

RESULTS OF INDOOR AIR QUALITY INVESTIGATION

NAVAL SEA SYSTEM COMMAND

WASHINGTON NAVY YARD

BUILDING 197 BASELINE

CONDUCTED FOR:

NAVSEA

SEPTEMBER 2001

ADVANCED ENVIRONMENTAL SERVICES, INC.

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EXECUTIVE SUMMARY

Naval Sea System Command (NAVSEA) issued a contract to Advanced Environmental Services, Inc. (AESI) for a baseline indoor air quality study at some of their buildings at the Navy Yard, Washington.

During the week of September 3-7, 2001, Dr. David Anderson of AESI toured the facilities and conducted preliminary baseline sampling. The facilities, for the most part, were recently remodeled and occupied by NAVSEA personnel, transferring in from Crystal City, Virginia. Some of these buildings were listed as historical sites.

NAVSEA personnel occupied building 197. The initial inspection and sampling of Building 197 was conducted on September 4, 2001. Additional testing was conducted on September 8 and 27, 2001. *Stachybotrys* was discovered by a column on the Fifth floor on the September 27 visit.

On the second visit, samples were collected from under the false floor to determine if rats were contributing to the overall levels of indoor air quality. A total of twenty-one (21) air samples were collected inside the facility on the first visit, and nine (9) for the Special study, and including outside samples for comparison. The air samples were collected for mold using Petri dishes (for viable organisms) and Zefon™ Air-O-Cell cassettes for total, non-viable airborne organisms, and for total Volatile Organic Chemicals (VOCs) in the air. The samples were sealed and shipped via Fed Ex to an outside microbiological lab. The preliminary results were received via fax, with the final results received via mail.

On September 4, the outside the air results were found to be high at 2,733 Counts per Cubic Meter of Air for total spores and 127 Colony Forming Units per Cubic Meter of Air (CFU / M³) of viable spores.

Air samples collected from inside Building 197 were significantly lower than the outside air – between 8 and 10 fold lower. No *Stachybotrys* was found on this date, but was found on September 27 using swab samples.

The samples for VOCs were collected from the building. Several organic compounds were identified – but at low (micrograms of organic material per Cubic Meter of Air) concentrations, including 2-Propanol, and Chloroethane.

On September 8, samples were collected from a cubicle, from under the floor tile, and from outside for comparison, with a total of nine samples collected. Outside, the air results were found to be 1,500 Counts per Cubic Meter of Air for total spores and 929 Colony Forming Units per Cubic Meter of Air (CFU / M³) of viable spores. The air samples from the cubicle was much better than the outside air, and the air samples collected from under the floor were better than the cubicle samples. Acetone and 2-Propanol were the main VOCs found inside the building.

Verbal reports were issued to Mr. Michael Smith, COTR, with the preliminary data. It appears that the mold and moisture levels are not within the guidelines currently used, due to the roof leak and presence of *Stachybotrys* on ceiling tile.

The report is based on information available to us at this time. No other aspects if indoor air quality (IAQ) were examined. AESI reserves the right to revise, supplement, and otherwise amend our opinions and conclusions, if necessary and warranted by the discovery of new or additional information.

David O. Anderson, Ph.D.
CIH, CSP, QEP, CPEA

January 23, 2002
Date Issued

INTRODUCTION, METHODOLOGIES, AND OBSERVATIONS

Naval Sea System Command (NAVSEA) issued a contract to Advanced Environmental Services, Inc. (AESI) for a baseline indoor air quality study at some of their buildings at the Navy Yard, Washington.

The purpose of the visit was to conduct a visual inspection of the interior, to collect airborne and bulk samples to establish a baseline for Indoor Air Quality measurements, to determine if a possible health risk was present and to recommend appropriate corrective actions.

X The investigation was conducted in accordance with the recommendations and guidelines of the American Conference of Governmental Industrial Hygienists (ACGIH), the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE), the Occupational Safety and Health Administration (OSHA), the National Institute for Occupational Safety and Health (NIOSH), the Environmental Protection Agency (EPA), and established industry standards.

During the week of September 3-7, 2001, Dr. David Anderson of AESI toured the facilities and conducted preliminary baseline sampling with the assistance of the COTR, Michael Smith. The facilities, for the most part, were recently remodeled and occupied by NAVSEA personnel, transferring in from Crystal City, Virginia.

NAVSEA personnel occupied building 197, which was originally designed to manufacture naval armament; the building has a large atrium going from floor to ceiling (over 5 floors) with large overhead cranes still present, providing for an open space in the center.

On September 4, the weather was sunny and in the low 80's. Inside, the air conditioner was on and the temperature ranged from 69 to 72.5 degrees with a relative humidity of 38%. Visible mold was discovered by a support Column on the 5th floor. In addition, there was a rodent problem with rats finding access to the building from the sewer system and from the Shipping and Receiving area. New, raised flooring had been installed during the design stage, and this raised flooring provide access throughout all five floors of the building.

On September 4, a total of twenty-one (21) total samples for were collected both inside the building, and outside for comparison. The air samples were collected for mold using Petri dishes (for viable organisms) and ZefonTM Air-O-Cell cassettes for total, non-viable airborne organisms; samples for mold were also collected from carpeting and using a swab.

ZefonTM Air-O-Cell cassettes are used for total, non-viable airborne organisms. (For specific locations, please refer to Appendix A). Air-O-Cell cassettes collect samples for total organisms – both living (viable) and non-living (non-viable). The sampling pumps had been calibrated prior to arrival using a rotameter. These samples provide information on total fungal colony Counts per Cubic Meter (Counts / M³).

Petri Dish sample was also collected. The A-6 bioaerosol monitor, used to collect samples onto the Petri dish, was disinfected on-site using isopropyl alcohol. The air-sampling pump had been calibrated prior to the visit for the type of collection media using a standard method – wet test meter.

The samples collected in the Petri, which contained Potato Dextrose Agar (PDA) media, which allows for both cultivation and differentiation of spores, i.e. "viable". Following incubation, the samples are analyzed via light microscopy at 600X magnification, and the data are reported in numbers of Colony Forming Units per Cubic Meter of air (CFU / M³), as well as the specific genus types, such as *Aspergillus* and *Penicillium*. (Plates were shipped to the lab inside ice chests to minimize growth between collection and laboratory-controlled incubation).

One (1) bulk (swab) sample was also collected. The "swab" method uses a Sterile BBL Culture Swab collected over an approximately one hundred square centimeter surface area; the swab is placed into a plastic holder containing agar, sealed and labeled. This sample was for viable microorganisms

One (1) sample was collected from stained carpeting on the 5th floor using a method called "Carpet Check". This method uses a high flow pump drawing air through a 0.8-micron filter and housing; the housing is rubbed into the carpeting over a square foot of surface area and all materials collected in the filter are analyzed under a microscope.

In addition, three (3) samples were collected for total Volatile Organic Chemicals (VOCs) in the air. These samples used a 400 milliliter evacuated flask equipped with a flow-limiting orifice. Once activated, air was drawn into the prepared flask; following the sampling time, the flask was sealed. Upon arrival at the lab, the flask was purged and contents injected into a gas chromatograph equipped with a mass spectrometer; a total of sixty-three (63) different organic compounds were analyzed for each VOC sample collected.

On September 8, it was decided to conduct a series of tests to determine if the rodent problem could be contributing to the indoor air quality, called a "Special Project". A total of nine (9) samples were collected – Air-O-Cell, Petri Dish, and VOC – from outside, from a cubicle and from under the elevated floor.

All samples were sealed and shipped via Fed-Ex to an outside, independent microbiological lab that specialized in identification and analyses of these types of samples; in addition, they also participate in an Environmental Microbiological Proficiency Analytical Testing (EMPAT) quality control program administered by the American Industrial Hygiene Association, designed for maximum quality and control. An affiliate lab that is Accredited by the American Industrial Hygiene Association analyzed the organic materials. Chain-of-Custody forms were maintained.

A Tramex moisture meter was used to measure moisture in the walls. Excessive moisture was not discovered.

On September 27, swab samples were collected from around the column and ceiling tile on the 5th floor; these samples were handled in the same fashion as before and sent to the same lab.

The preliminary results for the samples were received via fax, followed by mail. (Appendix B). Several telephone conversations were held with NAVSEA discussing the results and procedures.

RESULTS AND DISCUSSION

TOXICOLOGICAL AND HEALTH EFFECTS

Bioaerosols:

Bioaerosols include any biological agent, which becomes airborne. Bioaerosols may include pollens, animal dander, bacteria, as well as fungi. Because fungi are spore-bearing organisms, which are ideally suited for airborne transport, they often produce symptoms of discomfort among certain individuals.

Fungi originally were considered as a group of plants lacking any stems leaves or roots. Consequently, they were classified along with algae and the lichens. Fungi differed from those groups, however, in their lack of chlorophyll. Fungi exist as parasites (plant, animal and human pathogens) or as saprophytes (decomposers of non-living organic matter).

There are currently about 80,000 described species of fungi, both yeasts and molds, with probably more species awaiting discovery. Fungi are beneficial as food, as producers of antibiotics, as fermenting agents, as sources of drugs, as well as in many aspects of industry. Fungi are also well documented for their role in allergy.

Those fungi most responsible for causing allergy include species belonging to *Alternaria*, *Cladosporium*, *Aspergillus*, *Drechslera*, *Fusarium*, *Phoma*, *Epicoccum*, *Penicillium*, *Rhizopus*, *Mucor*, *Aureobasidium pullulans*, *Nigrospora*, *Scopulariopsis* and spores of rusts and smuts. *Cladosporium* is the most common fungus found in the air, followed by *Alternaria*, *Penicillium*, *Aspergillus*, *Fusarium*, and *Aureobasidium pullulans*. Clinically, the causative allergenic agents for most persons sensitive to fungi are *Cladosporium* and *Alternaria*.

Aspergillus, *Penicillium*, *Rhizopus*, *Mucor*, *Fusarium* and *Cladosporium* are examples of fungi that can produce a large number of spores. As they are present at all times in both the indoor and outdoor environments and are an important factor in the production of allergy in susceptible individuals.

Although fungi may grow and produce spores in the water and soil, dead organic debris is considered the main repository for aerobic fungi. Fungal spores will disperse from leaf litter, decaying plant material and other available organic substrata into the air and then fall onto vegetation where they may cause disease; are carried into homes and offices where they may cause moldy bathrooms and basements; and inhaled by humans and animals where they may cause toxic reactions, disease, an allergy, or other fungal disorders; fall onto leather, wood, or food, causing various mold damage; or fall back to or sail onto other supportive materials and repeat the cycle. In any case, fungi cannot produce their own food and therefore must find a source of organic matter in order to survive. High humidity is also necessary for fungal growth and spore germination.

It is important to note that airborne fungal spores must be viable to produce disease or to grow and germinate, but they do not have to be viable to produce allergenic effects in sensitive people. Although a bright sunny afternoon might substantially reduce the viability of fungal spores in the air, it will not bring relief to persons suffering from fungal allergy. There is some indication that the occupants of this residence may currently suffer from this allergic reaction.

Fungal spores are always present in the air, with rain and snow washing down most from the air, and the wind and sunshine causing an increase in the atmospheric distribution of spores. The number of airborne fungi is lowest during the winter months and highest during the summer and autumn months, when dead organic debris is more plentiful.

From the compilation of numerous data, the following distribution indicates the majority and frequency of fungal organisms typically isolated in indoor environments:

<u>Organism</u>	<u>Per Cent</u>
<i>Cladosporium</i>	100
<i>Penicillium</i>	91
<i>Alternaria</i>	87
<i>Epicoccum</i>	53
<i>Aspergillus sp.</i>	49
<i>Aureobasidium</i>	44
<i>Drechslera</i>	38
<i>Acremonium</i>	36
<i>Fusarium</i>	25
<i>Aspergillus niger</i>	19
<i>Rhizopus</i>	13

Possible health effects associated with fungi generally fall into one of three groups:

1. Allergic: sensitization and immune responses such as allergic rhinitis (hay fever), asthma, or hypersensitivity pneumonitis.
2. Infectious: growth of the fungus in or on the body, as with aspergillosis or histoplasmosis
3. Toxic: disruption of cellular function and interaction with DNA, as occurs with toxicogenic effects, including aflatoxin-induced cancer.

Mycotoxins exert their effect on organisms in many ways including interference with cellular respiration, interference with carbohydrate and lipid metabolism, and direct binding with DNA and RNA. Several trichothecene mycotoxins are produced by *Stachybotrys*, and both *Aspergillus* and *Penicillium* can produce ochratoxin A. (For detailed explanations, please refer to Appendix C).

Stachybotrys Health Effects

Stachybotrys atra (SA) can produce several toxic chemicals called trichothecene mycotoxins. These mycotoxins are known to be toxic to both humans and farm animals exposed to significant quantities. Initially the toxic effects of the mold were seen in farm animals that had eaten contaminated hay or grain. Farm workers also experienced health effects (dermatitis, blood and immune system disorders) from handling contaminated material. A recent evaluation of several trichothecenes by the International Agency for Research on Cancer (IARC) found no evidence that they cause cancer.

There have been only a few documented cases of health problems from indoor exposure to SA. In general, the intensity of exposure and health effects from SA in the indoor environment is much less severe than those, which were experienced by farm animals and workers.

If SA spores are released into the air, there is a potential for allergic, respiratory or immunologic symptoms to develop or become exacerbated. These conditions include: asthma, hypersensitivity pneumonitis, allergic rhinitis, dermatitis, sinusitis and conjunctivitis. It is thought that these diseases are mediated by an immune response to SA (or other environmental agents). Many of the related symptoms are non-specific, but debilitating, such as discomfort, inability to concentrate and fatigue. Presently, it is not known whether long-term indoor exposure to airborne SA increases the risk of certain chronic respiratory diseases. In one reported case of indoor exposure, residents experienced cold and flu symptoms, diarrhea, headaches, fatigue, rashes and other symptoms. These symptoms disappeared after all of the contaminated ductwork, insulation, and ceiling material was replaced.

