Mold/Pollen Evaluation Report

Oyster River School District
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IAQ Testing by:
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AIRCUITY™

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Introduction

Thank you for using the Aircuity IAQ Evaluation System. This report and associated analytical services are designed to assist you in improving and maintaining a better indoor environment. Aircuity's mission is to make buildings more energy efficient, more comfortable, and healthier for occupants.

The Aircuity Advisor has generated this customized report using the indoor air quality data collected using the Aircuity portable monitor, combining this data with building and occupant information provided during the setup process. The recommendations in this report are based on this indoor air quality data and information, as well as an extensive IAQ database of similar buildings.

The results are completely confidential and protected according to the terms in the Limiting Conditions section of this report.

This report is divided into the following sections:

1. Laboratory Results - Charts indicating the names of mold and pollen spore types, number of spores per cubic meter, and the percentage of spore types from the total counted. In addition, the number of pollen grains per cubic meter is noted. Comparison charts are also a part of this section.

2. Analysis and Recommendations - Provides an in-depth analysis of each area tested, including recommendations for each area based on the recorded results and building and occupant information provided during the setup process that is referred to as profile information. Note: When corrective actions are taken, a follow-up analysis is suggested to demonstrate the effectiveness of the action taken.

3. Background - This section summaries the profile information that was provided. The accuracy and completeness of this information is critical since the Aircuity Advisor™ uses this information to develop recommendations.

4. Sampling Methods - Methods for gathering and measuring mold sprores and pollen.

5. How to Interpret Results - Guide to use of results and recommendations.

6. Description of Mold Types - Detailed description of all mold types screened for during mold testing.

7. Limiting Conditions- Certain limitations as to accuracy, recommendations, conclusions, and compliance with regulations are summarized. Confidentiality is defined.

8. Glossary - Key terms are defined.

Laboratory Results

Mold/Pollen Test History

Test Area	Test Start Date
Classroom 11	10/13/2016 1:53:00 PM
Outdoor	10/12/2016 9:53:00 AM
Classroom 11	2/8/2016 8:07:00 AM
Classrooom 10	2/5/2016 9:36:00 AM

PreTest Observations and Symptoms

This report reflects a Proactive survey of all test areas for which valid cartridge data exists.

- *The following observations contributed to mold and/or pollen assessment:*
  - *Classroom 11*
    - Filtration Method: Particle Filtration

Laboratory Analysis Results

The laboratory results of the mold/pollen testing are listed below. While types and numbers of mold (fungal) spores counted in each indoor area are significant, important diagnostic information is derived from a comparison of indoor to outdoor samples. For each area tested, a comparison of both the total count ratio (indoor/outdoor) and the percentage of each mold type in the sample are also displayed to make these comparisons easier.

In situations when the collection of an outdoor sample is impractical or impossible, such as during the winter in northern climates (<40 degrees F or snow cover), assessments are still possible but are more limited (see How to Interpret Results). In these cases the tables will not contain the indoor/outdoor ratio information as above.

Mold/Pollen Sample Results

Outdoor		
FUNGI	**Spores/m3**	**Spore %**
Alternaria|Ulocladium	0	0
Ascospores	0	0
Basidiospores	36197	97.76
Cladosporium	0	0
Curvularia	0	0
Drechslera	0	0
Epicoccum	0	0
Nigrospora	0	0
Penicillium|Aspergillus types	276	0.75
Periconia sp|smuts|myxomycetes	0	0
Pithomyces	0	0
Stachybotrys	0	0
Stemphyllium	0	0
Torula	0	0
Unknown	0	0
Other	552	1.49
Totals	37025	100

Classroom 11		
FUNGI	**Spores/m3**	**Spore %**
Alternaria|Ulocladium	0	0
Ascospores	139	5.1
Basidiospores	2100	76.98
Cladosporium	350	12.83
Curvularia	0	0
Drechslera	0	0
Epicoccum	0	0
Nigrospora	0	0
Penicillium|Aspergillus types	139	5.1
Periconia sp|smuts|myxomycetes	0	0
Pithomyces	0	0
Stachybotrys	0	0
Stemphyllium	0	0
Torula	0	0
Unknown	0	0
Other	0	0
Totals	2728	100
Indoor/Outdoor Ratio	0.07	
Max. Recom. Ratio	0.50	
Typical Ratio	0.05 - 0.25	

Pollen Counts	
AREA	**Grains/m3**
Outdoor	0
Classroom 11	0
Totals	0
Indoor/Outdoor Ratio	0
Max. Recom. Ratio	0.50
Typical Ratio	0.05 - 0.25

