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Indoor Air Quality Screening
At

Scarsdale UFSD

Greenacres School
41 Huntington Avenue
Scarsdale, NY 10583

RegCom's Project Numbers
SUFSD.1087.17.IAQ
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ABSTRACT

The Scarsdale UFSD retained Regulatory Compliance to conduct an indoor air quality (IAQ) at the Greenacres School, due to staff complaints about a possible indoor air quality concern, the District has decided to take a proactive approach and conduct an indoor air quality to determine the health status of the affected areas.

An IAQ involves the use of detector tubes/grab samples to determine if further investigation is warranted. The detector tubes are accurate enough to determine the hazards in the workplace. Detector tube pump systems are very effective way to conduct on-the-spot air monitoring and meet the OSHA requirement of 25% error.

Samples were collected in pre-identified areas in the building. The organisms identified in the majority of the indoor air samples collected are typically those found in the air from the exterior of the building and no action is required.

The non-classroom side of the basement had a MoldSCORE that ranged from 104 - 300. A MoldSCORE rating greater than 150 indicates a moderate probability that the spores originated from inside the building and greater than 250 indicates a high probability. The MoldSCORE along with visual observations have concluded that fungal growth has occurred in the basement boiler room.

The organisms identified in the indoor air samples collected in the Psychologist Office, classroom 7A and room 9, had a MoldSCORE range from164 - 204, consisting of Smuts, Periconia and Myxomycetes, which are typically outdoor organism/plant pathogens. The MoldSCORE for these classrooms is an artificiality and can occur when specific spore types are high outdoors and infiltrate into a building on a certain day (as does pollen) but remain indoors and then exceed outdoor levels that have subsequently decreased. This can be and is commonly seen with obligate plant parasites, such as rust fungi or tree pathogens that never colonize indoor spaces, yet can occur indoors in excess of outdoor levels on given days. Therefore, the organisms identified in the indoor air samples are those found in the air from the exterior of the building and no action is required.

The organism identified in classroom 2B, classroom 22, classroom 35 and the Teacher's Lounge had a MoldScore range from 191 – 250, which indicates that there is a moderate probability that the spores originated inside the classrooms. Mold growth was visually identified in the Teacher's Lounge, beneath the contact paper in the cabinet beneath the sink.

Bioaerosol sampling only represents a snap shot in time and the "true" average concentration of microorganisms may differ.

Molds are part of the natural environment, and can be found everywhere, indoors and outdoors. They are found in schools, homes, hospitals, industry etc. Outdoors, molds play a part in nature by breaking down dead organic matter such as fallen leaves and dead trees. It is impossible to get rid of all mold and mold spores indoors; some mold spores will be found floating through the air and in house/school dust. However, mold is not usually a problem, unless it begins growing indoors and not appropriately corrected. Mold exposure can irritate the eyes, skin, nose, throat, and lungs of both mold-allergic and non-allergic people. Symptoms other than the allergic and irritant types are not commonly reported as a result of inhaling mold. The bioaerosol results for Greenacres School are typical of findings that RegCom has identified in other public schools, hospitals etc. over the past 20 years. Greenacres school has a few isolated areas that need attention or further investigation if recommended actions fail to correct the situation.

The average concentration for nuisance dust, formaldehyde, ozone, nitrogen dioxide carbon monoxide, carbon dioxide and total petroleum hydrocarbons were below or equal to the outside sample.

It is recommended for the basement (non-classroom areas) that the school inspect, discard suspected moldy contaminated material, clean and disinfect the area, clean the courtyard basement stairwell, install dehumidifiers (if humidity levels remain elevated), and ventilate the basement.

For the four (4) areas, classroom 2B, 35, 22 and the Teacher's Lounge had a MoldScore above 150 and it is recommended that the school clean and disinfect all surfaces, clean and disinfect the areas beneath the sinks and remove any contact paper, replace any damaged/stained ceiling tiles, clean and disinfect window air conditioning units. Inspect and ensure that the unit ventilators are clean and that filters changed periodically. There are other recommendations included in the report.

None of the information contained herein should be construed as medical advice. Only a qualified physician should make any decision relative to medical significance.

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1.0 INTRODUCTION

The Scarsdale UFSD retained Regulatory Compliance to conduct an indoor air quality (IAQ) at the Greenacres School, due to staff complaints about a possible indoor air quality concern, the District has decided to take a proactive approach and conduct an indoor air quality to determine the health status of the affected areas.

An IAQ involves the use of detector tubes/grab samples to determine if further investigation is warranted. The detector tubes are accurate enough to determine the hazards in the workplace. Detector tube pump systems are very effective way to conduct on-the-spot air monitoring and meet the OSHA requirement of 25% error.