Association between SA in buildings and health effects

Health risk cannot be predicted based simply on the presence of SA in building materials as indicated by sampling results. In order for humans to be exposed indoors, spores must be released into the air and inhaled. Also, it appears that the symptoms listed above are not likely to develop in all persons exposed at levels likely to be found in buildings. The attack rate (percentage of persons who develop symptoms) is generally low. At the present time, "safe" (or "unsafe") exposure levels have not been established.

INTERPRETATIVE GUIDELINES

Previous research and test data have revealed that indoor airborne spore levels of 30 % to 70 % of the outdoor spore levels are normal, with the same general distribution of spore types. Filtered air, air-conditioned air, or air remote from outside sources may average 5 to 15 % of the outside air at the time of sampling. Based on these guidelines, a residence with open doors and windows and heavy foot traffic may average 135 % of the outdoor level while a high rise office building with little air exchange may average 2 %. In addition, dusty interiors may exceed 100 % of the outdoors to some degree, but will still mirror the outdoor distribution of spore types. Dusty conditions were not noted.

Data collected by the National Institute for Occupational Safety and Health (NIOSH) collectively suggest that a level of 1,000 total colony-forming units (cfu) per cubic meter of air (M³) may warrant investigation and remedial action. The American Conference of Governmental Industrial Hygienists (ACGIH) Committee on Bioaerosols suggests that the indoor air-borne fungal spore concentration, either in Colony Forming Units or as Countable organisms, should not exceed 30 % of the outside levels and that the indoor level should be qualitatively similar to the outside level; currently there is no TLV for mold. During the growing season, according to the OSHA Technical Manual, levels of outdoor airborne fungal spore levels can range from 1,000 to 100,000 cfu/M³. This reference goes on to indicate that airborne contaminant indicators are 1,000 cfu/M³, but that levels above this do not necessarily imply that the conditions are unsafe or hazardous. Risk management investigation should be initiated if the following species are confirmed to be present: *Stachybotrys*, *Aspergillus versicolor*, *Aspergillus flavus*, *Aspergillus fumigatus*, and / or *Fusarium moniforme*.

In April 2000, the Indoor Air Quality Association published "Recommended Guidelines for Indoor Environments" (IAQA 01-2000). In this document, their recommendation for culturable (viable) fungal bioaerosols was 300 cfu/M³ for total and 50 cfu/M³ for individual fungal spores, excluding *Cladosporium*.

Currently in the United States, IAQ issues are not regulated by a governmental agency. The ACGIH recommends gathering the best data possible and using knowledge, experience, expert opinion, logic, and common sense interpretation of current information. As stated earlier, microbiological species present in the indoor environment should be generally representative of the species in the outdoor environment to a significantly lesser degree. The indoor air samples should not contain specific identifiable pathogenic microbiological organisms.

AIR-O-CELL:

The Air-O-Cell Cassette is a unique sampling device designed for the rapid collection and analysis of a wide range of airborne particles, including fungal spores. Air is drawn through a sampling cassette that contains a small, greased microscopic slide; the samples are analyzed via light microscopy at 600X magnification, with the entire slide (100% of the sample) being analyzed. The results are reported as **total**, meaning they include both viable (i.e., living) and non-viable fungal spores. This technique does not allow for the differentiation between *Aspergillus* and *Penicillium* spores, due to the small size. Small spherical fungal spores that cannot be identified and may include *Aspergillus*, *Penicillium*, and *Trichoderma* are grouped together as *Amerospores*. Additionally it does not allow for cultivation or speciation of spores. Typically the results from this collection and analysis method are higher than the Petri dish method, as all spores are collected and counted.

The sample results produced by the lab were received initially by fax and final copies via mail (Appendix B).

AIR SAMPLE RESULTS, SEPTEMBER 4:

Outside:

Air-O-Cell: The air sample results were found to be high at 2,733 Counts per Cubic Meter of Air.
Petri Dish: Viable cultures revealed 127 Colony Forming Units per Cubic Meter of Air (CFU / M³) of viable spores were incubated and identified.

Air samples collected from inside were lower than the outside air.

Fifth Floor (5W1030)

- Air-O-Cell: The air sample results were found to be 27 Counts per Cubic Meter of Air

Fifth Floor (5W1170)

- Air-O-Cell: The air sample results were found to be less than 13 Counts per Cubic Meter of Air
- Petri Dish: Viable cultures revealed less than 7 Colony Forming Units per Cubic Meter of Air (CFU / M³) of viable spores.
- VOC: The air sample revealed two (2) different VOCs found. The chemicals found were 2-Proponol and Chloroethane.
- Swab: A swab sample was collected of visible mold by the column; the lab analyzed the swab for viable fungi, and not total fungi, finding *Alternaria* present.

Fifth Floor (5W1810)

- Carpet Check sample – revealed low levels of mold present

Fifth Floor (5W2717)

- Air-O-Cell: The air sample results were found to be 67 Counts per Cubic Meter of Air

Fourth Floor (4E2730)

- Air-O-Cell: The air sample results were found to be 512 Counts per Cubic Meter of Air.
- Petri Dish: Viable cultures revealed 20 Colony Forming Units per Cubic Meter of Air.

Fourth Floor (4W1210)

- Air-O-Cell: The air sample results were found to be 13 Counts per Cubic Meter of Air

Fourth Floor (4W1222)

- VOC: The air sample revealed three (3) different VOCs found. The chemicals found were Acetone, 2-Proponol and Chloroethane.

Third Floor (3E1503)

- Air-O-Cell: The air sample results were found to be 13 Counts.
- Petri Dish: Viable cultures revealed 20 Colony Forming Units per Cubic Meter of Air.

Third Floor (3W2604)

- Air-O-Cell: The air sample results were found to be 13 Counts.

Second Floor (2W2160)

- Air-O-Cell: The air sample results were found to be 27 Counts.

Second Floor (2E2200)

- Air-O-Cell: The air sample results were found to be less than 13 Counts.

First Floor (1W1850):

- Air-O-Cell: The air sample results were found to be less than 13 Counts.
- VOC: The air sample revealed three (3) different VOCs. The chemicals found were Acetone, 2-Proponol, and Chloroethane.

First Floor (1W3070):

- Air-O-Cell: The air sample results were found to be 27 Counts.

BULK SAMPLE:

One (1) bulk sample was collected using a swab. The sample was collected by 5W1170 and found 4 CFU per swab of *Alternaria*.

CARPET CHECK:

The sample collected on the fifth floor revealed a low concentration of 4,000 Counts per Gram of material collected.

AIR SAMPLE RESULTS, SEPTEMBER 8 (SPECIAL PROJECT – UNDER FLOORING)

Outside:

Air-O-Cell: The air sample results were found to be at 1,500 Counts per Cubic Meter of Air for total spores – 51 % *Amerospores*, 24 % *Cladosporium*, 16 % *Ascospores*, and 9 % *Basidiospores*.

Petri Dish: Viable cultures revealed 929 Colony Forming Units per Cubic Meter of Air (CFU / M³) of viable spores were incubated and identified. 71 % of this sample was *Cladosporium*, 23 % *Penicillium*, and 2 other species at 4 % or less.

VOC: (Collected in the Yard): The outside air sample revealed two compounds found – all in the part per billion ranges (ppb). They were Acetone (420 ppb) and 2-Proponol (6.9 ppb).

Air samples collected from inside were lower than the outside air.

1W3091-1119 (Cubicle):

- Air-O-Cell: The air sample results were found to be 387 Counts.
- Petri Dish: Viable cultures revealed 47 Colony Forming Units.
- VOC: The air sample revealed three (3) different VOCs found. The chemicals found were Acetone, 2-Proponol and Toluene.

Under Floor:

- Air-O-Cell: The air sample results were found to be 227 Counts.
- Petri Dish: Viable cultures revealed 27 Colony Forming Units.
- VOC: The air sample revealed three (3) different VOCs found. The chemicals found were Acetone, 2-Proponol and Toluene, as was found in the air adjacent to where the floor tile was removed.

BULK SAMPLE RESULTS, SEPTEMBER 27:

Two (2) bulk samples were collected using swabs by the column located by 5W1170. The first sample was collected above the tile and found 5 – 25 % *Alternaria*, verifying what was discovered using the first swab earlier in September. The second swab collected a sample from the Southeast Corner of the Column revealing 5 – 25 % *Stachybotrys*.

CONCLUSIONS

This baseline survey revealed that, on the date of the testing, the overall air quality indoors was better than the air quality outside. Rodent infestation is a problem. The roof leak above the 5th floor on the West side has provided moisture sufficient to allow *Stachybotrys* to grow.

RECOMMENDATIONS

The Shipping/Receiving area needs improved housekeeping. Openings to the sewers and gutters in this area must be sealed so rodents do not find this way into the building.

Based on the evidence of mold growth, remediation is necessary. The following are guidelines to be followed by personnel trained in mold remediation, and not General Contractors. All remediation should be done by an organization familiar with mold abatement and conducted wearing the proper protective equipment. During the remediation, containment using 6-mil plastic sheeting and negative pressure using ventilation drawn through a HEPA filter prior to discharging should be utilized.

All contaminated sheetrock and wood must be removed using wet methods - misted with chlorine and water in order to minimize dust and spore generation.

Porous materials, such as joists, studs and plates, should be thoroughly examined for visible signs of fungal growth. If visual inspection reveals evidence of mold, the wooden structures and / or additional sheetrock may require removal. Deteriorated wood should be removed and replaced as part of the abatement effort. Once the contaminated materials are removed, visible signs of mold should be treated. **Treatment** consists of abrasive techniques (i.e., sanding, wire brushing, etc.) followed by HEPA vacuuming and application of a biocide, such as bleach and water, quaternary ammonium compounds, or other common biocides available for this purpose; gases such as chlorine or ozone should not be used.

DECONTAMINATION OF THE BUILDING:

Fifth Floor: Working in containment and under negative pressure, the Column by 5W1170 should be addressed. The roof leak must be fixed. Remove the affected ceiling tile and insulation using wet methods. Treat the affected wood and metal objects using methods described above. In addition, an air lock should be installed for entry and exit, and decontamination. Negative pressure, exhausted through HEPA air filters must be employed.

Floor and Carpeting:

All fabric materials should be HEPA-vacuumed a minimum of fifteen (15) feet in all directions from the affected Column.

Office Equipment and Personal Effects:

"Hard" items such as metal, wood, glass, and plastic can be HEPA vacuumed and wiped down with a biocide. Other "soft" items such as boxes, chair coverings, papers, etc, should be discarded; conversely, if these items are needed, they can be HEPA vacuumed.

HVAC System: The system providing service to 5W should be cleaned and disinfected following abatement according to guidelines published such as those issued by the North American Duct Cleaning Association (NADCA). During this process, all vents on this side should be thoroughly cleaned or replaced.

HEPA air filters ("air scrubbers") should be run 3 to 5 days following abatement.

Fungi are found almost everywhere indoors as well as out. In order for mold to survive it needs a source of food and a source of moisture. Typically, moisture comes from water leaks or from the air. All sources of excessive water infiltration, such as plumbing leaks and roof leaks, must be identified and stopped prior to any successful abatement activity.

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 a work area and entering an occupied or non-abatement area, while protecting the health of workers performing the abatement, as well as the occupants.

It is the responsibility of the Contractors conducting remediation to ensure the methods enacted are adequate. The listed remediation methods are not meant to exclude other similarly effective methods. Any changes to the remediation methods listed in these guidelines, however, should be carefully considered prior to implementation.

The use of gaseous ozone or chlorine dioxide for remedial purposes is **not** recommended. Both compounds are highly toxic and contamination of occupied space may pose a health threat. Furthermore, the effectiveness of these treatments is unproven.

The following procedures are recommended for remediation / abatement:

- Containment of the affected area:

1. Complete isolation of work area from non-affected spaces using plastic sheeting sealed with duct tape (including ventilation ducts / grills, fixtures, and any other openings)
 2. The use of an exhaust fan with a HEPA filter to generate negative pressure
 3. Airlocks and a decontamination area
- Personnel trained in the handling of hazardous materials equipped with the following types of Personal Protective Equipment (PPE):
 1. Respiratory protection (e.g., at a minimum, a N-95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended; alternatively full-face respirators with High Efficiency Particulate Air (HEPA) or P-100 filters may be used
 2. Disposable protective clothing covering both head and shoes
 3. Gloves
 - Contaminated materials that cannot be cleaned should be removed from the building in sealed plastic bags. The outside of the bags should be cleaned with a damp cloth and a detergent / biocide solution or HEPA vacuumed in the decontamination chamber prior to their transport to uncontaminated areas of the building. There are currently no special requirements for the disposal of moldy materials.
 - The contained area and decontamination room should be HEPA vacuumed and cleaned with a damp cloth and / or mop with a detergent / biocide solution and be visibly clean prior to the removal of isolation barriers.

These procedures are designed to minimize both exposure to the remediation crews and to minimize further exposure to the building and contents.

After remediation, additional visual inspection and clearance sampling conducted by or under the direction of a Certified Industrial Hygienist – not the abatement contractor – should be conducted to verify the results of the abatement prior to reconstruction and occupancy. Air scrubbers must be turned off 24 to 48 hours before clearance testing.

The condensation drainage system for the AHUs should be corrected to allow for piping to carry moisture directly into the drain, and not run across the floor.

Follow-up to these suggestions is also suggested.