Mold Percent Comparison By Area

	Outdoor %	Classroom 11 %
Alternaria|Ulocladium	0	0
Ascospores	0	5
Basidiospores	98	77
Cladosporium	0	13
Curvularia	0	0
Drechslera	0	0
Epicoccum	0	0
Nigrospora	0	0
Penicillium|Aspergillus types	1	5
Periconia sp|smuts|myxomycetes	0	0
Pithomyces	0	0
Stachybotrys	0	0
Stemphyllium	0	0
Torula	0	0
Unknown	0	0
Other	1	0
Chart Total	**100**	**100**

Mold Values Comparison By Area

	Outdoor	Classroom 11
Alternaria|Ulocladium	0	0
Ascospores	0	139
Basidiospores	36197	2100
Cladosporium	0	350
Curvularia	0	0
Drechslera	0	0
Epicoccum	0	0
Nigrospora	0	0
Penicillium|Aspergillus types	276	139
Periconia sp|smuts|myxomycetes	0	0
Pithomyces	0	0
Stachybotrys	0	0
Stemphyllium	0	0
Torula	0	0
Unknown	0	0
Other	552	0
Chart Total	**37025**	**2728**

Background Information

Attributes

Attribute	Value
Year of Construction	1975
Location	Suburban
Number of Floors	1
Square Footage	100000
Primary Use(s)	School
Closed Space (% building area separated by walls)	Greater than 75 percent
Basement	No
Operable Windows (capable of being opened by occupants)	Between 10 and 50 percent
HVAC Equipment (check all that apply)	Air Handlers, Unit Ventilators
Air Handler Count	4
Boiler or Furnace	Natural Gas
Cooling Tower	No
Special Features (check all that apply)	computer rooms, kitchens
Elevators (if both, then chose "Hydraulic")	None

Events

Event	Date
NO EVENTS RECORDED	

Area Attributes - Classroom 11

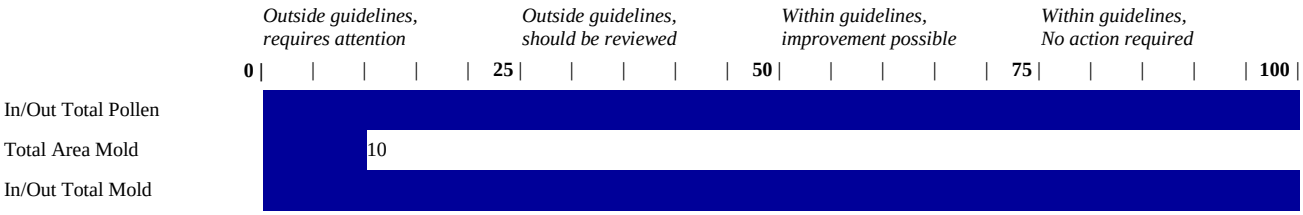
Attribute	Value
Space Heating Systems	Air System equipped with hot water heating coils
Space Cooling Systems	None
Area Type (separated from other areas by walls)	Closed
Outdoor Air	Economizer Cycle With Fixed Minimum Outdoor Air Intake
Air Delivery	Constant Volume
Return Air	Ducted
Humidification Method	None
Supplemental Humidification	No
Filtration Type	Particle Filtration
Supplemental Filtration	No
Terminal-Type Supplemental Filtration	No
Floor Covering	Vinyl Tile

Area Summary - Classroom 11

Filtration/Infiltration Assessment

- During this testing period, the area (indoor) pollen was within recommended guidelines and does not require attention.
- **During this testing period, the area (indoor) mold spores were significantly above recommended guidelines and requires attention.**
  - Diagnostics:
    - The total mold count within this space is high.
  - Possible Causes:
    - Inadequate filtration of the outdoor air, either at the building or test area level.
    - Improper building pressurization allowing unfiltered outdoor air to penetrate this space.
    - An indoor source of mold (see results from Indoor Source Assessment).

Filtration/Infiltration Ratings

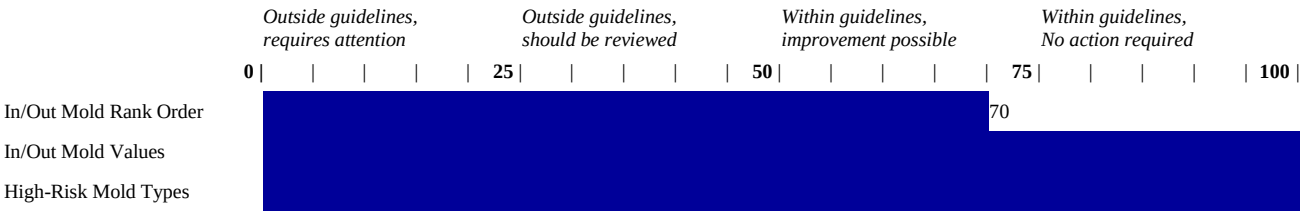


- In/Out Total Mold (Pollen) - Rates the differences in total count between indoor and outdoor samples (refer to Indoor/Outdoor Ratio values in results table(s).
- Total Area Mold - Rates the total mold count against a threshold value of 1000 spores/m3.

