# INDOOR AIR QUALITY COMPARISON STUDY

## HEPA AIR FILTRATION SYSTEM

## OF THE FACILITY LOCATED AT
## 2818 MARSHALL DRIVE
## SARASOTA, FLORIDA

January 7, 2003

Air Quality Environmental, Inc.
*Indoor Environmental Consultants & Lab Services*
521 49th Street North, St. Petersburg, Florida 33710 (727) 327-7477 FAX (727) 327-1657

Fantech
1712 Northgate Boulevard
Sarasota, Florida 34234

Attention: Mr. Lindsay Ambler

Date: January 7, 2003

Lab File #: 03-1317.Fantech

Re: Indoor Air Quality comparison study of a HEPA filtration system: for the residence at 2818 Marshall Drive, Sarasota, Florida.

Dear Mr. Ambler,

**Air Quality Environmental, Inc.** is pleased to submit the enclosed Indoor Air Quality Inspection Report for the above referenced facility. We appreciate the opportunity to serve you on this project. Should you have any questions concerning the information contained in this report, please do not hesitate to contact us.

Sincerely,

Wolfgang Paltian

Wolfgang Paltian, CIE
Microscopist / Mycology

## BACKGROUND INFORMATION

**Air Quality Environmental, Inc.** was authorized by Mr. Lindsay Ambler of Fantech to conduct a comparison study of a HEPA filtration system installation at 2818 Marshall Drive, Sarasota, Florida. The scope of work included:

* Inspection of the installation

* Collection and Analysis of Samples and Environmental Measurements

* Preparation of an Indoor Air Quality Inspection / Comparison Report

## SUMMARY OF INSPECTION

The facility is an older single story, single family residence that had suffered roof leaks in the past. The initial inspection performed on November 26, 2002 was to determine possible contamination sources along with establishing a baseline for the comparison of a HEPA air filtration system.

### Inspection Personnel

A visual inspection of the facility was first conducted to establish a sampling plan for the facility. Once this was accomplished, the inspector collected bulk, air and swab samples from areas where complaints by the occupants have been reported (or areas identified for potential microbial growth). Field notes were obtained during the inspection.

The visual inspection and sample collection was performed by Mr. Wolfgang Paltian and Erich Paltian of Air Quality Environmental, Inc. on January 6, 2003.

### Sampling Activities

The sampling procedures utilized for the collection first required the establishment of suspect sampling areas. A suspect sampling area is defined as an area where complaints by the occupants have been reported, identified as an area for potential microbial growth, or was established previously as an area containing abnormal concentrations of microbial growth. The individual sampling areas were examined and representative samples where randomly collected.

The U.S. Environmental Protection Agency (EPA), American Industrial Hygiene Association (AIHA), National Environmental Health Association (NEHA) and other prominent organizations in the field of indoor air quality has published guidelines and recommendations pertaining to inspection and sampling for air contaminants. These guidelines were adhered to during the inspection.

Samples collected during the inspection were analyzed using Compound Brightfield Microscopy analysis methodology using 100X magnification. Nonviable samples were collected using the Zefon type air cassettes with a trace of 14.4 mm. Viable samples utilized the use of malt extract agar (MEA) and tryptic soy agar (TSA).

### Description of Areas Inspected

Analysis identifies all the areas inspected and/or analyzed for the detection of airborne contaminates. A brief summary of these areas follows:

- Outside (used as a reference of normal air concentrations)
- Living Spaces

**2818 MARSHALL DRIVE**
**SARASOTA, FLORIDA**

## INSPECTION AND ANALYSIS RESULTS

1. A visual inspection was made of the HEPA filtration system which was attached to the air handler located on the back porch of the residence. The system was installed to bring in approximately 33% outside make-up air while bringing 100% of return air through the installed system.
2. Air samples taken from the inside dining area were compared to the previous sample taken from the same location. The results where significantly improved. There was a total reduction of outside baseline mold spores from the original sample which can be attributed to the change in weather. However, the contamination levels of *Penicillium / Aspergillus* and the particulate counts were greatly reduced. Considering that no remediation activities occurred other than the installation of the HEPA filtration unit, it can be assumed that this system was successful.
3. The CO2 (carbon dioxide) levels taken from the environmental measurements indicated improved air exchange with the outside. This is assumed to be due to 33% of the make-up air for the HVAC system being directed from the outside.
4. It is not known as to what limits of contamination levels this system would effectively perform successfully at and it is by no means the solution for eliminating mold contaminated materials in place of removal of such materials. It is however, an excellent system for the purpose of maintaining a high degree of air quality within a given space. This is a determination based on the reduction of *Penicillium / Aspergillus* levels of originally 3,905 spores per cubic meter to 188, and particulates that were TMTC (too many to count) to a reduced 52,170 which are now both within normal ranges.