Appendix A

Sampling Locations

Sampling Locations – September 4

Sample Number	Sample Type	Location
1	Air-O-Cell	5W1030
2	Air-O-Cell	5W1170
3	Petri Dish	5W1170
4	Swab	5W1170
5	VOC	5W1170
6	Carpet Check	5W1810
7	Air-O-Cell	5W2717
8	Petri Dish	4E2730
9	Air-O-Cell	4E2730
10	Air-O-Cell	4W1210
11	VOC	4W1222
12	Air-O-Cell	3E1503
13	Petri Dish	3E1503
14	Air-O-Cell	3W2604
15	Air-O-Cell	2W2160
16	Air-O-Cell	2E2200
17	Air-O-Cell	1W1850
18	VOC	1W1850
19	Air-O-Cell	1W3070
20	Air-O-Cell	Outside
21	Petri Dish	Outside

Sampling Locations – September 8

Sample Number	Sample Type	Location
1	Air-O-Cell	1W3091
2	Petri Dish	1W3091
3	VOC	1W3091
4	Air-O-Cell	Sub-floor
5	Petri Dish	Sub-floor
6	VOC	Sub-floor
7	Air-O-Cell	Outside
8	Petri Dish	Outside
9	VOC	Outside

Sampling Locations – September 27

Sample Number	Sample Type	Location
1	Swab	5W1170 Above Tile
2	Swab	5W1170 SE Corner of Column

Appendix B

Microbiological Results

And

Lab Data

September 4

September 8



AEROTECH LABORATORIES, INC.

Lab Number: A-109-0686
 Project Name: WNY
 Project Number: 0880A (197)
 Date Received: 09/07/01
 Date Reported: 09/13/01

AIHA Empat No. 102297
 Air-O-Cell Cassette Analysis
 Aerotech Method: A001

AESI
 1112 Charlestown Ct.
 Keller, TX 76248
 Attn: Dr. David Anderson

Lab Number	1			2			7					
	Sample Identification	5W 1030 AOC 0931	5W 1170 AOC 0949	SW 2717 AOC 0971	Volume (M ³)	0.0750	0.0750	0.0750				
Date Analyzed	09/12/2001			09/12/2001			09/12/2001					
Percent Of Trace Analyzed	100% of Trace at 600X Magnification			100% of Trace at 600X Magnification			100% of Trace at 600X Magnification					
Debris Rating	3			3			2					
Mycelial Fragments	Total Count	Result	Detection Limit	%	Total Count	Result	Detection Limit	%	Total Count	Result	Detection Limit	%
	1	13	13	n/a	<1	<13	13	n/a	<1	<13	13	n/a
Pollen Count	<1	<13	13	n/a	<1	<13	13	n/a	<1	<13	13	n/a
	Total Fungal Spores	2	27	13	100	<1	<13	13	n/a	5	67	13
Fungal Spore Identification												
Alternaria												
Amerospores	1	13	13	50					1	13	13	20
Arthrinium												
Ascospores												
Aspergillus/Penicillium												
Aureobasidium												
Basidiospores												
Bipolaris/Dreschlera												
Botrytis												
Chaetomium												
Cladosporium												
Curvularia	1	13	13	50					1	13	13	20
Epicoccum												
Fusarium												
Nigrospora												
Oidium/Peronospora												
Pithomyces/Ulocladium												
Rusts												
Smuts/Myxomycetes												
Stachybotrys												
Stemphylium												
Torula												
Unidentified Conidia												
Notes:												

Prepared By: *AB*
 CS Review: *SB*
 Technical Review: *AK*
 Final Review: *AK*



AEROTECH LABORATORIES, INC.

Lab Number: A-109-0686
 Project Name: WNY
 Project Number: 0880A (197)
 Date Received: 09/07/01
 Date Reported: 09/13/01

AIHA Empat No. 102297
Air-O-Cell Cassette Analysis
 Aerotech Method: A001

AESI
 1112 Charleston Ct.
 Keller, TX 76248
 Attn: Dr. David Anderson

Lab Number	9			10			12					
	Sample Identification	4E2230 AOC 0965	4W1210 AOC 0946	3E1303 AOC 0934	Volume (M ³)	0.0750	0.0750	0.0750	Date Analyzed	09/12/2001	09/12/2001	
Percent Of Trace Analyzed	100% of Trace at 600X Magnification			100% of Trace at 600X Magnification			100% of Trace at 600X Magnification					
Debris Rating	2			2			3					
Mycelial Fragments	Total Count	Count/M ³		Total Count	Count/M ³		Total Count	Count/M ³				
		Result	Detection Limit		Result	Detection Limit		Result	Detection Limit			
Pollen Count	<1	<13	13	n/a	<1	<13	13	n/a	<1	<13	13	n/a
Total Fungal Spores	<1	<13	13	n/a	<1	<13	13	n/a	<1	<13	13	n/a
Total Fungal Spores	39	520	13	100	1	13	13	100	1	13	13	100
Fungal Spore Identification												
<i>Alternaria</i>	1	13	13	3								
Amerospores												
<i>Arthrinium</i>												
Ascospores												
<i>Aspergillus/Penicillium</i>												
<i>Aureobasidium</i>												
Basidiospores					1	13	13	100				
<i>Bipolaris/Dreschlera</i>												
<i>Botrytis</i>												
<i>Chaetomium</i>												
<i>Cladosporium</i>	37	493	13	95								
<i>Curvularia</i>												
<i>Epicoccum</i>												
<i>Fusarium</i>												
<i>Nigrospora</i>	1	13	13	3								
<i>Odium/Peronospora</i>												
<i>Pithomyces/Ulocladium</i>												
Rusts												
<i>Smuts/Myxomycetes</i>												
<i>Stachybotrys</i>												
<i>Stemphylium</i>												
<i>Torula</i>												
Unidentified Conidia												
Notes:												

Prepared By: *ASB*
 CS Review: *ASB*
 Technical Review: *ASB*
 Final Review: *ASB*



AEROTECH LABORATORIES, INC.

Lab Number: A-109-0688
 Project Name: WNY
 Project Number: 0880A (197)
 Date Received: 09/07/01
 Date Reported: 09/13/01

AIHA Empat No. 102297
Air-O-Cell Cassette Analysis
 Aerotech Method: A001

AESI
 1112 Charleston Ct.
 Keller, TX 76248
 Attn: Dr. David Anderson

Lab Number	14			15			16					
	Sample Identification	Volume (M ³)	Date Analyzed	Sample Identification	Volume (M ³)	Date Analyzed	Sample Identification	Volume (M ³)	Date Analyzed			
	3W 2604 AOC 0935	0.0750	09/12/2001	2W 2160 AOC 0929	0.0750	09/12/2001	2E2200 AOC 0932	0.0750	09/12/2001			
	100% of Trace at 600X Magnification			100% of Trace at 600X Magnification			100% of Trace at 600X Magnification					
Debris Rating	3			3			3					
	Total Count	Result	Detection Limit	%	Total Count	Result	Detection Limit	%	Total Count	Result	Detection Limit	%
Mycelial Fragments	<1	<13	13	n/a	<1	<13	13	n/a	<1	<13	13	n/a
Pollen Count	<1	<13	13	n/a	1	13	13	n/a	<1	<13	13	n/a
Total Fungal Spores	1	13	13	100	2	27	13	100	<1	<13	13	n/a
	Fungal Spore Identification											
Alternaria												
Amerospores	1	13	13	100								
Arthrinium												
Ascospores												
Aspergillus/Penicillium												
Aureobasidium												
Basidiospores					1	13	13	50				
Bipolaris/Dreschlera												
Botrytis												
Chaetomium												
Cladosporium					1	13	13	50				
Curvularia												
Epicoccum												
Fusarium												
Nigrospora												
Oidium/Peronospora												
Pithomyces/Ulocladium												
Rusts												
Smuts/Myxomycetes												
Stachybotrys												
Stemphylium												
Torula												
Unidentified Conidia												
Notes:												

Technical Review:
 Final Review:

Prepared By: AB
 CS Review: SB



AEROTECH LABORATORIES, INC.

Lab Number: A-109-0686
 Project Name: WNY
 Project Number: 0880A (197)
 Date Received: 09/07/01
 Date Reported: 09/13/01

AIHA Empat No. 102297
 Air-O-Cell Cassette Analysis
 Aerotech Method: A001

AESI
 1112 Charleston Ct.
 Keller, TX 76248
 Attn: Dr. David Anderson

Lab Number	17			19			20					
	Sample Identification	1W1850 AOC 0951	1W3070 AOC 0928	Out AOC 0948	Volume (MP)	0.0750	0.0300	Date Analyzed	09/12/2001			
Percent Of Trace Analyzed	100% of Trace at 600X Magnification			100% of Trace at 600X Magnification			100% of Trace at 600X Magnification					
Debris Rating	3			3			2					
Mycelial Fragments	Total Count	Result	Detection Limit	%	Total Count	Result	Detection Limit	%	Total Count	Result	Detection Limit	%
	<1	<13	13	n/a	<1	<13	13	n/a	<1	<33	33	n/a
Pollen Count	Total Count	Result	Detection Limit	%	Total Count	Result	Detection Limit	%	Total Count	Result	Detection Limit	%
	<1	<13	13	n/a	1	13	13	n/a	<1	<33	33	n/a
Total Fungal Spores	Total Count	Result	Detection Limit	%	Total Count	Result	Detection Limit	%	Total Count	Result	Detection Limit	%
	<1	<13	13	n/a	2	27	13	100	82	2,733	33	100
Fungal Spore Identification												
Alternaria												
Amerospores					1	13	13	50	25	833	33	30
Arthrinium									1	33	33	1
Ascospores									12	400	33	15
Aspergillus/Penicillium												
Aureobasidium												
Basidiospores												
Bipolaris/Dreschlera					1	13	13	50	30	1,000	33	37
Botrytis												
Chaetomium												
Cladosporium												
Curvularia									6	200	33	7
Epicoccum									1	33	33	1
Fusarium												
Nigrospora												
Oldium/Peronospora												
Pithomyces/Ulocladium												
Rusts												
Smuts/Myxomycetes												
Stachybotrys									6	200	33	7
Stemphylium												
Torula												
Unidentified Conidia												

Technical Review: *[Signature]*
 Final Review: *[Signature]*

Prepared By: *[Signature]*
 CS Review: *[Signature]*



AEROTECH LABORATORIES, INC.

AESI
 1112 Charleston Ct.
 Keller, TX 76248
 Attn: Dr. David Anderson

AIHA Empat No. 102297
Viable Fungi Analysis - Air
 Aerotech Method: A003

Lab Number: A-109-0686
 Project Name: WNY
 Project Number: 0880A (197)
 Date Received: 09/07/01
 Date Reported: 09/24/01

Sample Identification	3			8			13			
	CFU	CFU/M ³		CFU	CFU/M ³		CFU	CFU/M ³		
		Result	Detection Limit		Result	Detection Limit		Result	Detection Limit	%
Viable Fungi 20-25°C	<1	<7	7	n/a			3	20	7	100
<i>Acremonium</i>										
<i>Alternaria</i>										
<i>Arthrinium</i>										
<i>Aspergillus fumigatus</i>										
<i>Aspergillus niger</i>							1	7	7	33
<i>Aspergillus species Var. 1</i>										
<i>Aspergillus species Var. 2</i>										
<i>Aureobasidium</i>										
<i>Bipolaris</i>										
<i>Chaetomium</i>										
<i>Chyso sporium</i>										
<i>Cladosporium</i>							1	7	7	33
<i>Cunninghamella</i>										
<i>Curvularia</i>										
<i>Epicoccum</i>										
<i>Fusarium</i>										
<i>Geotrichum</i>										
<i>Mucor</i>										
<i>Mycelia sterilia</i>										
<i>Paecilomyces</i>										
<i>Penicillium species Var. 1</i>										
<i>Penicillium species Var. 2</i>							1	7	7	33
<i>Phoma</i>										
<i>Rhizopus</i>										
<i>Sporotrichum</i>										
<i>Stachybotrys</i>										
<i>Stemphylium</i>										
<i>Trichoderma</i>										
<i>Ulocladium</i>										
<i>Yeast</i>							1	7	7	33

Notes:

Prepared By: AB
 CS Review: [Signature]

Technical Review: [Signature]
 Final Review: [Signature]



AEROTECH LABORATORIES, INC.

AESI
 1112 Charleston Ct.
 Keller, TX 76248
 Attn: David Anderson

Lab Number: A-109-0686
 Project ID: 0880 A (197)
 Date Received: 09/07/01
 Date Reported: 09/13/01

AIHA Empat No. 102297
 CarpetChek™ Analysis

Lab Number	6	SW 1810 Carpet	
Sample Identification	SW 1810 Carpet	09/12/01	
Date Analyzed	09/12/01	Total Count/Gram	%
Mycelial Fragments	<4,000	n/a	
Pollen	<4,000	n/a	
Total Fungal Spores	4,000	100	
Fungal Spore Identification			
Alternaria			
Amerospores			
Arthrinium			
Ascospores			
Aspergillus/Penicillium			
Aureobasidium			
Basidiospores			
Bipolaris/Dreschlera			
Botrytis			
Chaetomium			
Cladosporium			
Curvularia			
Epicoccum			
Fusarium			
Nigrospora			
Oidium/Peronospora			
Pithomyces/Utocladium			
Rusts			
Smuts/Myxomycetes			
Stachybotrys			
Stemphylium			
Torula			
Unidentified Conidia	4,000	100	

Prepared By: *AB*
 CS Review: *BB*

Technical Review: *AB*
 Final Review: *BB*



AEROTECH LABORATORIES, INC.

Lab Number: A-109-0686
 Project Name: WNY
 Project Number: 0860A (197)
 Date Received: 09/07/01
 Date Reported: 09/24/01

AIHA Empat No. 102297
Viable Fungi Analysis - Air
 Aerotech Method: A003

AESI
 1112 Charleston Ct.
 Keller, TX 76248
 Attn: Dr. David Anderson

Sample Identification	21		CFU	Result	Detection Limit	%
	Out Petri	CFU/M ³				
Date Incubated	09/07/2001		19	127	7	100
Date Analyzed	09/21/2001		1	7	7	5
Culture Media	Potato Dextrose (PDA)		3	20	7	16
Volume (M ³)	0.1500					
Viable Fungi 20-25°C						
<i>Acremonium</i>						
<i>Alternaria</i>						
<i>Aspergillus fumigatus</i>						
<i>Aspergillus niger</i>						
<i>Aspergillus species Var. 1</i>						
<i>Aspergillus species Var. 2</i>						
<i>Aureobasidium</i>						
<i>Bipolaris</i>						
<i>Chaetomium</i>						
<i>Chrysosporium</i>						
<i>Cladosporium</i>			3	20	7	16
<i>Cunninghamella</i>						
<i>Curvularia</i>						
<i>Epicoccum</i>						
<i>Fusarium</i>						
<i>Geotrichum</i>						
<i>Mucor</i>						
<i>Mycelia sterilia</i>			1	7	7	5
<i>Paecilomyces</i>						
<i>Penicillium species Var. 1</i>			9	60	7	47
<i>Penicillium species Var. 2</i>			2	13	7	11
<i>Phoma</i>						
<i>Rhizopus</i>						
<i>Sporotrichum</i>						
<i>Stachybotrys</i>						
<i>Stemphylium</i>						
<i>Trichoderma</i>						
<i>Ulocladium</i>						
<i>Yeast</i>						
Notes:						

Prepared By: *AB*
 CS Review: *AB*

Technical Review: *h*
 Final Review: *h*



AEROTECH LABORATORIES, INC.