Indoor Source Assessment

- During this testing period, the area mold types were similar to the outdoor types and do not require attention.
- No high-risk mold types were found.

Indoor Source Ratings



- In/Out Mold Rank Order - Rates differences in overall mold composition between indoor and outdoor samples (most easily seen in Mold Percent Comparison table).
- In/Out Mold Values - Rates differences between indoor and outdoor samples for individual mold types (most easily seen in the Mold Value Comparison table).

Recommended Actions

- The following recommendations are suggested to reduce mold spore levels in the area that appear to be due to filtration/infiltration:
    - Close/seal windows and doors to the test space.
    - Investigate the design and operation of the overall filtration system.
    - Ensure that the test space is positively pressurized relative to the outside.

Further Testing

Pollen

- No further testing is required at this time, based solely on the conditions of the current test. However, further testing is recommended when significant changes to building conditions occur (e.g., change in season, extent of reported symptoms, building pressurization, etc) that impact pollen.

Mold

- Follow-up testing after actions are taken will verify previous diagnoses and successful outcomes.

Sampling Methods

Currently, there are no universally accepted protocols or regulatory requirements regarding air sampling for molds. In large part, this is due to the inability of any single technique to provide a complete analysis of all molds in an area. For example, it is known that some mold spores can be allergenic, irritating, or even infectious (in severely debilitated individuals) only when they are viable (i.e., alive), while other spore types may produce allergic responses or be irritating to the respiratory tract even when they are no longer alive and capable of growth. Therefore, an analytical method that relies on molds to grow on an agar medium in order to identify and count them will miss non-viable spores. Conversely, spore-capture methods that gather material for direct microscopic examination do not assess viability, nor do they allow the differentiation among some important species that would be available from a culture technique. Because of these differences, sampling for molds in any given environment would optimally use both a culture-based method and one based on direct examination to obtain a full evaluation. However, this dual approach can be very costly and time-consuming, and thus may not be practical to use.

When the use of only one technique is advisable, the spore-capture technique used in the Aircuity system is considered the preferable choice, according to most professionals. The benefits and limitations of this technique are discussed below, as well as the limitations of the technique as used with the Aircuity IAQ Evaluation System.

Benefits of the Spore-Capture Technique
Samplers used to collect spores from the air capture most spore types as well as other airborne particles. The spores and particles are collected on a glass slide or filter inside the sampler and are then examined under a microscope, without the intermediate step of culturing the spores on an agar medium. Using this method, most mold problems that cause spores to be released can be identified. This is true even if the spores are no longer viable or if species of spores are present that do not grow well in culture (e.g., Stachybotrys). In such cases, a sampling protocol based only on culture-based techniques may not detect a mold-related indoor environmental problem. Spore samplers will also capture airborne pollen grains. While not an indicator of indoor growth (unless associated with indoor plants), pollen is important as a potential contributor to allergies, and its presence may indicate that significant unfiltered outdoor air is entering a building. Finally, spore capture methods do not require the special handling inherent to the use of agar growth media, i.e. samples can be stored for a time prior to examination, and are not sensitive to temperature.

Limitations of the Spore-Capture Technique
Many mold spores have unique shapes or surface characteristics and can be identified with a great deal of certainty under the microscope. Some spore types, however, are very small or are relatively featureless and are much more difficult to identify in this way. When large numbers of such spores are present, air testing for molds can result in a significant number of spores being labeled as "Unknown". This limited identification of spores may impact the effectiveness of the IAQ testing. The Aircuity Advisor will warn the user when the percentage of unknown spores is great enough to have an impact on the analysis. Also, in very dusty environments, the dust particles collected along with the airborne spores may obscure the spores and make identification and counting difficult. In this case, the Aircuity Advisor will identify high dust levels as a primary issue and will indicate that the mold assessment is limited as a result.

Additional Limitations
In any mold testing procedure, multiple samples are always preferred for both indoor and outdoor samples to increase the confidence of results. The Aircuity screening procedure generally limits sampling to a single filter for each area to reduce the cost of the test. While this limits the effectiveness of the test to some degree, it is deemed sufficient for the purpose of a general survey method.

How to Interpret Results

There are currently no standards or guidelines used to determine the "safe" or "normal" levels of mold spores and pollen grains in the indoor air. Also, wide variations of the spore concentrations can take place within a relatively short period of time in both outdoor and indoor air. However, by comparing levels of mold spores and pollen grains in the indoor air directly to those found outdoors, we can make reasonable assessments of the potential for problems within the building.

In situations when the collection of an outdoor sample is impractical or impossible, such as during the winter in northern climates (<40 degrees F or snow cover), assessments are still possible but are more limited as discussed below.

Filtration/Infiltration Assessment

The filtration / infiltration assessment compares the total mold spore count indoors to that found outdoors (when an outdoor sample is taken).