## RESPONSE ACTION RECOMMENDATIONS

It is still recommended that the original protocol for remediation be followed along with measures taken to insure that the water intrusion issues have been corrected. Once accomplished, no further actions are required. The install system should maintain an excellent degree of indoor air quality to its residents.

*The above recommendations by this inspection are based solely on the limited observations and data collected at the time of the inspection of the property. Additional areas of remediation may be encountered and thus extend the scope of the work. The goal of remediation is to remove or clean contaminated materials in a way that prevents the emission of fungi and dust contaminated with fungi from leaving the work area and entering an occupied area. Air Quality Environmental, Inc. offers remediation guidelines that are recognized as appropriate protocol established by the United States Environmental Protection Agency (EPA). It is up to the owner or property management to review such data and recommendations and make prudent judgments based on feasibility.*

## APPENDIX

## LABORATORY ANALYTICAL GUIDELINES
## ENVIRONMENTAL MEASUREMENTS
## LABORATORY ANALYSIS
## DEFINITIONS AND PATHOGENICITY OF ORGANISMS DETECTED

Air Quality Environmental, Inc.

521 49th Street North, St. Petersburg, Florida 33710 (727) 327-7477 Fax (727) 327-1657

## Laboratory Analytical Guidelines

*Non-viable/viable air samples (spore traps)*

- Compare the outside air counts with the inside counts. Outside concentrations are considered normal concentrations. All counts represent organisms and particulates in one cubic meter of air.
- Count denotes number of spores identified of given spore type: no count denotes no spores observed of the given type.
- Sample counts obtained by direct microscopic examination of wet-mounted slides.
- Unless otherwise noted, all counts determined under oil immersion (100X objective); (spores counted) x (15 passes of objective field view of 0.189mm / the length of trace at 14.4 mm) x (lm3).

*Tape Lift / Bulk / Random Air*

- Samples are based on a relative concentration of 5 random passes. Actions per quantification are as follows:

| | |
|---|---|
| Trace | Ubiquitous / normal amounts, indicates no action required (<5 spores total) |
| Minor | Indicates potential growth, or prolonged exposure to ubiquitous mold (>5 spores total) |
| Significant | Indicates some limited contamination may exist, requires further investigation (2-5 spores per field) |
| Abundant | Indicates colonization / contamination, requires remediation (too many to count with hyphal fragments) |

- Sample identification obtained by direct microscopic examination of wet-mounted slides.
- Unless otherwise noted, all identification determined under oil immersion (1000X).

*Cultures*

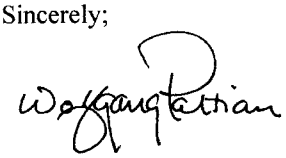
- All air culture counts are calculated using "Positive Hole Conversion Adjustment" and listed as colony forming units per cubic meter. Specifics regarding "Positive Hole Conversion Adjustment" are available upon request.
- All other cultures are listed as colony forming units only.
- Media types used: Malt Extract Agar (MEA), Czapek Cellulose Agar (CCA), Tryptic Soy Agar (TSP).

*All Analysis*

- Limit of detection is presented as the calculation concentration for recovery of a single spore for the indicated sample volume and processing conditions. Reported data were obtained from samples and sampling information as provided by the on-site investigator. This data and general information are provided to assist the client or inspector in an overall assessment. Interpretation of the data is left to the client or persons contracted by client to interpret collected analysis of that data.

- TMTC (Too Many To Count) indicates colonies that run together and cannot be specifically counted.