Thursday, September 13, 2001

Dr. David Anderson
AESI
1112 Charleston Ct.
Keller, TX 76248

Re: Aerotech Project Number A-109-0686

Dear Dr. David:

Aerotech is pleased to provide the enclosed report of analyses for samples submitted Friday, September 07, 2001. This cover letter and accompanying pages are an integral part of this report. All analyses are performed in our AIHA proficiency-tested laboratory under the FDA Good Laboratory Practice Guidelines and the parameters outlined in the most current version of the American Conference of Governmental Industrial Hygienists Bioaerosol Guidelines. The data generated in this report is based on the samples and accompanying information provided. Aerotech employees did not collect samples for this project, and may provide limited interpretation of this data as it relates to the overall investigation.

Quality Assurance

Aerotech is staffed by certified microbiologists, maintains a rigorous Quality Assurance program and participates in the American Industrial Hygiene Association's Environmental Microbiology Proficiency Testing Program. Our AIHA EMPAT Number is 102297. Aerotech is extremely proud of its excellent scoring in this program and will provide copies of our results upon request. They can also be downloaded from our web site at www.aerotechlabs.com. Below you will find additional information regarding the specific analyses requested for this project.

A001, A002, WC001

Air-O-Cell Cassette

The Air-O-Cell Cassette is a unique sampling device designed for the rapid collection and analysis of a wide range of airborne particles, including fungal spores. Samples are analyzed via light microscopy at 600X magnification, with the entire slide (100% of the sample) being analyzed. The results are reported as **total**, meaning they include both viable and non-viable fungal spores. Unfortunately, this technique does not allow for the differentiation between *Aspergillus* and *Penicillium* spores. Small (~1-3 μ) spherical fungal spores that cannot be identified and may include *Aspergillus*, *Penicillium*, and *Trichoderma* and others are grouped together as *Amerospores*. Additionally it does not allow for cultivation or speciation of spores. Slides containing greater than 500 fungal spores are difficult to count accurately due to overcrowding and are therefore estimations. Similarly, excessive non-microbial particulates can mask the presence of fungal spores, thereby reducing counting accuracies. All slides are graded with the following debris scale for data qualification.

Debris Rating Scale

Non-Microbial Particulate Debris Rating	Description	Interpretation
0	No particles detected	No particulates in on slide. The absence of particulates could indicate improper sampling, as most air samples typically contain some particulates
1	Minimal non-microbial debris present.	Reported values are not affected by debris.
2	Up to 25% of the slide occluded with non-microbial particulates.	Non-microbial particulates can mask the presence of fungal spores. As a result, actual values could be up to 1.3 times higher than reported.
3	26% to 75% of the slide occluded with non-microbial particulates.	Non-microbial particulates can mask the presence of fungal spores. As a result, actual values could be up to 1.4 to 4 times higher than reported
4	76% to 90% of the slide occluded with non-microbial particulates.	Non-microbial particulates can mask the presence of fungal spores. As a result, actual values could be up to 4 to 10 times higher than reported.
5	Greater than 90% of the slide occluded with non-microbial particulates.	Quantification not possible. Resamples should be collected at shorter time interval, or other measures taken to reduce the collection of non-microbial debris.

A003, A004, A005, A006, B002, B003, B004, B007, CC002, CC003, CC004, CC005, S002, S003, S004, S007
W001, W002, W003, W004

Culture Analyses for Fungi and Bacteria

Cultureable microorganisms are those that are viable when media is inoculated, and will grow on the selected media and at the selected temperature. This technique has certain limitations when analyzing for certain types of fungi, specifically *Stachybotrys*. Some reports indicate that the recovery efficiency of *Stachybotrys* spores can be as low as 10% when compared to total spore techniques.

The type of media and incubation temperature can vary depending on the scope of the survey. Isolates are identified to the service level requested. Typical analysis includes identification of most fungi to the genus level. *Aspergillus* and *Penicillium* species are differentiated based on morphology with each variant reported separately. Identification to the species level can be performed if requested in advance. General incubation parameters are summarized below. Incubation times can vary depending on specific growth characteristics. Samples submitted for culture analysis using Cornmeal Agar (CMA) or Cellulose Agar are cultured for 14 days.

Test	Incubation Temperature (°C)	Incubation Time
Environmental Bacteria	28	48 hours
Total Fungi	20-25	7-10 days
Thermophilic fungi	37	7-10 days
Thermophilic Actinomycetes	50	48 hours

Common Culture Media

Acronym	Name
BAP	Tryptic Soy Agar with 5% Sheep Blood
PCA	Plate Count Agar
R2A	R2A
BCYE	Buffered Charcoal Yeast Extract Agar
PDA	Potato Dextrose Agar
MEA	Malt Extract Agar
DG-18	Dichloran Glycerol Agar
SAB	Sabaouroud's Dextrose Agar
RBA	Rose Bengal Agar
CYA	Czapeck's Yeast Agar

CC001, CC002

CarpetChek™ and DustChek™ Analyses

Microscopic analysis of dust is a rapid analytical technique for quantification and identification of fungal spores in dust. Direct microscopic analysis for total fungal includes a total spore count, total pollen count, and total mycelial fragment (hyphae) count. All counts are reported as total count per gram of dust. Spores are identified microscopically to the genus level. Some genera such as *Aspergillus* and *Penicillium* are indistinguishable and grouped together on a report. The toxigenic mold *Stachybotrys* is readily identifiable by this method. Results of this test are reported as a total count, which includes potentially viable and non-viable spores. The presence of certain spores may be masked when using this microscopic method due to the heterogeneous and complex nature of the dust matrix.

Viable Vs. Total Fungal Spores in Dust

	Viable	Total (Viable and Non-Viable)
Reporting Units	Colony Forming Units (CFU)	Total Count
Potentially Allergenic/Toxicogenic	Yes	Yes
Analytical Detection Limit	10-200 CFU/g	4,000-40,000 Spore Count per g

An in-depth study of viable fungi in carpet dust was performed by Scott and Hodgson (*Prevalence Of Fungi In Carpet Dust Samples*, 1998). For their study, 243 dust samples were collected from 35 buildings over a three-period and analyzed for viable fungi. Their study identified specific indicators of building contamination based on the analysis of the carpet dust. Their findings indicate "normal" levels of viable fungi between 10,000 and 100,000 CFU/gram of carpet dust from 74% of the control buildings. Sixty-four percent (64%) of the contaminated tested showed levels of viable fungi to be 100,000 CFU/gram or higher. Analysis of total fungi counts was not performed in this study.

A010, A010.1, B013

Volatile Organic Compounds (VOC's)

Analysis for VOC's includes the EPA T015 method, utilizing a gas chromatograph (GC) coupled to a mass spectrometer (MS). This method includes quantification of 63 compounds. Tentatively identified compounds (TIC's) can also be identified and their concentrations estimated by performing a compound library search of over 100,000 compounds. Results are reported in parts per billion on a volume basis (ppbv).

This communication is intended only for the individual or entity to which it is directed. It may contain information that is privileged, confidential, or otherwise exempt from disclosure under applicable law. Dissemination, distribution, or copying of this communication by anyone other than the intended recipient, or a duly designated employee or agent of such recipient, is prohibited. If you have received this communication in error, please notify us immediately by telephone at 800.651.4802, and delete this message and all attachments thereto.

For additional information, or if you have any questions regarding this report, please do not hesitate to call.

Sincerely,

Ruth Skinner
Project Manager
Aerotech Laboratories, Inc.
800-651-4802

Analytical References

1. Medically Important Fungi: A Guide to Identification, 3rd ed., ASM, 1995.

2. Standard Methods for the Examination of Water and Wastewater, 19th ed., APHA, 1995.
3. Sampling and Identifying Allergenic Pollens and Molds, Blewstone, 1990.
4. Identifying Filamentous Fungi: A Clinical Laboratory Handbook, Star, 1996.
5. Manual of Clinical Microbiology, 7th ed., ASM, 1999.
6. A Laboratory Guide to Common *Aspergillus* Species and their Teleomorphs, CSIRO, 1994.
7. Bioaerosols: Assessment and Control, ACGIH, 1999.



AEROTECH LABORATORIES, INC.

AESI
 1112 Charleston Ct.
 Keller, TX 76248
 Attn: David Anderson

Lab Number: A-109-0686-18
 Project ID: WNY/0880A (197)
 Sample ID: 1W 1850 VOC
 Sample Size: 400 mL Can
 Date Received: 09/07/01
 Date Analyzed: 09/07/00
 Date Reported: 09/28/01

Volatile Organic Compounds (VOC's) - Air

EPA TO14A/TO15

Compound	Results		Comments
	ppbv	µg/m ³	
Dibromochloromethane	<2.0	<17.3	
Dichlorodifluoromethane(F-12)	<2.0	<10.1	
Dichlorotetrafluoroethane(F-11)	<2.0	<11.4	
Ethyl Acetate	<2.0	<7.3	
Ethylbenzene	<2.0	<8.8	
Heptane	<2.0	<8.3	
Hexachlorobutadiene	<2.0	<21.7	
Hexane	<2.0	<7.2	
m&p-Xylene	<4.0	<17.6	
Methyl tert-butyl ether	<4.0	<14.6	
Methylene chloride	<2.0	<7.1	
o-Xylene	<2.0	<8.8	
Propene (Propylene)	<2.0	<3.5	
Styrene	<2.0	<8.6	
Tetrachloroethene	<2.0	<13.8	
Tetrahydrofuran	<4.0	<12	
Toluene	<2.0	<7.7	
trans-1,2-Dichloroethene	<2.0	<8	
trans-1,3-Dichloropropene	<2.0	<9.2	
Trichloroethene	<2.0	<10.9	
Trichlorofluoromethane	<2.0	<11.4	
Trichlorotrifluoroethane	<2.0	<15.5	
Vinyl acetate	<2.0	<7.2	
Vinyl chloride	<2.0	<5.2	

Tentatively Identified Compounds (TIC's)

Estimated Concentration (ppbv)	Number Of Compounds Detected
10-100	0
100-200	0
Greater than 200	0

Input By: *SB*
 CS Review: *MB*

Technical Review: *Kit*
 Final Review: *Kit*

A010 Page 2 of 2



AEROTECH LABORATORIES, INC.

AESI
1112 Charleston Ct.
Keller, TX 76248
Attn: David Anderson

Volatile Organic Compounds (VOC's) - Air

EPA TO14A/TO15

Lab Number: A-109-0686-18
Project ID: WNY/0880A (197)
Sample ID: 1W 1850 VOC
Sample Size: 400 mL Can
Date Received: 09/07/01
Date Analyzed: 09/07/00
Date Reported: 09/28/01

Results			
Compound	ppbv	µg/m ³	Comments
1,1,1-Trichloroethane	<2.0	<11.1	
1,1,2,2-Tetrachloroethane	<2.0	<14	
1,1,2-Trichloroethane	<2.0	<11.1	
1,1-Dichloroethane	<2.0	<8.2	
1,1-Dichloroethene	<2.0	<8.1	
1,2,4-Trichlorobenzene	<2.0	<15	
1,2,4-Trimethylbenzene	<2.0	<10	
1,2-Dibromoethane	<2.0	<15.6	
1,2-Dichlorobenzene	<2.0	<12.2	
1,2-Dichloroethane	<2.0	<8.2	
1,2-Dichloropropane	<2.0	<9.4	
1,3,5-Trimethylbenzene	<2.0	<10	
1,3-Butadiene	<2.0	<4.5	
1,3-Dichlorobenzene	<2.0	<12.2	
1,4-Dichlorobenzene	<2.0	<12.2	
2,2,4-Trimethylpentane	<2.0	<9.5	
2-Butanone (MEK)	<2.0	<6	
2-Hexanone	<2.0	<8.3	
2-Propanol	37	92.3	
4-Ethyltoluene	<2.0	<8.8	
4-Methyl-2-pentanone	<4.0	<16.6	
Acetone	400	964.5	
Allyl chloride	<2.0	<6.4	
Benzene	<2.0	<6.5	
Benzyl chloride	<2.0	<10.6	
Bromodichloromethane	<2.0	<13.6	
Bromoethene(Vinyl Bromide)	<2.0	<8.9	
Bromoform	<2.0	<21	
Bromomethane	<2.0	<7.9	
Carbon disulfide	<2.0	<6.3	
Carbon tetrachloride	<2.0	<12.8	
Chlorobenzene	<2.0	<9.4	
Chloroethane	5.5	14.7	
Chloroform	<2.0	<9.9	
Chloromethane	<2.0	<4.2	
cis-1,2-Dichloroethene	<2.0	<8	
cis-1,3-Dichloropropene	<2.0	<9.2	
Cyclohexane	<2.0	<7	

Input By: *SP*
CS Review: *AK*

Technical Review: *KH*
Final Review: *AK*

A010 Page 1 of 2



AEROTECH LABORATORIES, INC.