In/Out Total Mold – The only source of mold spores indoors should be from the outdoor air where they are typically plentiful (with the exception of winter months in northern climates). Here the ratio of indoor to outdoor total spore and grain counts are used to evaluate the efficiency of outdoor air filtration and / or the amount of infiltration from open windows, low building pressurization, etc. In commercial buildings, very low ratios (indicating little outdoor penetration) tend to occur when the outdoor concentration is high. Conversely, high ratios (>1), indicating possible indoor growth, generally occur when outdoor concentrations are low, such as during the winter. These ratios are strongly dependent on the absolute concentrations being measured, so the totals are taken into account for the evaluation (Spengler, J., ed., et al, IAQ Handbook, 2001, 45:9).

Total Area Mold – This rating compares the total indoor mold spore count to a level that experts say may affect sensitive individuals (1000 spores / m3). While individual sensitivities to mold spores vary widely, this information can be useful in creating simple pro-active measures that may improve indoor conditions, such as modifying the frequency or intensity of cleaning in affected areas, adding a local filtration system, upgrading filters or cleaning ductwork. You should keep in mind that sometimes the outdoor level of mold spores is extremely high (during a mold “bloom”) and can cause indoor levels to temporarily rise above the “target” value even when the building is clean and reasonably tight. You can usually recognize this condition by a low (0.3 or less) indoor/outdoor count ratio in the lab report table when the total indoor count level is exceeded. Under these conditions it may be very difficult to lower the indoor levels further.

An indoor-only mold report will base its assessment solely using the total indoor count criteria. It always assumes a low outdoor count, and thus will judge any high mold count as a reason for further investigation.

Indoor Source Assessment

To estimate the potential for indoor sources of mold, a comparison between the composition of indoor and outdoor samples is necessary. While some variations in the types and percentages of mold found in the two samples is perfectly normal, large differences may indicate indoor growth. The In/Out Mold Rank Order measure compares the predominant order of outdoor mold genera to the indoor samples, based on the assumption that indoor mold originates from an outside source. A significant difference in the order of the major fractions of outdoor and indoor mold may indicate an indoor source of mold. The following example of rank order categorization compares an outdoor sample to two indoor samples.

Mold Genera	Outdoor Sample			Office 203			Lunch Room		
	Rank	Spores/m^3	Pct.	Rank	Spores/m^3	Pct.	Rank	Spores/m^3	Pct.
Basidiospores	1	8,625	58	1	345	46	4	276	11
Ascospores	2	4,278	28	2	207	27	2	690	26
Penicillium/Aspergillus	3	1,518	10	4	69	9	1	1,173	45
Cladosporium	4	552	4	3	138	18	3	483	18
Total		14,973	100		759	100		2,622	100

When an outdoor sample is not available for comparison, a secondary rule is applied that screens the sample for mold spore types that constitute a significant number (>300 spores/m^3) and percentage (>30%) of the sample. This is a less definitive method than using the outdoor comparison, but still useful. In these cases the collection of two or more indoor samples is recommended.

A few molds have been identified as high-risk based upon the severity of symptoms associated with extended exposure (Stachybotrys), and their presence even at relatively low concentrations will be brought to attention for further investigation. Please note that the mere presence of these types in indoor samples should not be cause for alarm, but rather for a professional opinion.

Description of Mold Types

Alternaria / Ulocladium
Using the testing protocol employed with the Aircuity system, *Alternaria* and *Ulocladium* spores are often indistinguishable.
Alternaria is a large and universally occurring genus, and the spores are easily carried by the wind. It is commonly found in house dust, carpets, textiles and on horizontal surfaces in building interiors. It is a common cause of allergies.
Ulocladium is fairly widespread and may be found on plant materials, in soil, dust, rotten wood, paper, textiles and in water-damaged cellulose rich building materials. It is known to be a common source of respiratory allergens.

Ascospores
Ascospores are considered a wet weather spores. They are typically plentiful during light rainfall or in pre-dawn hours when condensation is heavy. The fungi in this group include many different genera and they produce a spore type that, like basidiospores (see below), are often referred to as "sexual spores" (that is, they result from meiotic and mitotic cell division). While typically found outdoors, some types (for example, Chaetomium) are commonly encountered on wet indoor materials.

Basidiospores
These "sexually produced" spores (also see "Ascospores") come from mushrooms, puffballs, and bracket fungi. These spore producing structures are found in lawns, fields, parks, and wooded areas from spring through fall, often within a few days after rainfall. In mushrooms and bracket fungi, the release of spores requires high humidity and so they are often abundant in the pre-dawn hours. While these spores are considered to be allergenic, few studies have been done.