Environmental Conditions (10/11/17): 71 ^{0}F and 63% RH. Precipitation event: None
Environmental Conditions (10/28/17): 58 ^{0}F and 51% RH. Precipitation event: Rain

A baseline IAQ was conducted to determine if the concerns were related to the environment of the building. The investigation consisted of the following:

- Carbon monoxide (CO)
- Carbon dioxide (CO_2)
- Nitrogen dioxide (NO_2)
- Ozone (O_3)
- Formaldehyde (CHO)
- Total Petroleum Hydrocarbons (TPH)
- Biological sampling
- Temperature (T)
- Total nuisance dust
- Relative humidity (RH)

1.1 REASON FOR CHOOSING THE SAMPLING PARAMETERS

1.1.1 Carbon monoxide (CO): is an odorless, colorless gas that interferes with the delivery of oxygen in the blood to the rest of the body. It is produced by the incomplete combustion of fuels. The major sources of CO are cigarettes, motor vehicles, and defective combustion equipment such as furnaces, boilers and hot water heaters. Problems can arise from improper installation, maintenance and inadequate ventilation.

1.1.2 Carbon dioxide (CO_2): in the ranges encountered in the indoor environment does not constitute a health hazard. Carbon dioxide is a normal constituent of exhaled breath and, if monitored, can be used as a screening technique to evaluate whether adequate quantities of outside air (OA) is being introduced into the building. As carbon dioxide levels rise, it indicates that the ventilating system is malfunctioning or the design occupancy of the room is being exceeded. When this happens, a buildup up of common indoor air pollutants can occur, leading to discomfort or health complaints. Inadequate ventilation is a major cause of health complaints such as, respiratory, eye, nose, and throat irritation, lethargy and headaches.

1.1.3 Nitrogen Dioxide (NO_2) is a combustion product from furnaces, motor vehicles, welding and combustion equipment. NO_2 is a colorless, gas that can cause headaches, nausea, dizziness, vomiting, coughing and irritation of the respiratory tract, shortness of breath, and increased incidences of respiratory illness. Children and individuals with asthma and other respiratory illness are at greater risk from exposure to nitrogen oxides.

1.1.4 Ozone (O_3) is a pollutant from automobile pollutant and sunlight, lighting, electronic equipment, electrostatic air cleaners and copy machines. Ozone can be irritating to the eyes, mucous membranes and cause upper respiratory tract irritation.

1.1.5 Formaldehyde (HCHO) is a colorless, organic compound of carbon, hydrogen and oxygen having the formula HCHO. It is used extensively in industry in the production of synthetic urea and urea-formaldehyde resins, which themselves are widely used as adhesives in making particle board, laminates, plywood and other wood products. Many adhesives and glues also contain this compound, including some used for carpets and wallpaper coverings, and other widely used product-containing formaldehyde is urea-formaldehyde foam insulation. Formaldehyde is also used as a flame retardant for fabrics. Other sources include bulked stored paper products, some cosmetic products, combustion processes including smoking, and atmospheric photochemical smog. The potential for formaldehyde products to be present in the building air is considerable. The main concern is the potential for “out-gassing.” Airborne formaldehyde can cause irritation to the eyes nose, throat, and the respiratory tract. Prolonged exposure can cause sanitization and/or allergic reactions.

1.1.6 Total Petroleum Hydrocarbons (TPH) is a term used to describe a large family of several hundred chemical compounds that originally come from crude oil. Crude oil is used to make petroleum products, which can contaminate the environment. Because there are so many different chemicals in crude oil and in other petroleum products (Tar from roofing compounds), it is not practical to measure each one separately. However, it is useful to measure the total amount of TPH at a site. Most people can withstand short exposures to fuel oil vapors without any problems. However, breathing fuel oil vapors overtime can affect a person's ability to smell and taste. High levels can cause headaches, nausea, light-headedness, poor coordination, increased blood pressure and difficulty concentrating. Most people can smell oil vapors at levels as low as 0.1 parts per million (ppm) in air.

1.1.7 Total Nuisance Dust is the amount of dust found in the air and the health hazards include itching and irritation to the skin and upper respiratory system, respiratory infection, and aggravation of existing respiratory or cardiovascular disease in elevated levels.

1.1.8 Temperature (T) and Relative Humidity (RH) are considered thermal comfort variables and should not be overlooked. The majority of indoor air quality (IAQ) complaints are related to these 2 parameters. Furthermore, temperature and humidity are variables that affect other indoor air contaminates. American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) has published guidelines describing thermal environmental conditions (ASHRAE Standard 55-1992, Thermal Environmental Conditions for Human Occupancy). These guidelines are intended to achieve thermal conditions in a given environment that at least 80% of the persons who occupy that environment will find acceptable or "comfortable." Temperature and humidity are comfort parameters that have been cited as the source of over 35% of indoor air quality complaints. Dry air can affect the human body by causing respiratory ailments such as asthma, bronchitis, sinusitis, and nosebleeds, or general dehydration since the body fluids are depleted during respiration. Skin moisture evaporation can cause skin irritations and eye itching and the "apparent temperature" of the air is lower than what the thermometer indicates and the body "feels" colder.