AESI
 1112 Charleston Ct.
 Keller, TX 76248
 Attn: David Anderson

Lab Number: A-109-0686-11
 Project ID: WNY/0880A (197)
 Sample ID: 4W 1222 Cube VOC
 Sample Size: 400 mL Can
 Date Received: 09/07/01
 Date Analyzed: 09/07/00
 Date Reported: 09/28/01

Volatile Organic Compounds (VOC's) - Air
 EPA TO14A/TO15

Results			
Compound	ppbv	µg/m ³	Comments
Dibromochloromethane	<2.0	<17.3	
Dichlorodifluoromethane(F-12)	<2.0	<10.1	
Dichlorotetrafluoroethane(F-11)	<2.0	<11.4	
Ethyl Acetate	<2.0	<7.3	
Ethylbenzene	<2.0	<8.8	
Heptane	<2.0	<8.3	
Hexachlorobutadiene	<2.0	<21.7	
Hexane	<2.0	<7.2	
m&p-Xylene	<4.0	<17.6	
Methyl tert-butyl ether	<4.0	<14.6	
Methylene chloride	<2.0	<7.1	
o-Xylene	<2.0	<8.8	
Propene (Propylene)	<2.0	<3.5	
Styrene	<2.0	<8.6	
Tetrachloroethene	<2.0	<13.8	
Tetrahydrofuran	<4.0	<12	
Toluene	<2.0	<7.7	
trans-1,2-Dichloroethene	<2.0	<8	
trans-1,3-Dichloropropene	<2.0	<9.2	
Trichloroethene	<2.0	<10.9	
Trichlorofluoromethane	<2.0	<11.4	
Trichlorotrifluoroethane	<2.0	<15.5	
Vinyl acetate	<2.0	<7.2	
Vinyl chloride	<2.0	<5.2	

Tentatively Identified Compounds (TIC's)

Estimated Concentration (ppbv)	Number Of Compounds Detected
10-100	1
100-200	0
Greater than 200	0

Input By: *DB*
 CS Review: *DB*

Technical Review: *PH*
 Final Review: *[Signature]*

A010 Page 2 of 2



AEROTECH LABORATORIES, INC.

AESI
1112 Charleston Ct.
Keller, TX 76248
Attn: David Anderson

Volatile Organic Compounds (VOC's) - Air

EPA TO14A/TO15

Lab Number: A-109-0686-11
Project ID: WNY/0880A (197)
Sample ID: 4W 1222 Cube VOC
Sample Size: 400 mL Can
Date Received: 09/07/01
Date Analyzed: 09/07/00
Date Reported: 09/28/01

Compound	Results		Comments
	ppbv	$\mu\text{g}/\text{m}^3$	
1,1,1-Trichloroethane	<2.0	<11.1	
1,1,2,2-Tetrachloroethane	<2.0	<14	
1,1,2-Trichloroethane	<2.0	<11.1	
1,1-Dichloroethane	<2.0	<8.2	
1,1-Dichloroethene	<2.0	<8.1	
1,2,4-Trichlorobenzene	<2.0	<15	
1,2,4-Trimethylbenzene	<2.0	<10	
1,2-Dibromoethane	<2.0	<15.6	
1,2-Dichlorobenzene	<2.0	<12.2	
1,2-Dichloroethane	<2.0	<8.2	
1,2-Dichloropropane	<2.0	<9.4	
1,3,5-Trimethylbenzene	<2.0	<10	
1,3-Butadiene	<2.0	<4.5	
1,3-Dichlorobenzene	<2.0	<12.2	
1,4-Dichlorobenzene	<2.0	<12.2	
2,2,4-Trimethylpentane	<2.0	<9.5	
2-Butanone (MEK)	<2.0	<6	
2-Hexanone	<2.0	<8.3	
2-Propanol	120	299.3	
4-Ethyltoluene	<2.0	<8.8	
4-Methyl-2-pentanone	<4.0	<16.6	
Acetone	120	289.3	
Allyl chloride	<2.0	<6.4	
Benzene	<2.0	<6.5	
Benzyl chloride	<2.0	<10.6	
Bromodichloromethane	<2.0	<13.6	
Bromoethene(Vinyl Bromide)	<2.0	<8.9	
Bromoform	<2.0	<21	
Bromomethane	<2.0	<7.9	
Carbon disulfide	<2.0	<6.3	
Carbon tetrachloride	<2.0	<12.8	
Chlorobenzene	<2.0	<9.4	
Chloroethane	6.6	17.7	
Chloroform	<2.0	<9.9	
Chloromethane	<2.0	<4.2	
cis-1,2-Dichloroethene	<2.0	<8	
cis-1,3-Dichloropropene	<2.0	<9.2	
Cyclohexane	<2.0	<7	

Input By: DB
CS Review: AB

Technical Review: KH
Final Review: [Signature]



AEROTECH LABORATORIES, INC.

AESI
 1112 Charleston Ct.
 Keller, TX 76248
 Attn: David Anderson

Lab Number: A-109-0686-05
 Project ID: WNY/0880A (197)
 Sample ID: 5W 1170 VOC
 Sample Size: 400 mL Can
 Date Received: 09/07/01
 Date Analyzed: 09/07/01
 Date Reported: 09/28/01

Volatile Organic Compounds (VOC's) - Air

EPA TO14A/TO15

Results			
Compound	ppbv	µg/m ³	Comments
Dibromochloromethane	<2.0	<17.3	
Dichlorodifluoromethane(F-12)	<2.0	<10.1	
Dichlorotetrafluoroethane(F-11)	<2.0	<11.4	
Ethyl Acetate	<2.0	<7.3	
Ethylbenzene	<2.0	<8.8	
Heptane	<2.0	<8.3	
Hexachlorobutadiene	<2.0	<21.7	
Hexane	<2.0	<7.2	
m&p-Xylene	<4.0	<17.6	
Methyl tert-butyl ether	<4.0	<14.6	
Methylene chloride	<2.0	<7.1	
o-Xylene	<2.0	<8.8	
Propene (Propylene)	<2.0	<3.5	
Styrene	<2.0	<8.6	
Tetrachloroethene	<2.0	<13.8	
Tetrahydrofuran	<4.0	<12	
Toluene	<2.0	<7.7	
trans-1,2-Dichloroethene	<2.0	<8	
trans-1,3-Dichloropropene	<2.0	<9.2	
Trichloroethene	<2.0	<10.9	
Trichlorofluoromethane	<2.0	<11.4	
Trichlorotrifluoroethane	<2.0	<15.5	
Vinyl acetate	<2.0	<7.2	
Vinyl chloride	<2.0	<5.2	

Tentatively Identified Compounds (TIC's)

Estimated Concentration (ppbv)	Number Of Compounds Detected
10-100	1
100-200	0
Greater than 200	0

Input By: *DB*
 CS Review: *AKB*

Technical Review: *KH*
 Final Review: *[Signature]*

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AEROTECH LABORATORIES, INC.

AESI
 1112 Charleston Ct.
 Keller, TX 76248
 Attn: David Anderson

Lab Number: A-109-0686-05
 Project ID: WNY/0880A (197)
 Sample ID: 5W 1170 VOC
 Sample Size: 400 mL Can
 Date Received: 09/07/01
 Date Analyzed: 09/07/01
 Date Reported: 09/28/01

Volatile Organic Compounds (VOC's) - Air
 EPA TO14A/TO15

Results			
Compound	ppbv	µg/m ³	Comments
1,1,1-Trichloroethane	<2.0	<11.1	
1,1,2,2-Tetrachloroethane	<2.0	<14	
1,1,2-Trichloroethane	<2.0	<11.1	
1,1-Dichloroethane	<2.0	<8.2	
1,1-Dichloroethene	<2.0	<8.1	
1,2,4-Trichlorobenzene	<2.0	<15	
1,2,4-Trimethylbenzene	<2.0	<10	
1,2-Dibromoethane	<2.0	<15.6	
1,2-Dichlorobenzene	<2.0	<12.2	
1,2-Dichloroethane	<2.0	<8.2	
1,2-Dichloropropane	<2.0	<9.4	
1,3,5-Trimethylbenzene	<2.0	<10	
1,3-Butadiene	<2.0	<4.5	
1,3-Dichlorobenzene	<2.0	<12.2	
1,4-Dichlorobenzene	<2.0	<12.2	
2,2,4-Trimethylpentane	<2.0	<9.5	
2-Butanone (MEK)	<2.0	<6	
2-Hexanone	<2.0	<8.3	
2-Propanol	260	648.5	
4-Ethyltoluene	<2.0	<8.8	
4-Methyl-2-pentanone	<4.0	<16.6	
Acetone	<2.0	<4.8	
Allyl chloride	<2.0	<6.4	
Benzene	<2.0	<6.5	
Benzyl chloride	<2.0	<10.6	
Bromodichloromethane	<2.0	<13.6	
Bromoethene(Vinyl Bromide)	<2.0	<8.9	
Bromoform	<2.0	<21	
Bromomethane	<2.0	<7.9	
Carbon disulfide	<2.0	<6.3	
Carbon tetrachloride	<2.0	<12.8	
Chlorobenzene	<2.0	<9.4	
Chloroethane	13	34.9	
Chloroform	<2.0	<9.9	
Chloromethane	<2.0	<4.2	
cis-1,2-Dichloroethene	<2.0	<8	
cis-1,3-Dichloropropene	<2.0	<9.2	
Cyclohexane	<2.0	<7	

Input By: *DB*
 CS Review: *MB*

Technical Review: *KH*
 Final Review: *[Signature]*



AEROTECH LABORATORIES, INC.

AESI
 1112 Charleston Ct.
 Keller, TX 76248
 Attn: David Anderson

Lab Number: A-109-0688-06
 Project ID: NYW/0880-"S"
 Sample ID: VOC IW3091 (119)
 Sample Size: 400 mL Can
 Date Received: 09/07/01
 Date Analyzed: 09/07/01
 Date Reported: 10/16/01

Volatile Organic Compounds (VOC's) - Air

EPA TO14A/TO15

Results			
Compound	ppbv	µg/m ³	Comments
Dibromochloromethane	<2.0	<17.3	
Dichlorodifluoromethane(F-12)	<2.0	<10.1	
Dichlorotetrafluoroethane(F-11)	<2.0	<11.4	
Ethyl Acetate	<2.0	<7.3	
Ethylbenzene	<2.0	<8.8	
Heptane	<2.0	<8.3	
Hexachlorobutadiene	<2.0	<21.7	
Hexane	<2.0	<7.2	
m&p-Xylene	<4.0	<17.6	
Methyl tert-butyl ether	<4.0	<14.6	
Methylene chloride	<2.0	<7.1	
o-Xylene	<2.0	<8.8	
Propene (Propylene)	<2.0	<3.5	
Styrene	<2.0	<8.6	
Tetrachloroethene	<2.0	<13.8	
Tetrahydrofuran	<4.0	<12	
Toluene	2.7	10.3	
trans-1,2-Dichloroethene	<2.0	<8	
trans-1,3-Dichloropropene	<2.0	<9.2	
Trichloroethene	<2.0	<10.9	
Trichlorofluoromethane	<2.0	<11.4	
Trichlorotrifluoroethane	<2.0	<15.5	
Vinyl acetate	<2.0	<7.2	
Vinyl chloride	<2.0	<5.2	

Non-Target Analytes

Estimated Concentration (ppbv)	Number Of Compounds Detected
>200	0
10-50	0
50-200	0

Input By: SB
 CS Review: CH

Technical Review: KTH
 Final Review: [Signature]

A010 Page 2 of 2



AEROTECH LABORATORIES, INC.

AESI
 1112 Charleston Ct.
 Keller, TX 76248
 Attn: David Anderson

Lab Number: A-109-0688-03
 Project ID: NYW/0880-"S"
 Sample ID: VOC IW3091 (119)
 Sample Size: 400 mL Can
 Date Received: 09/07/01
 Date Analyzed: 09/07/01
 Date Reported: 10/16/01

Volatile Organic Compounds (VOC's) - Air

EPA TO14A/TO15

Compound	Results		Comments
	ppbv	µg/m ³	
1,1,1-Trichloroethane	<2.0	<11.1	
1,1,2,2-Tetrachloroethane	<2.0	<14	
1,1,2-Trichloroethane	<2.0	<11.1	
1,1-Dichloroethane	<2.0	<8.2	
1,1-Dichloroethene	<2.0	<8.1	
1,2,4-Trichlorobenzene	<2.0	<15	
1,2,4-Trimethylbenzene	<2.0	<10	
1,2-Dibromoethane	<2.0	<15.6	
1,2-Dichlorobenzene	<2.0	<12.2	
1,2-Dichloroethane	<2.0	<8.2	
1,2-Dichloropropane	<2.0	<9.4	
1,3,5-Trimethylbenzene	<2.0	<10	
1,3-Butadiene	<2.0	<4.5	
1,3-Dichlorobenzene	<2.0	<12.2	
1,4-Dichlorobenzene	<2.0	<12.2	
1,4-Dioxane	<2.0	<7.3	
2,2,4-Trimethylpentane	<2.0	<9.5	
2-Butanone (MEK)	2.6	7.8	
2-Hexanone	<2.0	<8.3	
2-Propanol	68	169.6	
4-Ethyltoluene	<2.0	<8.8	
4-Methyl-2-pentanone	<4.0	<16.6	
Acetone	410	988.6	
Allyl chloride	<2.0	<6.4	
Benzene	<2.0	<6.5	
Benzyl chloride	<2.0	<10.6	
Bromodichloromethane	<2.0	<13.6	
Bromoethene(Vinyl Bromide)	<2.0	<8.9	
Bromoform	<2.0	<21	
Bromomethane	<2.0	<7.9	
Carbon disulfide	<2.0	<6.3	
Carbon tetrachloride	<2.0	<12.8	
Chlorobenzene	<2.0	<9.4	
Chloroethane	<2.0	<5.4	
Chloroform	<2.0	<9.9	
Chloromethane	<2.0	<4.2	
cis-1,2-Dichloroethene	<2.0	<8	
cis-1,3-Dichloropropene	<2.0	<9.2	
Cyclohexane	<2.0	<7	

Input By: SB
 CS Review: CH

Technical Review: KH
 Final Review: *[Signature]*

A010 Page 1 of 2



AEROTECH LABORATORIES, INC.