Cladosporium
Cladosporium is a cosmopolitan genus that is usually considered the most frequently found genus in outdoor air in temperate climates. Because of their abundance outdoors, the spores are also usually found indoors. *Cladosporium*, a decomposer that will grow on many damp surfaces, including dirty refrigerators and damp painted surfaces, is usually associated with humid environments. It is also found on dead plants, woody plants, food, straw, soil and textiles, and its tendency to produce large quantities of easily airborne spores make this fungus a significant concern for those with fungal allergies or asthma.

Curvularia
Curvularia is a common parasite and decomposer of a number of plants, especially grasses. It is distributed worldwide, yet mostly occurs in subtropical or tropical environments. It is a possible contaminant on many outdoor or indoor surfaces.

Drechslera
Drechslera, a large cosmopolitan genus, is found in plant debris and soil, and is considered to be a plant pathogen of numerous plants, particularly grasses. It is commonly considered an allergenic fungus.

Epicoccum
Epicoccum is commonly found with *Cladosporium* in plants, soil, grains, textiles and paper products. *Epicoccum* is frequently isolated from air, especially in agricultural areas, and occasionally occurs in house dust. It is increasingly thought to be an important allergenic fungus.

Nigrospora
Nigrospora is found in decaying plant material and soil, and is rarely found growing indoors. It is reported to be allergenic.

Penicillium / Aspergillus
Using the testing protocol employed with the Aircuity system, *Penicillium* and *Aspergillus* spores are generally

indistinguishable.
The genus *Penicillium* contains a large number of species. Outdoors it is commonly found in soil, cellulose, grains and compost piles. Indoors it may be found in food, carpet, wallpaper, paint, and in interior fiberglass duct insulation. *Penicillium* is considered to be an important allergenic fungus and, in additional to being an agent of allergies and asthma, may cause conditions such as hypersensitivity pneumonitis in susceptible individuals.
There are more that 160 different species of *Aspergillus*. These species are frequently found in forage products, grains, nuts, cotton, organic debris and water damaged building materials. *Aspergillus* related infectious diseases are relatively uncommon in healthy individuals (with normally functioning immune systems). However, its presence may be a concern in clinical settings.

Periconia/smuts/myxomycetes
This group of three unrelated fungal types is listed together because morphologically the spores are frequently indistinguishable.
Periconia is found on the roots of various crops and dead plant stems, and is the cause of root-rot disease in some cultivated plants. The spores are not particularly abundant in the air, and its significance as a cause of allergic disease is not well known.
Smuts do not grow indoors but are parasitic on a variety of plants, notably cereal crops, other grasses and weeds. They are members of the Basidiomycetes, and are thought to be allergenic.
Myxomycetes are commonly known as slime molds, and are typically found in the forest where it is cool, moist and shady. They can be seen on decaying wood (for example, in wood chip mulch) and in decaying leaves as colorful, shapeless structures. The tiny spores peak in number in early summer and late fall.

Pithomyces
Pithomyces is found in dead stems, rotting leaves, paper, feed grass, tree bark and in many types of plants. It is an early colonizer of dead organic material, and in northern climates airborne spores can be found well into the fall season. It is known only as a possible allergen, and is more likely to be a factor in rural areas.

Pollen
Pollen is a vessel used by flowering plants to transport the male reproductive cell to the female flower to fertilize the female cell (resulting in seed formation). Many pollen grains are transported via the air. Pollen found indoors almost always has an outdoor source, but may occasionally be produced indoors when plants are cultivated indoors. Indoor plants typically contain pollen adapted for insect transport (not air transport) and thus are not usually an indoor source. Pollen is unlikely to penetrate the HVAC systems of most buildings but is more likely carried indoors by humans and pets. The local flora and season will determine the types of pollen found in the local air. Exposure to pollen of certain plant types is a known to result in allergic symptoms in susceptible individuals.

Stachybotrys
Stachybotrys grows on water- damaged cellulose-rich materials such as sheet rock, paper, ceiling tiles, cellulose containing insulation backing and wallpaper. This fungus is significant due to its ability to produce mycotoxins that are extremely toxic. Exposure to these toxins can produce a variety of symptoms including dermatitis, cough, cold and flu symptoms, headache and fever. It generally appears as a sooty black fungus, and is best isolated using surface sampling techniques - *Stachybotrys* spores do not readily become airborne and therefore the presence of the fungus is not always detected using air sampling techniques.

Torula
Torula is a cosmopolitan fungus, common on dead weeds and grass but also found in soil and on dung. It appears as a velvety black material on the surface. Spore production is at a peak in the fall and late spring/early summer. *Torula* is reported to be allergenic.

Unknown
The unknown category is used when the analyst identifies a fungal spore on the filter, but cannot positively type it. It is not uncommon to place a significant number of spores in this category, and the Aircuity Advisor™ will use this information as well as that from the known types.