Sincerely;



Wolfgang Paltian
Microscopist / Mycology

*Member: National Environmental Health Association, American Industrial Hygiene Association, and Indoor Air Quality Association*
*Partner with the U.S. Environmental Protection Agency in establishing Indoor Air Quality guidelines and protocol*

Additional information can be found on our website: www.AirQualityEnvironmental.com

**Environmental Measurements**

| Location | Date | Temp (°F) | R. Humidity (%) | CO2 | CO | # of Occupants |
|---|---|---|---|---|---|---|
| Dining Room | 11/26/02 | 76.3 | 62.2 | 849 | 1.8 | 3 |
| Dining Room | 1/6/03 | 72.7 | 44.2 | 589 | 1.7 | 4 |
| Outside Air | 1/6/03 | 64.8 | 58.7 | 322 | 1.6 | NA |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

Recommended Thresholds:

| | |
|---|---|
| Temperature (degrees F) | 73-78° F |
| Relative Humidity (%) | 30-50% |
| Carbon Dioxide (CO2) | 700ppm above outdoor levels |
| Carbon Monoxide (CO) | <35 ppm (parts per million) |

**Carbon Dioxide (CO2)** – Carbon dioxide, which is also released from normal metabolic processes, can act as both a respiratory depressant and stimulant. Exposure to carbon dioxide has been shown to change the blood pH and carbon dioxide levels. It can also increase the respiration rate and decrease the ability to perform strenuous exercise. The long-term significance of chronic exposure to carbon dioxide is not known, but increases in respiratory and gastrointestinal disorders have been postulated. Exposure to low levels would not be likely to result in symptoms; at higher concentrations rapid pulse and breathing rates may be accompanied by a sensation of heaviness in the chest, particularly if the person is performing moderate activity. ASHRAE sets guidelines of 700ppm above outside levels to achieve proper air exchange with respect to human bioeffluents (body odor). It can also be an indicator of improper air exchange (moisture problems) with outdoor air that can lead to mold growth within. Hazardous levels are 5,000 ppm TWA (time weighed average) and 30,000 ppm (short term exposure limit). These limits have been established by the ACGIH, OSHA, and NIOSH. Normal outside readings are between 300 and 400 ppm.

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Client Name: Fantech
1712 Northgate Boulevard
Sarasota, Florida 34234

Project Name: 2818 Marshall Drive, Sarasota
Date Collected: 1/6/03
Analysis Date: 1/7/03

**Air-O-Cell** Sample Volume: 47 Liters (limit of detection)

| **Lab Number** | 4442 | 4443 | | 4677 | 4678 |
|---|---|---|---|---|---|
| **Customer Number** | 01 | 02 | | 01 | 02 |
| **Sample Identification** | Outside (baseline) | Inside / Dining Room | | Outside (baseline) | Inside / Dining Room |
| | 11/26/2002 | 11/26/2002 | | 1/6/2003 | 1/6/2003 |
| Alternaria | | 47 | | | 47 |
| Ascospores | 517 | 47 | | 47 | 47 |
| Basidiospores | 1,833 | 141 | | 1,692 | 47 |
| Bipolaris / Drechslera | 141 | | | | |
| Cercospore | | | | | |
| Chaetomium | | | | | |
| Cladosporium | 987 | 7,661 | | 94 | |
| Curvularia | 47 | | | | |
| Epicoccum | | | | | |
| Fusarium | 47 | | | | |
| Microsporum | | 47 | | | |
| Myxomycetes | | | | | |
| Penicillium / Aspergillus | 705 | **3,905** | | 188 | **188** |
| Periconia | 47 | | | | |
| Pithomyces | | | | | |
| Rusts / Smuts | 188 | 47 | | | |
| Stachybotrys | | | | | |
| Torula | | | | | |
| Unidentified | 376 | 564 | | 141 | 305 |
| Other: | | | | | |
| Other: | | | | | |
| Hyphal Fragments | 235 | 2,021 | | 94 | 47 |
| Other: Dust Mites | | 47 | | | |
| Other: Insect Parts | | 282 | | | 47 |
| Pollen | 94 | 47 | | | |
| Fibers | | 564 | | | 305 |
| Particles /m3 | 74,025 | **TMTC** | | 43,005 | **52,170** |
| Total Spore Count /m3 | **4,935** | **12,459** | | **2,162** | **634** |