AESI
 1112 Charleston Ct.
 Keller, TX 76248
 Attn: David Anderson

Lab Number: A-109-0688-03
 Project ID: NYW/0880-"S"
 Sample ID: VOC IW3091 (119)
 Sample Size: 400 mL Can
 Date Received: 09/07/01
 Date Analyzed: 09/07/01
 Date Reported: 10/16/01

Volatile Organic Compounds (VOC's) - Air

EPA TO14A/TO15

Compound	Results		Comments
	ppbv	µg/m ³	
Dibromochloromethane	<2.0	<17.3	
Dichlorodifluoromethane(F-12)	<2.0	<10.1	
Dichlorotetrafluoroethane(F-11)	<2.0	<11.4	
Ethyl Acetate	<2.0	<7.3	
Ethylbenzene	<2.0	<8.8	
Heptane	<2.0	<8.3	
Hexachlorobutadiene	<2.0	<21.7	
Hexane	<2.0	<7.2	
m&p-Xylene	<4.0	<17.6	
Methyl tert-butyl ether	<4.0	<14.6	
Methylene chloride	<2.0	<7.1	
o-Xylene	<2.0	<8.8	
Propene (Propylene)	<2.0	<3.5	
Styrene	<2.0	<8.6	
Tetrachloroethene	<2.0	<13.8	
Tetrahydrofuran	<4.0	<12	
Toluene	3.3	12.6	
trans-1,2-Dichloroethene	<2.0	<8	
trans-1,3-Dichloropropene	<2.0	<9.2	
Trichloroethene	<2.0	<10.9	
Trichlorofluoromethane	<2.0	<11.4	
Trichlorotrifluoroethane	<2.0	<15.5	
Vinyl acetate	<2.0	<7.2	
Vinyl chloride	<2.0	<5.2	

Non-Target Analytes

Estimated Concentration (ppbv)	Number Of Compounds Detected
>200	0
10-50	0
50-200	0

Input By: SB
 CS Review: CH

Technical Review: KH
 Final Review: *[Signature]*



AEROTECH LABORATORIES, INC.

AESI
1112 Charleston Ct.
Keller, TX 76248
Attn: David Anderson

Lab Number: A-109-0688-06
Project ID: NYW/0880-"S"
Sample ID: VOC Subfloor
Sample Size: 400 mL Can
Date Received: 09/07/01
Date Analyzed: 09/07/01
Date Reported: 10/16/01

Volatile Organic Compounds (VOC's) - Air

EPA TO14A/TO15

Results			
Compound	ppbv	µg/m ³	Comments
1,1,1-Trichloroethane	<2.0	<11.1	
1,1,2,2-Tetrachloroethane	<2.0	<14	
1,1,2-Trichloroethane	<2.0	<11.1	
1,1-Dichloroethane	<2.0	<8.2	
1,1-Dichloroethene	<2.0	<8.1	
1,2,4-Trichlorobenzene	<2.0	<15	
1,2,4-Trimethylbenzene	<2.0	<10	
1,2-Dibromoethane	<2.0	<15.6	
1,2-Dichlorobenzene	<2.0	<12.2	
1,2-Dichloroethane	<2.0	<8.2	
1,2-Dichloropropane	<2.0	<9.4	
1,3,5-Trimethylbenzene	<2.0	<10	
1,3-Butadiene	<2.0	<4.5	
1,3-Dichlorobenzene	<2.0	<12.2	
1,4-Dichlorobenzene	<2.0	<12.2	
2,2,4-Trimethylpentane	<2.0	<9.5	
2-Butanone (MEK)	<2.0	<6	
2-Hexanone	<2.0	<8.3	
2-Propanol	20	49.9	
4-Ethyltoluene	<2.0	<8.8	
4-Methyl-2-pentanone	<4.0	<16.6	
Acetone	340	819.8	
Allyl chloride	<2.0	<6.4	
Benzene	<2.0	<6.5	
Benzyl chloride	<2.0	<10.6	
Bromodichloromethane	<2.0	<13.6	
Bromoethene(Vinyl Bromide)	<2.0	<8.9	
Bromoform	<2.0	<21	
Bromomethane	<2.0	<7.9	
Carbon disulfide	<2.0	<6.3	
Carbon tetrachloride	<2.0	<12.8	
Chlorobenzene	<2.0	<9.4	
Chloroethane	<2.0	<5.4	
Chloroform	<2.0	<9.9	
Chloromethane	<2.0	<4.2	
cis-1,2-Dichloroethene	<2.0	<8	
cis-1,3-Dichloropropene	<2.0	<9.2	
Cyclohexane	<2.0	<7	

Input By: SB
CS Review: CH

Technical Review: KH
Final Review: [Signature]

A010 Page 1 of 2



AEROTECH LABORATORIES, INC.

AESI
1112 Charleston Ct.
Keller, TX 76248
Attn: David Anderson

Volatile Organic Compounds (VOC's) - Air
EPA TO14A/TO15

Lab Number: A-109-0688-09
Project ID: NYW/0880-"S"
Sample ID: VOC Yard
Sample Size: 400 mL Can
Date Received: 09/07/01
Date Analyzed: 09/07/01
Date Reported: 10/16/01

Results			
Compound	ppbv	$\mu\text{g}/\text{m}^3$	Comments
Dibromochloromethane	<2.0	<17.3	
Dichlorodifluoromethane(F-12)	<2.0	<10.1	
Dichlorotetrafluoroethane(F-11)	<2.0	<11.4	
Ethyl Acetate	<2.0	<7.3	
Ethylbenzene	<2.0	<8.8	
Heptane	<2.0	<8.3	
Hexachlorobutadiene	<2.0	<21.7	
Hexane	<4.0	<14.3	
m&p-Xylene	<4.0	<17.6	
Methyl tert-butyl ether	<2.0	<7.3	
Methylene chloride	<2.0	<7.1	
o-Xylene	<2.0	<8.8	
Propene (Propylene)	<2.0	<3.5	
Styrene	<2.0	<8.6	
Tetrachloroethene	<2.0	<13.8	
Tetrahydrofuran	<4.0	<12	
Toluene	<2.0	<7.7	
trans-1,2-Dichloroethene	<2.0	<8	
trans-1,3-Dichloropropene	<2.0	<9.2	
Trichloroethene	<2.0	<10.9	
Trichlorofluoromethane	<2.0	<11.4	
Trichlorotrifluoroethane	<2.0	<15.5	
Vinyl acetate	<2.0	<7.2	
Vinyl chloride	<2.0	<5.2	

Non-Target Analytes

Estimated Concentration (ppbv)	Number Of Compounds Detected
>200	0
10-50	0
50-200	0

Input By: SB
CS Review: CH

Technical Review: KH
Final Review: [Signature]

A010 Page 2 of 2



AEROTECH LABORATORIES, INC.

AESI
 1112 Charleston Ct.
 Keller, TX 76248
 Attn: David Anderson

Lab Number: A-109-0688-09
 Project ID: NYW/0880-"S"
 Sample ID: VOC Yard
 Sample Size: 400 mL Can
 Date Received: 09/07/01
 Date Analyzed: 09/07/01
 Date Reported: 10/16/01

Volatile Organic Compounds (VOC's) - Air

EPA TO14A/TO15

Results			
Compound	ppbv	µg/m ³	Comments
1,1,1-Trichloroethane	<2.0	<11.1	
1,1,2,2-Tetrachloroethane	<2.0	<14	
1,1,2-Trichloroethane	<2.0	<11.1	
1,1-Dichloroethane	<2.0	<8.2	
1,1-Dichloroethene	<2.0	<8.1	
1,2,4-Trichlorobenzene	<2.0	<15	
1,2,4-Trimethylbenzene	<2.0	<10	
1,2-Dibromoethane	<2.0	<15.6	
1,2-Dichlorobenzene	<2.0	<12.2	
1,2-Dichloroethane	<2.0	<8.2	
1,2-Dichloropropane	<2.0	<9.4	
1,3,5-Trimethylbenzene	<2.0	<10	
1,3-Butadiene	<2.0	<4.5	
1,3-Dichlorobenzene	<2.0	<12.2	
1,4-Dichlorobenzene	<2.0	<12.2	
2,2,4-Trimethylpentane	<2.0	<9.5	
2-Butanone (MEK)	<2.0	<6	
2-Hexanone	<2.0	<8.3	
2-Propanol	6.9	17.2	
4-Ethyltoluene	<2.0	<8.8	
4-Methyl-2-pentanone	<4.0	<16.6	
Acetone	420	1012.7	
Allyl chloride	<2.0	<6.4	
Benzene	<2.0	<6.5	
Benzyl chloride	<2.0	<10.6	
Bromodichloromethane	<2.0	<13.6	
Bromoethene(Vinyl Bromide)	<2.0	<8.9	
Bromoform	<2.0	<21	
Bromomethane	<2.0	<7.9	
Carbon disulfide	<2.0	<6.3	
Carbon tetrachloride	<2.0	<12.8	
Chlorobenzene	<2.0	<9.4	
Chloroethane	<2.0	<5.4	
Chloroform	<2.0	<9.9	
Chloromethane	<2.0	<4.2	
cis-1,2-Dichloroethene	<2.0	<8	
cis-1,3-Dichloropropene	<2.0	<9.2	
Cyclohexane	<2.0	<7	

Input By: SB
 CS Review: CH

Technical Review: KH
 Final Review: *[Signature]*

A010 Page 1 of 2



AEROTECH LABORATORIES, INC.

September 27, 2001

David Anderson
AESI
1112 Charleston Court
Keller, TX 76248
TEL: (817) 379-6968
FAX (817) 337-0615

RE: NYW/0880 - "S"

Order No.: 0109167

Dear David Anderson:

Precision Analytical Laboratories, Inc. received 3 samples on 9/7/2001 for the analyses presented in the following report.

This report includes the following information:

- Case Narrative.
- Analytical Report: includes test results, report limit (Limit), any applicable data qualifier (Qual), units, dilution factor (DF), and date analyzed.
- QC Summary Report.

This communication is intended only for the individual or entity to whom it is directed. It may contain information that is privileged, confidential, or otherwise exempt from disclosure under applicable law. Dissemination, distribution, or copying of this communication by anyone other than the intended recipient, or a duly designated employee or agent of such recipient, is prohibited. If you have received this communication in error, please notify us immediately and destroy this message and all attachments thereto. If you have any questions regarding these test results, please do not hesitate to call.

Sincerely,

Ruth Skinner 
Project Manager

CC:



AEROTECH LABORATORIES, INC.

CLIENT: AESI
Project: NYW/0880 - "S"
Lab Order: 0109167

CASE NARRATIVE

Data Qualifiers:

Listed below are data qualifiers which may be used in your analytical report to explain any analytical or quality control issues. If one or more of the following data qualifiers is associated with your analytical or quality control data it will be noted in your report under the column header "QUAL". Any quality control deficiencies that cannot be adequately described by these qualifiers will be addressed in the analytical comments section of this case narrative.

R4 RPD exceeded the method control limit. Recovery met acceptance criteria.

All analyses included in this report were performed by Precision Analytical Laboratories, Inc. (PAL), 1725 W. 17th Street, Tempe, Arizona (ADHS certification no. AZ0610, California 2410).

PAL participates in the AIHA Proficiency Analytical Testing (PAT) program for metals, solvents, and formaldehyde.

Samples were analyzed using methods outlined in references such as:

Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW846, 3rd Edition.

NIOSH Manual of Analytical Methods, Fourth Edition, 1994. NIOSH Method 7300 analyses are performed using a modified digestion procedure to eliminate the use of perchloric acid. NIOSH Methods 1501 and 1003 are modified to incorporate the use of a mass spectrometer detector instead of FID.

Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, Second Edition, 1999.

Analytical Comments:

All method blanks and laboratory control spikes met EPA method and/or laboratory quality control objectives for the analyses included in this report.

Sample results have not been corrected for blank values.

If any additional non-target peaks were found for the Method TO-15 analysis, the number of non-target peaks found and the approximate concentration range will be included at the end of the analytical report, designated with a "T" qualifier. If requested, the laboratory can perform a forward library search for the non-target peaks found to provide additional information about the chemical composition and



AEROTECH LABORATORIES, INC.

CLIENT: RESI

Project: NYW/0880 - "S"

Lab Order: 0109167

CASE NARRATIVE

estimated concentration of the additional peaks. Please contact your project manager for more information.



AEROTECH LABORATORIES, INC.

Tuesday, September 11, 2001

David Anderson
AESI
1112 Charleston Ct.
Keller, TX 76248

Re: Aerotech Project Number A-109-0688

Dear David:

Aerotech is pleased to provide the enclosed report of analyses for samples submitted Friday, September 07, 2001. This cover letter and accompanying pages are an integral part of this report. All analyses are performed in our AIHA proficiency-tested laboratory under the FDA Good Laboratory Practice Guidelines and the parameters outlined in the most current version of the American Conference of Governmental Industrial Hygienists Bioaerosol Guidelines. The data generated in this report is based on the samples and accompanying information provided. Aerotech employees did not collect samples for this project, and may provide limited interpretation of this data as it relates to the overall investigation.

Quality Assurance

Aerotech is staffed by certified microbiologists, maintains a rigorous Quality Assurance program and participates in the American Industrial Hygiene Association's Environmental Microbiology Proficiency Testing Program. Our AIHA EMPAT Number is 102297. Aerotech is extremely proud of its excellent scoring in this program and will provide copies of our results upon request. They can also be downloaded from our web site at www.aerotechlabs.com. Below you will find additional information regarding the specific analyses requested for this project.

A001, A002, WC001

Air-O-Cell Cassette

The Air-O-Cell Cassette is a unique sampling device designed for the rapid collection and analysis of a wide range of airborne particles, including fungal spores. Samples are analyzed via light microscopy at 600X magnification, with the entire slide (100% of the sample) being analyzed. The results are reported as **total**, meaning they include both viable and non-viable fungal spores. Unfortunately, this technique does not allow for the differentiation between *Aspergillus* and *Penicillium* spores. Small (~1-3 μ) spherical fungal spores that cannot be identified and may include *Aspergillus*, *Penicillium*, and *Trichoderma* and others are grouped together as *Amerospores*. Additionally it does not allow for cultivation or speciation of spores. Slides containing greater than 500 fungal spores are difficult to count accurately due to overcrowding and are therefore estimations. Similarly, excessive non-microbial particulates can mask the presence of fungal spores, thereby reducing counting accuracies. All slides are graded with the following debris scale for data qualification.