Description of Mold Types

Other

This category is reserved for fungal types found that are not in the above categories, and for other materials (both organic and inorganic) that may be found in unusually high concentrations on the filter and are identified by the analyst. This information is not used by the Aircuity Advisor™, but is included in the report for the user's consideration

Limiting Conditions

Optima Monitor
The Optima Monitor operates in accordance with generally accepted practices for the determination of indoor air components in both sampling and sensing technology. The operator of the Optima Monitor certifies that all manufacturers techniques have been adhered to and that those techniques are in general acceptance by other qualified indoor air quality consultants.

Aircuity Advisor™
The Aircuity Advisor utilizes data from both the Optima Monitor and from voluntary input by the operator or their representative. Aircuity cannot guarantee the accuracy of operator input and makes no representation that a physical inspection of the subject building has taken place nor that any communication has taken place directly with Aircuity regarding the subject building, its condition, materials, makeup, occupants, or symptoms of occupants.

Conclusions
The conclusions in this report are based on limited information and are in no way to be construed as absolute analysis of all conditions. These conclusions are intended to guide the user to identify conditions for further investigation or determination by an on-site professional.

Recommendations
Recommendations are expressed as a series of possible solutions to problems identified and are in no way certified as to their effectiveness. Recommendations should be considered by an on-site professional for a determination of effectiveness prior to implementation.

Independent Laboratory Analysis
When Aircuity, Inc. has relied on an analysis conducted by an independent laboratory, the results provided by the laboratory are taken at face value, and no independent evaluation has been conducted on these results.

Current Law
No attempt has been made to determine the compliance of the subject building to any local, state, federal, or other law or regulation.

Confidentiality
Every effort has been made to safeguard the confidentiality of the contracted users personal, professional, and building specific information. Aircuity will not sell, trade, or rent information to any other related or unrelated party. All efforts have been made, through data encryption and password protection, to make individual building information and test results available only to the contracted user excluding all other parties, including Aircuity, from this information. Aircuity, Inc. may share aggregate data from buildings with other users or researchers in order to provide a more meaningful context with which to compare individual building data, but this information will never include any personal or building-specific identifiers. Aircuity, Inc. will not disclose any confidential client information without the client's specific written authorization.

Glossary

ACTION LEVEL: A term used to identify the level of indoor radon at which remedial action is recommended. (EPA's current action level is 4 pCi/L.)

AIR CLEANING: An IAQ control strategy to remove various airborne particulates and/or gases from the air. The three types of air cleaning most commonly used are particulate filtration, electrostatic precipitation, and gas sorption.

AIR EXCHANGE RATE: The rate at which outside air replaces indoor air in a space. Expressed in one of two ways: the number of changes of outside air per unit of time air changes per hour (ACH); or the rate at which a volume of outside air enters per unit of time - cubic feet per minute (cfm).

AIR HANDLING UNIT (AHU): For purposes of this document refers to equipment that includes a blower or fan, heating and/or cooling coils, and related equipment such as controls, condensate drain pans, and air filters. Does not include ductwork, registers or grilles, or boilers and chillers.

AIR PASSAGES: Openings through or within walls, through floors and ceilings, and around chimney flues and plumbing chases, that permits air to move out of the conditioned spaces of the building.

ANIMAL DANDER: Tiny scales of animal skin.

ALLERGEN: A substance capable of causing an allergic reaction because of an individual's sensitivity to that substance.

ALLERGIC DISEASES: Diseases characterized by allergic responses to pollutants. The hypersensitivity diseases most clearly associated with indoor air quality are asthma, rhinitis, and hypersensitivity pneumonitis. Hypersensitivity pneumonitis is a rare but serious disease that involves progressive lung damage as long as there is exposure to the causative agent.

ALLERGIC RHINITIS: Inflammation of the mucous membranes in the nose that is caused by an allergic reaction.

ANTIMICROBIAL: Agent that kills microbial growth. See "disinfectant," "sanitizer," and "sterilizer."

BIOLOGICAL CONTAMINANTS: Agents derived from, or that are, living organisms (e.g., viruses, bacteria, fungi, and mammal and bird antigens) that can be inhaled and can cause many types of health effects including allergic reactions, respiratory disorders, hypersensitivity diseases, and infectious diseases. Also referred to as "microbiologicals" or "microbials."

BREATHING ZONE: Area of a room in which occupants breathe as they stand, sit, or lie down.

BUILDING ENVELOPE: Elements of the building, including all external building materials, windows, and walls, that enclose the internal space.

BUILDING-RELATED ILLNESS (BRI): Diagnosable illness whose symptoms can be identified and whose cause can be directly attributed to airborne building pollutants (e.g., Legionnaire's disease, hypersensitivity pneumonitis). Also: A discrete, identifiable disease or illness that can be traced to a specific pollutant or source within a building. (Contrast with "Sick building syndrome").

CEILING PLENUM: Space below the flooring and above the suspended ceiling that accomodates the mechanical and electrical equipment and that is used as part of the air distribution system. The space is kept under negative pressure.