Comments:

Wolfgang Paltian

Analyzed by: Wolfgang Paltian
Microscopist / Mycology

## Definitions and Pathogenicity of Organisms Detected

***Alternaria sp.*** This fungus is a large universally occurring genus. Several form-species are found as saprophytes on dead and dying plant parts. Conidia of this fungus are easily carried by the wind. Commonly found in house dust, carpets, textiles, and on horizontal surfaces in building interiors and is one of the main fungal causes of allergy. Outdoors, it may be isolated from samples of soil, seeds and plants, and is frequently reported in air. The large spore size suggests that the spores from this fungus will deposit in the nose, mouth and upper respiratory tract causing nasal septum infections. It has also been associated with hypersensitivity pneumonitis. It is a common cause of extrinsic asthma. Acute symptoms include edema and bronchiospasms; chronic cases may develop pulmonary emphysema. Baker's asthma is associated with inhalation of Alternaria conidia present in flour. Farmer's lung type of allergy has also been reported recently. Other diseases caused by Alternaria include mycotic keratitis, skin infections, and osteomyelitis. Also, the species Alternaria alternata is capable of producing tenuazonic acid and other toxic metabolites that may be associated with disease in humans or animals. Several species of Alternaria are pathogenic to plants.

***Ascospore*** A general category of spores that have been produced by means of sexual reproduction in an ascus. Ubiquitous, saprophytic, and plant pathogens, many are easily identifiable (i.e. Chaetomium). Frequently found in the air after rain. Many ascomycete spores are reported to be allergenic. This group also contains potential opportunistic pathogens and toxin producers.

***Aspergillus / Penicillium sp.*** - They are important causes of food spoilage, grain deterioration, and toxin production. Both Aspergillus and Penicillium are known as inhalant allergens and some species can cause systemic infections and mycotoxicoses. They also play important roles in industrial fermentations for antibiotics, cheese production, and numerous fermented foods.

***Basidiospore*** A general category of spores that have been released from the basidium of a fungi. A ubiquitous Type I & III allergen, saprophyte and plant pathogen that releases its spores in high humidity. A rare opportunistic pathogen, toxin-producing (mushrooms) and an agent of dry wood rot.

***Bipolaris sp.*** Bipolaris is a plant parasite and some are pathogenic to grasses. This fungus can grow as a mold in semi-dry environments. Bipolaris has been reported to produce the mycotoxin – sterig-matocystin that has been shown to cause liver and kidney damage when ingested by laboratory animals. This fungus is associated with phaeohyphomycosis, a disease consisting of a group of mycotic infections characterized by the presence of demataceous septate hyphae. Infections of the eyes and skin by black fungi could also be classified as phaeohyphomycosis). This fungus causes allergic fungal sinusitis, characterized by the presence of Bipolaris in the sinuses. In certain people with severe allergies, the large spores of this fungus can travel to the sinuses (upper respiratory tract), where they attach to the mucus and grow, producing an unrelenting allergic reaction that progressively and permanently damages the sinuses).

***Cladosporium sp.*** - C. herbarum is the most frequently found species in outdoor air in temperate climates. It is often found indoors, usually in lesser numbers than outdoors. The dry conidia become easily airborne and are transported over long distances. This fungus is often encountered in dirty refrigerators, especially in reservoirs where condensation is collected. On moist window frames, it can easily be seen covering the whole painted area with a velvety olive-green layer. Cladosporium often discolors interior paint, paper, or textiles stored under humid conditions. Houses with poor ventilation, houses with thatched straw roofs and houses situated in low damp environments may have heavy concentrations of Cladosporium, which will be easily expressed when domestic mold is analyzed. It is commonly found on the surface of fiberglass duct liner in the interior of supply ducts. It is also found on dead plants, woody plants, food, straw, soil, paint, and textiles. The ability to sporulate heavily, ease of dispersal, and buoyant spores makes this fungus the most important fungal airway allergen; and together with Alternaria, it commonly causes asthma and hay fever in the Western hemisphere. A few species of this genus cause disease, which range from phaeohyphomycosis, a group of mycotic infections characterized by the presence of demataceous septate hyphae. Infections of the eyes and skin by black fungi (also classified as phaeohyphomycosis), and chromoblastomycosis, chronic localized infection of the skin and subcutaneous tissue that follows the traumatic implantation of the etiologic agent are also caused by this fungus. Chromoblastomycosis lesions are verrucoid, ulcerated, and crusted. Skin abscesses, mycotic keratitis and pulmonary fungus ball have been recorded in immuno- compromised patients. It may also cause corneal infections and mycetoma, characterized by localized infections that involve cutaneous and subcutaneous tissue, fascia, and bone consisting of abscesses, granulomata, and draining sinuses, usually in immuno-compromised hosts.