Debris Rating Scale

Non-Microbial Particulate Debris Rating	Description	Interpretation
0	No particles detected	No particulates in on slide. The absence of particulates could indicate improper sampling, as most air samples typically contain some particulates
1	Minimal non-microbial debris present.	Reported values are not affected by debris.
2	Up to 25% of the slide occluded with non-microbial particulates.	Non-microbial particulates can mask the presence of fungal spores. As a result, actual values could be up to 1.3 times higher than reported.
3	26% to 75% of the slide occluded with non-microbial particulates.	Non-microbial particulates can mask the presence of fungal spores. As a result, actual values could be up to 1.4 to 4 times higher than reported
4	76% to 90% of the slide occluded with non-microbial particulates.	Non-microbial particulates can mask the presence of fungal spores. As a result, actual values could be up to 4 to 10 times higher than reported.
5	Greater than 90% of the slide occluded with non-microbial particulates.	Quantification not possible. Resamples should be collected at shorter time interval, or other measures taken to reduce the collection of non-microbial debris.

A003, A004, A005, A006, B002, B003, B004, B007, CC002, CC003, CC004, CC005, S002, S003, S004, S007
W001, W002, W003, W004

Culture Analyses for Fungi and Bacteria

Cultureable microorganisms are those that are viable when media is inoculated, and will grow on the selected media and at the selected temperature. This technique has certain limitations when analyzing for certain types of fungi, specifically *Stachybotrys*. Some reports indicate that the recovery efficiency of *Stachybotrys* spores can be as low as 10% when compared to total spore techniques.

The type of media and incubation temperature can vary depending on the scope of the survey. Isolates are identified to the service level requested. Typical analysis includes identification of most fungi to the genus level. *Aspergillus* and *Penicillium* species are differentiated based on morphology with each variant reported separately. Identification to the species level can be performed if requested in advance. General incubation parameters are summarized below. Incubation times can vary depending on specific growth characteristics. Samples submitted for culture analysis using Cornmeal Agar (CMA) or Cellulose Agar are cultured for 14 days.

Test	Incubation Temperature (° C)	Incubation Time
Environmental Bacteria	28	48 hours
Total Fungi	20-25	7-10 days
Thermophilic fungi	37	7-10 days
Thermophilic Actinomycetes	50	48 hours

Common Culture Media

Acronym	Name
BAP	Tryptic Soy Agar with 5% Sheep Blood
PCA	Plate Count Agar
R2A	R2A
BCYE	Buffered Charcoal Yeast Extract Agar
PDA	Potato Dextrose Agar
MEA	Malt Extract Agar
DG-18	Dichloran Glycerol Agar
SAB	Sabauroud's Dextrose Agar
RBA	Rose Bengal Agar
CYA	Czapeck's Yeast Agar

A010, A010.1, B013

Volatile Organic Compounds (VOC's)

Analysis for VOC's includes the EPA T015 method, utilizing a gas chromatograph (GC) coupled to a mass spectrometer (MS). This method includes quantification of 63 compounds. Tentatively identified compounds (TIC's) can also be identified and their concentrations estimated by performing a compound library search of over 100,000 compounds. Results are reported in parts per billion on a volume basis (ppbv).

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For additional information, or if you have any questions regarding this report, please do not hesitate to call.

Sincerely,

Ruth Skinner
Project Manager
Aerotech Laboratories, Inc.
800-651-4802

Analytical References

1. Medically Important Fungi: A Guide to Identification, 3rd ed., ASM, 1995.
2. Standard Methods for the Examination of Water and Wastewater, 19th ed., APHA, 1995.
3. Sampling and Identifying Allergenic Pollens and Molds, Blewstone, 1990.
4. Identifying Filamentous Fungi: A Clinical Laboratory Handbook, Star, 1996.
5. Manual of Clinical Microbiology, 7th ed., ASM, 1999.
6. A Laboratory Guide to Common *Aspergillus* Species and their Teleomorphs, CSIRO, 1994.
7. Bioaerosols: Assessment and Control, ACGIH, 1999.



AEROTECH LABORATORIES, INC.

September 24, 2001

David Anderson
AESI
1112 Charleston Court
Keller, TX 76248
TEL: (817) 379-6968
FAX (817) 337-0615

RE: WNY/0880A (197)

Order No.: 0109169

Dear David Anderson:

Precision Analytical Laboratories, Inc. received 3 samples on 9/7/2001 for the analyses presented in the following report.

This report includes the following information:

- Case Narrative.
- Analytical Report: includes test results, report limit (Limit), any applicable data qualifier (Qual), units, dilution factor (DF), and date analyzed.
- QC Summary Report.

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Sincerely,

Ruth Skinner 
Project Manager

CC:



AEROTECH LABORATORIES, INC.

Date: 11/15/00

CLIENT: AESI
Project: WNY/0880A (197)
Lab Order: 0109169

CASE NARRATIVE

Data Qualifiers:

Listed below are data qualifiers which may be used in your analytical report to explain any analytical or quality control issues. If one or more of the following data qualifiers is associated with your analytical or quality control data it will be noted in your report under the column header "QUAL". Any quality control deficiencies that cannot be adequately described by these qualifiers will be addressed in the analytical comments section of this case narrative.

R4 RPD exceeded the method control limit. Recovery met acceptance criteria.

All analyses included in this report were performed by Precision Analytical Laboratories, Inc. (PAL), 1725 W. 17th Street, Tempe, Arizona (ADHS certification no. AZ0610, California 2410).

PAL participates in the AIHA Proficiency Analytical Testing (PAT) program for metals, solvents, and formaldehyde.

Samples were analyzed using methods outlined in references such as:

Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW846, 3rd Edition.

NIOSH Manual of Analytical Methods, Fourth Edition, 1994. NIOSH Method 7300 analyses are performed using a modified digestion procedure to eliminate the use of perchloric acid. NIOSH Methods 1501 and 1003 are modified to incorporate the use of a mass spectrometer detector instead of FID.

Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, Second Edition, 1999.

Analytical Comments:

All method blanks and laboratory control spikes met EPA method and/or laboratory quality control objectives for the analyses included in this report.

Sample results have not been corrected for blank values.

If any additional non-target peaks were found for the Method TO-15 analysis, the number of non-target peaks found and the approximate concentration range will be included at the end of the analytical report, designated with a "T" qualifier. If requested, the laboratory can perform a forward library search for the non-target peaks found to provide additional information about the chemical composition and



AEROTECH LABORATORIES, INC.

CLIENT: AESI

Project: WNY/0880A (197)

Lab Order: 0109169

CASE NARRATIVE

estimated concentration of the additional peaks. Please contact your project manager for more information.

September 27



AEROTECH LABORATORIES, INC.

Lab Number: A-109-4273
 Project Name: WNK
 Project Number: 0983-197
 Date Received: 09/29/01
 Date Reported: 10/01/01

AESI
 1112 Charleston Ct.
 Keller, TX 76248
 Attn: David Anderson

AIHA Empat No. 102297
Microscopic Screen and Fungi Identification
 Aerotech Method: S001

Lab Number	1	2
Sample Identification	5th Floor SW 1170	5th Floor SE Corner
Date Analyzed	09/30/2001	09/30/2001
Mycelial Fragments	Results 1-5%	Results 1-5%
Fungal Spores	5-25%	5-25%
	Fungal Spore Identification	Fungal Spore Identification
<i>Alternaria</i>	5-25%	
Amerospores		
<i>Arthrinium</i>		
Ascospores		
<i>Aspergillus/Penicillium</i>		
<i>Aureobasidium</i>		
Basidiospores		
<i>Bipolaris/Dreschlera</i>		
<i>Botrytis</i>		
<i>Chaetomium</i>		
<i>Cladosporium</i>		
<i>Curvularia</i>		
<i>Epicoccum</i>		
<i>Fusarium</i>		
<i>Nigrospora</i>		
<i>Oidium/Peronospora</i>		
<i>Pithomyces/Utiocladium</i>		
Rusts		
<i>Smuts/Myxomycetes</i>		
<i>Stachybotrys</i>		5-25%
<i>Stemphylium</i>		
<i>Torula</i>		
Unidentified Conidia		
Notes:		



AEROTECH LABORATORIES, INC.

Lab Number: A-109-0688
 Project Name: NYW
 Project Number: 0880 S
 Date Received: 09/07/01
 Date Reported: 09/11/01

AIHA Empat No. 102297
 Air-O-Cell Cassette Analysis
 Aerotech Method: A001

AESI
 1112 Charleston Ct.
 Keller, TX 76248
 Attn: David Anderson

Lab Number	1			4			7			
	Sample Identification	0879 1W3091 C119	0896 Sub Floor	0896 Out	Volume (M ³)	0.0750	0.0750	0.0300	Date Analyzed	09/10/2001
Percent Of Trace Analyzed	100% of Trace at 600X Magnification			100% of Trace at 600X Magnification			100% of Trace at 600X Magnification			
Debris Rating	2			2			3			
Mycelial Fragments	Count/M ³		%	Count/M ³		%	Count/M ³		%	
	Total Count	Result		Detection Limit	Total Count		Result	Detection Limit		Total Count
Pollen Count	<1	<13	n/a	<1	<13	n/a	2	67	33	n/a
Total Fungal Spores	<1	<13	n/a	<1	<13	n/a	<1	<33	33	n/a
Total Fungal Spores	29	387	100	17	227	100	45	1,500	33	100
Fungal Spore Identification										
<i>Alternaria</i>	1	13	13	3						
Amerospores	28	373	13	97			23	767	33	51
<i>Arthrinium</i>										
Ascospores							7	233	33	16
<i>Aspergillus/Penicillium</i>										
<i>Aureobasidium</i>										
Basidiospores							4	133	33	9
<i>Bipolaris/Dreschlera</i>										
<i>Botrytis</i>										
<i>Chaetomium</i>										
<i>Cladosporium</i>										
<i>Curvularia</i>										
<i>Epicoccum</i>										
<i>Fusarium</i>										
<i>Nigrospora</i>										
<i>Oldium/Peronospora</i>										
<i>Pithomyces/Ulocladium</i>										
Rusts										
<i>Smuts/Myxomycetes</i>										
<i>Stachybotrys</i>										
<i>Stemphylium</i>										
<i>Torula</i>										
Unidentified Conidia							11	367	33	24
Notes:										

Technical Review: [Signature]
 Final Review: [Signature]

Prepared By: AB
 CS Review: JB



AEROTECH LABORATORIES, INC.

AESI
 1112 Charleston Ct.
 Keller, TX 76248
 Attn: David Anderson

AIHA Empat No. 102297
Viable Fungi Analysis - Air
 Aerotech Method: A003

Lab Number: A-109-0688
 Project Name: NYW
 Project Number: 0880 S
 Date Received: 09/07/01
 Date Reported: 09/21/01

Sample Identification	2				5				8			
	Petri 0879 1W3091 1119				Petri 0886 Sub Floor				Petri 0896 Out			
	CFU	Result	Detection Limit	%	CFU	Result	Detection Limit	%	CFU	Result	Detection Limit	%
Viable Fungi 20-25°C	7	47	7	100	4	27	7	100	52	929	18	100
<i>Acromonium</i>												
<i>Alternaria</i>												
<i>Aspergillus fumigatus</i>												
<i>Aspergillus niger</i>												
<i>Aspergillus species Var. 1</i>	2	13	7	29	2	13	7	50				
<i>Aspergillus species Var. 2</i>												
<i>Aureobasidium</i>												
<i>Bipolaris</i>												
<i>Chaetomium</i>												
<i>Chrysosporium</i>												
<i>Cladosporium</i>	1	7	7	14	2	13	7	50	37	661	18	71
<i>Cunninghamella</i>												
<i>Curvularia</i>	1	7	7	14								
<i>Epicoccum</i>												
<i>Fusarium</i>												
<i>Geotrichum</i>												
<i>Mucor</i>									2	36	18	4
<i>Mycelia sterilia</i>												
<i>Nigrospora</i>												
<i>Paecilomyces</i>									1	18	18	2
<i>Penicillium species Var. 1</i>	1	7	7	14								
<i>Penicillium species Var. 2</i>									12	214	18	23
<i>Phoma</i>												
<i>Rhizopus</i>												
<i>Sporotrichum</i>												
<i>Stachybotrys</i>												
<i>Stemphylium</i>												
<i>Trichoderma</i>												
<i>Ulocladium</i>												
<i>Yeast</i>	2	13	7	29								

Notes:

Prepared By: *SP*
 CS Review: *SP*



AEROTECH LABORATORIES, INC.

Monday, October 01, 2001

David Anderson
AESI
1112 Charleston Ct.
Keller, TX 76248

Re: Aerotech Project Number A-109-4273

Dear David :

Aerotech is pleased to provide the enclosed report of analyses for samples submitted Saturday, September 29, 2001. This cover letter and accompanying pages are an integral part of this report. All analyses are performed in our AIHA proficiency-tested laboratory under the FDA Good Laboratory Practice Guidelines and the parameters outlined in the most current version of the American Conference of Governmental Industrial Hygienists Bioaerosol Guidelines. The data generated in this report is based on the samples and accompanying information provided. Aerotech employees did not collect samples for this project, and may provide limited interpretation of this data as it relates to the overall investigation.

Quality Assurance

Aerotech is staffed by certified microbiologists, maintains a rigorous Quality Assurance program and participates in the American Industrial Hygiene Association's Environmental Microbiology Proficiency Testing Program. Our AIHA EMPAT Number is 102297. Aerotech is extremely proud of its excellent scoring in this program and will provide copies of our results upon request. They can also be downloaded from our web site at www.aerotechlabs.com. Below you will find additional information regarding the specific analyses requested for this project.