Glossary

CENTRAL AIR HANDLING UNIT (Central AHU): This is the same as an Air Handling Unit, but serves more than one area.

CFM. Cubic feet per minute. The amount of air, in cubic feet, that flows through a given space in one minute. 1 CFM equals approximately 2 liters per second (l/s).

CHEMICAL SENSITIZATION: Evidence suggests that some people may develop health problems characterized by effects such as dizziness, eye and throat irritation, chest tightness,
and nasal congestion that appear whenever they are exposed to certain chemicals. People may react to even trace amounts of chemicals to which they have become "sensitized."

CO: Carbon monoxide.

CO2:. Carbon dioxide.

COMMISSIONING: Start-up of a building that includes testing and adjusting HVAC, electrical, plumbing, and other systems to assure proper functioning and adherence to design criteria. Commissioning also includes the instruction of building representatives in the use of the building systems.

CONDITIONED AIR: Air that has been heated, cooled, humidified, or dehumidified to maintain an interior space within the "comfort zone." (Sometimes referred to as "tempered" air.)

CONSTANT AIR VOLUME SYSTEMS: Air handling system that provides a constant airflow while varying the temperature to meet heating and cooling needs.

DAMPERS: Controls that vary airflow through an air outlet, inlet, or duct. A damper position may be immovable, manually adjustable or part of an automated control system.

DIFFUSERS AND GRILLES: Components of the ventilation system that distribute and return air to promote air circulation in the occupied space. As used in this document, supply air enters a space through a diffuser or vent and return air leaves a space through a grille.

DRAIN TRAP: A dip in the drain pipe of sinks, toilets, floor drains, etc., which is designed to stay filled with water, thereby preventing sewer gases from escaping into the room.

ENVIRONMENTAL TOBACCO SMOKE (ETS): Mixture of smoke from the burning end of a cigarette, pipe, or cigar and smoke exhaled by the smoker (also secondhand smoke (SHS) or passive smoking).

EXHAUST VENTILATION: Mechanical removal of air from a portion of a building (e.g., piece of equipment, room, or general area).

FUNGI: Any of a group of parasitic lower plants that lack chlorophyll, including molds and mildews.

HEPA: High efficiency particulate arrestance (filters).

HUMIDIFIER FEVER: A respiratory illness caused by exposure to toxins from microorganisms found in wet or moist areas in humidifiers and air conditioners. Also called air conditioner or ventilation fever.

HVAC: Heating, ventilation, and air-conditioning system.

HYPERSENSITIVITY PNEUMONITIS: A group of respiratory diseases that cause inflammation of the lung (specifically granulomatous cells). Most forms of hypersensitivity pneumonitis are caused by the inhalation of organic dusts, including molds.

IAQ: Indoor air quality.

INDICATOR COMPOUNDS: Chemical compounds, such as carbon dioxide, whose presence at certain concentrations may be used to estimate certain building conditions (e.g., airflow, presence of sources).

INDOOR AIR POLLUTANT: Particles and dust, fibers, mists, bioaerosols, and gases or vapors.

LEGIONELLA: Legionellosis is an infection in humans caused by inhalation of bacterial species of Legionella. This bacteria can cause two types of infections: Legionnaires' disease, which was named for the noted 1976 outbreak in Philadelphia, and Pontiac fever.

MICROBIOLOGICALS: See "Biological Contaminants."

MODEL BUILDING CODES: The building codes published by the 4 Model Code Organizations and commonly adopted by state or other jurisdictions to control local construction activity.

MODEL CODE ORGANIZATIONS: Includes the following agencies and the model building codes they promulgate:
· Building Officials and Code Administrators International, Inc. (BOCA National Building Code/1993 and BOCA National Mechanical Code/1993);
· International Conference of Building Officials (Uniform Building Code/1991 and Uniform Mechanical Code/1991);
· Southern Building Code Congress, International, Inc. (Standard Building Code/1991 and Standard Mechanical Code/1991);
· Council of American Building Officials (CABO One- and Two-Family Dwelling Code/1992 and CABO Model Energy Code/1993).

NEGATIVE PRESSURE: Condition that exists when less air is supplied to a space than is exhausted from the space, so the air pressure within that space is less than that in surrounding areas. Under this condition, if an opening exists, air will flow from surrounding areas into the negatively pressurized space.

ORGANIC COMPOUNDS: Chemicals that contain carbon. Volatile organic compounds vaporize at room temperature and pressure. They are found in many indoor sources, including many common household products and building materials.

OUTDOOR AIR SUPPLY: Air brought into a building from the outdoors (often through the ventilation system) that has not been previously circulated through the system. Also known as "Make-Up Air."

PELs: Permissible Exposure Limits (standards set by the Occupational, Safety and Health Administration - OSHA).

PICOCURIE (pCi): A unit for measuring radioactivity, often expressed as picocuries per liter (pCi/L) of air.

PLENUM: Air compartment connected to a duct or ducts.

