/m^3	Percent
22-1130-07	Building #9 Sampled for 9 minutes at 10 L/min. or 90 liters of air The entire trace was analyzed at 600x magnification The analytical detection limit is 11 Spores/m^3	944	*Alternaria*	2	22	0.2
			Arthrinium	12	133	1.3
			Ascospore	43	478	4.6
			Aspergillus / Penicillium group	446	4,956	47.3
			Aureobasidium	4	44	0.4
			Basidiospore	3	33	0.3
			Chaetomium	11	122	1.2
			Cladosporium	352	3,911	37.3
			Epicoccum	7	78	0.7
			Ganoderma	3	33	0.3
			Hyphal fragment	10	111	1.1
			Oidium	2	22	0.2
			Periconia	5	56	0.5
			Stachybotrys	8	89	0.8
			Torula herbarum	1	11	0.1
			Ulocladium	18	200	1.9
			Unknown	17	189	1.8
	Particulate: High Levels				10,488	

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Certificate of Laboratory Analysis

Sample #	Burkard Air Sample Location	# spores	Spores Identified	Count	spores/m^3	Percent
22-1130-08	Building #10 Sampled for 9 minutes at 10 L/min. or 90 liters of air The entire trace was analyzed at 600x magnification The analytical detection limit is 11 Spores/m^3 Particulate: Moderate Levels	65	Ascospore *Aspergillus / Penicillium* group *Cladosporium* Hyphal fragment Unknown	9 29 18 4 5	100 322 200 44 56 722	13.8 44.6 27.7 6.2 7.7
22-1130-09	Outdoor Reference Sample Sampled for 9 minutes at 10 L/min. or 90 liters of air The entire trace was analyzed at 600x magnification The analytical detection limit is 11 Spores/m^3 Particulate: Low Levels	20	*Arthrinium* Ascospore *Aspergillus / Penicillium* group Basidiospore *Cladosporium* Hyphal fragment *Periconia* Unknown	1 5 2 1 7 1 1 2	11 56 22 11 78 11 11 22 222	5.0 25.0 10.0 5.0 35.0 5.0 5.0 10.0

Authorization Signature

Building Science Investigations, Inc.

Appendix - B
Certificate of Laboratory Analysis

Interpretation of Analytical Results - There are currently neither established government nor institutional regulations pertaining to the acceptable levels of microorganisms in indoor air or on miscellaneous surfaces. The interpretation of analytical results is problematic since the level of bioaerosols can vary greatly on a moment-to-moment basis with changes in occupant activity, pressure differentials, environmental conditions or changes in air flow dynamics. The following guideline has been designed by BSI to provide a general reference for the interpretation of microbial concentrations in the absence of recognized numerical standards. This guideline is not designed to be an absolute directive but a general reference to assist in the evaluation of relatively low, moderate, elevated or high fungal concentrations in an indoor environment.
Prudent risk management decisions pertaining to microbial organisms should not only be based on the concentration of organisms but on the types of species present, species rank order, indoor vs. outdoor comparisons, complaint vs. non-complaint comparisons, the health of the exposed occupants, duration of exposure, amount of growth and the dynamics of the building.[1,2] **It is not intended to evaluate potential health hazards or hazardous environments.**

Guideline for Evaluating Relative Concentrations	Burkard (spores/m^3)
Low Concentrations	Less than 300
Moderate Concentrations	300 - 600
Elevated Concentrations	600 - 1,200
High Concentrations	Greater than 1,200

Background Particulate Levels - Background particulate is an indication of the amount of non-biological debris present in a sample and is graded in four categories from low to high relative levels. It should be noted that elevated to high particulate levels may obscure small spores such as the *Aspergillus/Penicillium* group. Therefore, any count from samples with elevated to high background particulate levels should be regarded as a minimum count (i.e., the actual count may be higher than reported).

Relative Particulate Level	Description
Low Levels	Less than 25% deposition
Moderate Levels	25 - 50% deposition
Elevated Levels	50 - 75% deposition
High Levels	Greater than 75% deposition

Burkard Sample Analysis - 100% of the trace was analyzed at 600x magnification unless there is a notation made under the sample location description.

References

1. Dillon K, Ling-Ling H, Miller D. 2005. Field Guide for the Determination of Biological Contaminants in Environmental Samples. 2 Edition. Fairfax, VA: AIHA Pub. 284 p.
2. Macher J, editor. 1999. Bioaerosols: Assessment and Control. Cincinnati, OH: American Conference of Governmental Industrial Hygienists. 286 p.