B001: S001

Microscopic Screen

A microscopic screen is a rapid analytical technique for confirming the presence and identity of fungi on a surface. The results are expressed as a total count of the fungal spores per sample matrix unit. Samples are analyzed via light microscopy at 600X magnification. The results are reported as **total**, meaning they include both viable and non-viable fungal spores. Unfortunately, this technique does not allow for the differentiation between *Aspergillus* and *Penicillium* spores. Small (~1-3µ) spherical fungal spores that cannot be identified and may include *Aspergillus*, *Penicillium*, and *Trichoderma* are grouped together as *Amerospores*. Additionally this analysis does not allow for cultivation or speciation of spores.

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For additional information, or if you have any questions regarding this report, please do not hesitate to call.

Sincerely,

Ruth Skinner
Project Manager
Aerotech Laboratories, Inc.
800-651-4802

Analytical References

1. Medically Important Fungi: A Guide to Identification, 3rd ed., ASM, 1995.
2. Standard Methods for the Examination of Water and Wastewater, 19th ed., APHA, 1995.
3. Sampling and Identifying Allergenic Pollens and Molds, Blewstone, 1990.
4. Identifying Filamentous Fungi: A Clinical Laboratory Handbook, Star, 1996.
5. Manual of Clinical Microbiology, 7th ed., ASM, 1999.
6. A Laboratory Guide to Common *Aspergillus* Species and their Teleomorphs, CSIRO, 1994.
7. Bioaerosols: Assessment and Control, ACGIH, 1999.

Appendix C

Fungal Glossary

FUNGAL GLOSSARY

Acronium sp. (Cephalosporium sp.) - Reported to be allergenic. Can produce a trichothecene toxin that is toxic if ingested. It was the primary fungus identified in at least two houses where the occupant complaints were nausea, vomiting and diarrhea. The asexual state of *Emericellopsis sp.*, *Chaetomium sp.*, and *Nectriopsis sp.*, it can produce mycetomas, infections of the cornea and nails.

Alternaria sp. - Conidia dimensions 18-83 x 7-18 microns. A very common allergen with an IgE mediated response. It is often found in carpets, textiles, and on horizontal surfaces in building interiors. Often found on window frames. Outdoors it may be isolated from samples of soil, seeds and plants. It is commonly found in outdoor samples. The large spore size 20 - 200 microns in length and 7 - 18 microns in sizes, suggests that the spores from this fungi will deposited in the nose, mouth and upper respiratory tract. It may be related to "Baker's Asthma." It has been associated with hypersensitivity pneumonitis. The species *Alternaria alternata* is capable of producing tenuazonic acid and other toxic metabolites, which may be associated with disease in humans or animals. Common cause of extrinsic asthma (immediate-type hypersensitivity: type I). Acute symptoms include edema and bronchospasms; chronic cases may develop pulmonary emphysema.

Aspergillus flavus - Conidia dimensions 3-6 microns. It grows on moldy corn and peanuts. It can be found in warm soil, foods and dairy products. Some strains are capable of producing a group of mycotoxins - in the aflatoxin group. Aflatoxins are known animal carcinogen. There is limited evidence to suggest that this toxin is a human carcinogen. The toxin is a poisonous to humans by ingestion. It may also result in occupational disease via inhalation. Experiments have indicated that it is teratogenic and mutagenic. It is toxic to the liver. It is reported to be allergenic. Its presence is associated with reports of asthma. It can be found in water-damaged carpets. The production of the fungal toxin is dependent on the growth conditions and on the substrate used as a food source. This fungus is associated with aspergillosis of the lungs and/or disseminated aspergillosis. This fungus is occasionally identified as the cause of corneal, otomycotic and naso-orbital infections.

Aspergillus fumigatus - Conidia dimensions 2-3.5 microns. Major cause of aspergillosis. This organism causes both invasive and allergic aspergillosis. Aspergillosis affects individuals who are immune compromised. It is considered a human pathogen. It grows well at 35 °C. It is commonly found outdoors in compost piles with temperatures higher than 40 °C, in mild to warm soils and on cereals.

Aspergillus nidulans - Conidia dimensions 2-4 microns. Found in mild to warm soils and on slowly decaying plants. Can produce the mycotoxin sterigmatocystin. This toxin has been shown to produce liver and kidney damage in lab animals. This fungus is associated with aspergillosis of the lungs and/or disseminated aspergillosis. This species is only occasionally pathogenic.

Aspergillus niger - Conidia dimensions 3.5 - 5 microns or 4 to 5 microns. Less common cause of aspergillosis. It has a musty odor. It is commonly found in the environment on textiles, in soils, grains, fruits and vegetables. It has been reported to cause skin and pulmonary infections. It is a common cause of fungal related ear infections-otomycosis.

Aspergillus sp. - Reported to be allergenic. Members of this genus are reported to cause ear infections. Many species produce mycotoxins, which may be associated with disease in humans and other animals. Toxin production is dependent on the species or a strain within a species and on the food source for the fungus. Some of these toxins have been found to be carcinogenic in animal species. Several toxins are considered potential human carcinogens. Common cause of extrinsic asthma (immediate-type hypersensitivity: type I). Acute symptoms include edema and bronchospasms; chronic cases may develop pulmonary emphysema.

Aspergillus versicolor -Conidia dimensions 2-3.5 microns. It is commonly found in soil, hay, cotton and dairy products, it can produce a mycotoxin sterigmatocystin and cyclopiaxonic acid. These toxins can cause diarrhea and upset stomach. It is reported to be a kidney and liver carcinogen. This species is only occasionally pathogenic.

Basidiomycetes - Fungal spores that are from mushrooms. The specific mushroom species cannot be identified on the culture plate. Many mushroom spores are reported to be allergenic.

Bipolaris sp. - A fungus with large spores that would be expected to be deposited in the upper respiratory tract. This fungus can produce the mycotoxin - sterigmatocystin that has been shown to produce liver and kidney damage when ingested by laboratory animals.

Blastomyces sp. - Human pathogen. The fungus is commonly found in soil. It is a dimorphic fungus, which has filamentous fungus when grown at 25 ° C, and a yeast form at 37 ° C.

Botrytis sp. - Conidia dimensions 7-14 x 5-9 microns. Found in soil and vegetables. Possibly associated with allergic symptoms (skin tests)

Chaetomium sp. - Large ascomycetous fungus producing perithecia. It is found on a variety of substrates containing cellulose including paper and plant compost. It has been found on paper in sheetrock. It is reported to be allergenic. Can produce an *Acremonium*-like state on fungal media.

Cladosporium sp. (Hormodendrum sp.) - Most commonly identified outdoor fungus. The outdoor numbers are reduced in the winter. The numbers are often high in the summer. Often found indoors in numbers less than outdoor numbers. It is a common allergen. Indoor Cladosporium sp. may be different than the species identified outdoors. It is commonly found on the surface of fiberglass duct liner in the interior of supply ducts. A wide variety of plants are food sources for this fungus. It is found on dead plants, woody plants, food, straw, soil, paint and textiles. It can cause mycosis. Produces greater than 10 antigens. Antigens in commercial extracts are of variable quality and may degrade within weeks of preparation. Common cause of extrinsic asthma (immediate-type hypersensitivity: type I). Acute symptoms include edema and bronchospasms; chronic cases may develop pulmonary emphysema.

Cunninghamella sp. - Can cause disseminated and pulmonary infections in immune compromised hosts.

Curvularia sp. - Reported to be allergenic. It may cause corneal infections, mycetoma and infections in immune compromised hosts.

Dreschlera sp. - Conidia dimensions 40-120 x 17-28 microns. Found on grasses, grains and decaying food. It can occasionally cause a corneal infection of the eye.

Epicoccum sp. - Conidia dimensions 15-25 microns. A common allergen, it is found in plants, soil, grains, textiles and paper products.

Fusarium sp. - A common soil fungus. It is found on a wide range of plants. It is often found in humidifiers. Several species in this genus can produce potent trichothecene toxins. The trichothecene (scirpene) toxin targets the following systems: circulatory, alimentary, skin and nervous. Produces vomitoxin on grains during unusually damp growing conditions. Symptoms may occur either through ingestion of contaminated grains or possibly inhalation of spores. The genera can produce hemorrhagic syndrome in humans (alimentary toxic aleukia). Nausea, vomiting, diarrhea, dermatitis, and extensive internal bleeding characterize this. Reported to be allergenic. Frequently involved in eye, skin and nail infections.

Geotrichum sp. - Conidia dimensions 6-12 x 3-6 microns. A common contaminant of grains, fruits, dairy products, paper, textiles, soil and water, and often present as part of the normal human flora. The species *Geotrichum candidum* can cause a secondary infection (geotrichosis) in association with tuberculosis. This rare disease can cause lesions of the skin, bronchi, mouth, lung and intestine.

Gliocladium sp. - A fungus, which is structurally similar to *Penicillium sp.* It is reported to be allergenic.

Monilia sp. - Reported to be allergenic. This fungus produces soft rot of tree fruits. Other members produce a red bread mold. It is infrequently involved in corneal eye infections.

Mucor sp. - Often found in soil, dead plant material, horse dung, fruits and fruit juice. It is also found in leather, meat, dairy products, animal hair and jute. A *Zygomycetes* fungus that may be allergenic (skin and bronchial tests). This organism and other *Zygomycetes* will grow rapidly on most fungal media. May cause mucorosis in immune compromised individuals. The sites of infection are the lung, nasal sinus, brain, eye and skin. Infection may have multiple sites.

Paecilomyces sp. - Commonly found in soil and dust, less frequently in air. *P. variotii* can cause paecilomycosis. Linked to wood-trimmers disease and humidifier associated illnesses. They are reported to be allergenic. Some members of this genus are reported to cause pneumonia. It may produce arsine gas if growing on arsenic substrate, which can occur on wallpapers covered with Paris green.

Penicillium sp. - A wide number of organisms have been placed in this genus. Identification to species is difficult. Often found in aerosol samples. Commonly found in soil, food, cellulose and grains. It is also found in paint and compost piles. It may cause hypersensitivity pneumonitis, allergic alveolitis in susceptible individuals. It is reported to be allergenic (skin). It is commonly found in carpet, wallpaper, and in interior fiberglass duct insulation. Some species can produce mycotoxins. Common cause of extrinsic asthma (immediate-type hypersensitivity: type I). Acute symptoms include edema and bronchospasms; chronic cases may develop pulmonary emphysema.

Phoma sp. - A common indoor air allergen. It is similar to the early stages of growth of *Chaetomium sp.* The species are isolated from soil and associated plants (particularly potatoes). Produces pink and purple spots on painted walls. It may have antigens that cross-react with those of *Alternaria sp.* It will grow on butter, paint cement and rubber. It may cause phaeoerythromycosis a systematic or subcutaneous disease.

Rhizomucor sp. - The *Zygomycetous* fungus is reported to be allergenic. It may cause mucorosis in immune compromised individuals. It occupies a biological niche similar to *Mucor sp.* It is often linked to occupational allergy. May cause mucorosis in immune compromised individuals. The sites of infection are the lung, nasal sinus, brain, eye and skin. Infection may have multiple sites.

Rhizopus sp. - The *Zygomycetous* fungus is reported to be allergenic. It may cause mucorosis in immune compromised individuals. It occupies a biological niche similar to *Mucor sp.* It is often linked to occupational allergy. May cause mucorosis in immune compromised individuals. The sites of infection are the lung, nasal sinus, brain, eye and skin. Infection may have multiple sites.

Sporotrichum sp. - Reported to be allergenic. See also *Sporothrix sp.* there is some taxonomic confusion between these two genera. This genera does not cause sporotrichosis.

Stachybotrys sp. - Several strains of this fungus (*S. atra*, *S. chartarum* and *S. alternans* are synonymous) may produce a trichothecene mycotoxin- Satratoxin H - which is a poisonous by inhalation. The toxins are present on the fungal spores. This is a slow growing fungus on media. It does not compete well with other rapidly growing fungi. The dark colored fungi grows on building material with high cellulose content and low nitrogen content. Areas with relative humidities above 55% and are subject to temperature fluctuations are ideal for toxin production.

Individuals with chronic exposure to the toxin produced by this fungus reported cold and flu symptoms, sore throats, diarrhea, headaches, fatigue, dermatitis, intermittent local hair loss and generalized malaise. The toxins produced by this fungus will suppress the immune system affecting the lymphoid tissue and the bone marrow. Animals injected with the toxin from this fungus exhibited the following symptoms, necrosis and hemorrhage within the brain, thymus, spleen, intestine, lung, heart, lymph node, liver, and kidney. Affects by absorption of the toxin in the human lung are known as pneumomycosis.

This organism is rarely found in outdoor samples. It is usually difficult to find in indoor air samples unless it is physically disturbed or if there is (speculation- a drop in the relative humidity). The spores are in a gelatinous mass. Appropriate media for the growth of this organism will have high cellulose content and low nitrogen content. The spores will die readily after release. The dead spores are still allergenic and toxic. Percutaneous absorption has caused mild symptoms.

Stemphylium sp. - Reported to be allergenic. Isolated from dead plants and cellulose materials.

Trichoderma sp. - It is commonly found in soil, dead trees, pine needles, paper, and unglazed ceramics. It often will grow on other fungi. It produces antibiotics that are toxic to humans. It has been reported to be allergenic. It readily degrades cellulose.

Trichothecium sp. - Conidia dimensions 12-23 x 8-10 microns. Found in decomposing vegetation, soil, corn seeds and in flour. The species *Trichothecium roseum* can produce a trichothecene toxin that may be associated with disease in humans and other animals. Reported to be allergenic.

Ulocladium sp. - Isolated from dead plants and cellulose materials. Found on textiles.

Yeast - Various yeasts are commonly identified on air samples. Some yeasts are reported to be allergenic. They may cause problems if a person has had previous exposure and developed hypersensitivity's. Yeasts may be allergenic to susceptible individuals when present in sufficient concentrations.

(Adapted from University of Minnesota, © 12/00 AESI)

Appendix D

Selected Pictures