PM: Preventive Maintenance.

POLLUTANT PATHWAYS: Avenues for distribution of pollutants in a building. HVAC systems are the primary pathways in most buildings; however all building components interact to affect how air movement distributes pollutants.

POSITIVE PRESSURE: Condition that exists when more air is supplied to a space than is exhausted, so the air pressure within that space is greater than that in surrounding areas. Under this condition, if an opening exists, air will

flow from the positively pressurized space into surrounding areas.

PPM: Parts per million.

PRESSED WOOD PRODUCTS: A group of materials used in building and furniture construction that are made from wood veneers, particles, or fibers bonded together with an adhesive under heat and pressure.

PRESSURE, STATIC: In flowing air, the total pressure minus velocity pressure. The portion of the pressure that pushes equally in all directions.

PREVENTIVE MAINTENANCE: Regular and systematic inspection, cleaning, and replacement of worn parts, materials, and systems. Preventive maintenance helps to prevent parts, material, and systems failure by ensuring that parts, materials and systems are in good working order.

RADON (Rn) AND RADON DECAY PRODUCTS: Radon is a radioactive gas formed in the decay of uranium. The radon decay products (also called radon daughters or progeny) can be breathed into the lung where they continue to release radiation as they further decay.

RE-ENTRAINMENT: Situation that occurs when the air being exhausted from a building is immediately brought back into the system through the air intake and other openings in the building envelope.

SANITIZER: One of three groups of antimicrobials registered by EPA for public health uses. EPA considers an antimicrobial to be a sanitizer when it reduces but does not necessarily eliminate all the microorganisms on a treated surface. To be a registered sanitizer, the test results for a product must show a reduction of at least 99.9% in the number of each test microorganism over the parallel control.

SHORT-CIRCUITING: Situation that occurs when the supply air flows to return or exhaust grilles before entering the breathing zone (area of a room where people are). To avoid short-circuiting, the supply air must be delivered at a temperature and velocity that results in mixing throughout the space.

SICK BUILDING SYNDROME (SBS): Term that refers to a set of symptoms that affect some number of building occupants during the time they spend in the building and diminish or go away during periods when they leave the building. Cannot be traced to specific pollutants or sources within the building. (Contrast with "Building related illness").

SOIL GAS: The gas present in soil which may contain radon.

SOURCES: Sources of indoor air pollutants. Indoor air pollutants can originate within the building or be drawn in from outdoors. Common sources include people, room furnishings such as carpeting, photocopiers, art supplies, etc.

STACK EFFECT: The overall upward movement of air inside a building that results from heated air rising and escaping through openings in the building super structure, thus causing an indoor pressure level lower than that in the soil gas beneath or surrounding the building foundation.

STATIC PRESSURE: Condition that exists when an equal amount of air is supplied to and exhausted from a space. At static pressure, equilibrium has been reached.

STERILIZER: One of three groups of antimicrobials registered by EPA for public health uses. EPA considers an antimicrobial to be a sterilizer when it destroys or eliminates all forms of bacteria, fungi, viruses, and their spores. Because spores are considered the most difficult form of a microorganism to destroy, EPA considers the term sporicide to be synonymous with "sterilizer."

TLVs: Threshold Limit Values (guidelines recommended by the American Conference of Governmental Industrial Hygenists).

TVOC: Total volatile organic compounds. See "Volatile Organic Compounds (VOCs)"

UNIT VENTILATOR: A fan-coil unit package device for applications in which the use of outdoor- and return-air mixing is intended to satisfy tempering requirements and ventilation needs.

VARIABLE AIR VOLUME SYSTEM (VAV): Air handling system that conditions the air to constant temperature and varies the supply airflow to ensure thermal comfort.

VENTILATION AIR: Defined as the total air, which is a combination of the air brought inside from outdoors and the air that is being re-circulated within the building. Sometimes, however, used in reference only to the air brought into the system from the outdoors; this document defines this air as "outdoor air ventilation."

VENTILATION RATE: The rate at which indoor air enters and leaves a building. Expressed in one of two ways: the number of changes of outdoor air per unit of time (air changes per hour, or "ach") or the rate at which a volume of outdoor air enters per unit of time (cubic feet per minute, or "cfm").

VOLATILE ORGANIC COMPOUNDS (VOCs): Compounds that vaporize (become a gas) at room temperature. Common sources which may emit VOCs into indoor air include housekeeping and maintenance products, and building and furnishing materials. In sufficient quantities, VOCs can cause eye, nose, and throat irritations, headaches, dizziness, visual disorders, memory impairment; some are known to cause cancer in animals; some are suspected of causing, or are known to cause, cancer in humans. At present, not much is known about what health effects occur at the levels of VOCs typically found in public and commercial buildings.

ZONE: The occupied space or group of spaces within a building which has its heating or cooling controlled by a single thermostat.