***Curvularia sp.*** - Reported to be allergenic. It may cause corneal infections, mycetoma and infections in immune compromised hosts. This fungus can be parasitic or saprophytic.

**Dust Mites / Feces** - Dust mites eat human and pet skin cells. They live in rugs and carpets, sheets, mattresses and pillows and upholstered furniture. They are most common in Florida due to higher humidity. Of people with allergies, 10% - 15% are allergic to dust mites. Of people who have other allergies, 40% are allergic to dust mites. A single gram of house dust may contain as

many as 19,000 mites and 250,000 feces (which causes allergy symptoms). Symptoms are: itchy nose, or watery eyes, repeated sneezing upon awaking, occasional itching rashes and a blocked or runny nose. Relief occurs when outside the dwelling.

***Fusarium sp.*** - Commonly found in soil, plants, grains, and often times it is found in humidifiers. This fungus is the most common cause of mycotic keratitis. This mold has been isolated from skin lesions on burn patients, nail infections, ear infections, varicose ulcer, mycetoma , osteomyelitis following trauma, and disseminated infection. This fungus produces very harmful toxins, especially in storage of infected. crops. These toxins, known as trichothecene (scierpene) toxins target the circulatory, alimentary, skin, and nervous systems. Fusarium can also produce 1). Vomotoxin on grains which has been associated with outbreaks of acute gastrointestinal illness in humans. 2). T-2 Toxin and related trichothecenes are some of the deadliest known toxins. If ingested in sufficient quantity, T-2 toxin can severally damage the entire digestive tract and cause rapid death due to internal hemorrhage. 3). Fumosin, commonly found in corn and corn based products, with recently outbreaks of veterinary mycotoxicosis causing "crazy horse disease". 4). Zearalenone toxin which is similar in chemical structure to the female sex hormone estrogen and targets the reproductive organs.

**Hyphae** - The principal element of the growing or vegetative form of a mold (filamentous fungi), characterized by branching tube-like growth.

***Microsporum sp.*** – This genus includes some 17 species. It is found in soil and on animals. Can cause skin and hair infections.

**Particulates** - Solids or liquids light enough to be suspended in the air.

***Periconia sp.*** - Found on plants and grasses. Considered an allergen.

***Rusts and Smuts*** - A Teliomycetes that is commonly considered a plant pathogen. Widespread amongst plants and vegetation.

## Chain of Custody and Sample Submittal Form

# Air Quality Environmental, Inc.

521 49th Street North, St. Petersburg, Florida 33710
Phone: 727 327-7477 Fax: 727 327-1657

Client: Fantech / Lindsay Ambler
Address: 1712 Northgate Blvd.
Sarasota FL 34234
Phone: 888 359-3267 Fax:
Cell: Email Address:

REQUESTED TURNAROUND
Normal

Project Name: 2818 Marshall Drive
Job Location: Sarasota FL.
Project Information: Final / comparison to original survey

Job Number:

| Sample # | Location and Description of Sample | Type of Sample | Total Time | Liter Min. | Total Liters |
|---|---|---|---|---|---|
| 01 | Outside | Air O Cell | 7 | 15 | 105 |
| 02 | Dining Room | Air O Cell | 7 | 15 | 105 |

Sampled By: Wolfgang Pattian / Erich Pattian Date: 1/6/03
Trasported By: Wolfgang Pattian Date: 1/6/03
Special Instructions:

Received By / Date:

4677-4678
RECEIVED
JAN 06 2003
BY: Wolfgang Pattian

PC File # 03- 1317