1.1.9 Bioaerosols are airborne particles, large molecules, or volatile compounds that are living or were released from a living organism. The concern regarding the indoor environments is centered on fungi. Fungi are ubiquitous organisms that can be found in indoor environments wherever food and moisture conditions are conducive to their growth. The microorganisms found in outdoor air grow on moist surfaces of leaves and soils; these organisms infiltrate into the indoor environment or may be transported into the building by people. Thus, fungi and bacteria are commonly found in indoor air and on the surfaces of floor, wall, and ceiling systems or on surfaces in air-handling equipment. When mold spores are present in large numbers, they can cause allergic reactions, asthma episodes, infections and other respiratory problems. Although proof of the connection between specific exposures and symptoms is often impossible to obtain, it is possible to demonstrate bioaerosol reservoirs, amplifiers, and disseminators during the inspection.

1.1.10 Individual susceptibility, the aforementioned factors do not affect all people equally: susceptibility varies with a range of factors such as atopy (predisposition to allergic sensitization), prior exposure, stress and gender. In some cases, the basis of the relationship is not clear.

1.2 SAMPLING METHODOLOGY

Temperature and humidity were measured using the EXTECH Thermo-Hygrometer. Carbon dioxide was measured using a Telaire 7000. Carbon monoxide was measured using a MSA MiniCO Detector. Nitrogen dioxide, formaldehyde and ozone were measured using an MSA Kwik-Draw Pump detector tube. Total Petroleum Hydrocarbons

was measured using an Accuro Pump detector tube. Total nuisance dust was collected with a MIE personal DataRam (a real-time aerosol monitor). Biological, non-viable, total spore count samples were collected on Air-O-Cell cassettes at a flow rate of 10 liters per minute for approximately 10 minutes. The samples were sent to Environmental Laboratory Services (EM Lab) for identification.

2.0 RESULTS

Table 2.1: The temperature and humidity and the CO, CO_2, formaldehyde, nitrogen oxides, ozone, total petroleum hydrocarbons and total dust sample results are listed below for the Non-Classroom Side Basement (10/11/17):

Location	CO (ppm)	CO_2 (ppm)	Total Dust (mg/m^3)	TPH (mg/m^3)	CHO (ppm)	NO_2 (ppm)	O_3 (ppm)	T/H ^0f/%
Mech Space/PTA	0	400	0.009	BDL	BDL	BDL	BDL	71/69
PTA Storage Room	0	400	0.010	BDL	BDL	BDL	BDL	71/69
Custodial Office	0	410	0.010	BDL	BDL	BDL	BDL	73/71
Outside #1	0	400	0.008	BDL	BDL	BDL	BDL	71/63
Custodial Storage Rm	0	400	0.010	BDL	BDL	BDL	BDL	71/71
Outside #2	0	400	0.010	BDL	BDL	BDL	BDL	71/63
Boiler Room	0	400	0.010	BDL	BDL	BDL	BDL	71/70

Note: BDL = below detectable limit; PPM = parts per million, F/CC = fibers per cubic meter, N/A = not applicable, pCi = PicoCuries, NO_2 = nitrogen dioxide, CHO = formaldehyde, mg/m^2 = milligrams per cubic meter, TPH = total petroleum hydrocarbons Overall Uncertainty of detector tubes: NO_2 +/- 15%; O_3 +/- 25%; formaldehyde +/- 25%; TPH +/- 10%; Outside Sample #1 collected at basement entrance; Outside Sample #2 collected in the courtyard

Table 2.2 Bioaerosol Samples (for details see the attached report dated 10/11/17 for the Non-Classroom Side Basement):

Sample Location	Conc. ($spores/M^3$)	MoldSCORE Compared to Outside Sample #1	MoldSCORE Compared to Outside Sample #2
Mechanical Rm/PTA Storage	14130	213	300
PTA Storage Room	12530	262	295
Custodial Office	14750	263	300
Custodial Storage Room	9060	132	300
Boiler Room	16810	246	300
Outside #1	351,390	NA	NA
Outside #2	12310	NA	NA

Note: CFU/M^3= Colony-forming units per cubic meter; NA = not applicable; BDL = below detectable limit; Spores/M3 = spores per cubic meter; Outside Sample #1 collected at basement entrance; Outside Sample #2 collected in the courtyard

Table 2.3: The temperature and humidity and the CO, CO_2, formaldehyde, nitrogen oxides, ozone, total petroleum hydrocarbons and total dust sample results are listed below (10/28/17):

Location	CO (ppm)	CO_2 (ppm)	Total Dust (mg/m^3)	TPH (mg/m^3)	CHO (ppm)	NO_2 (ppm)	O_3 (ppm)	T/H $^0f/\%$
Main Office	0	400	0.009	BDL	BDL	BDL	BDL	56/51
Classroom 4	0	400	0.010	BDL	BDL	BDL	BDL	51/44
Classroom 2B	0	410	0.010	BDL	BDL	BDL	BDL	59/46
Cafeteria	0	400	0.008	BDL	BDL	BDL	BDL	55/43
Music Room	0	400	0.011	BDL	BDL	BDL	BDL	52/43
Classroom 20	0	400	0.010	BDL	BDL	BDL	BDL	57/48
Classroom 19	0	400	0.010	BDL	BDL	BDL	BDL	56/47
Classroom 18	0	400	0.015	BDL	BDL	BDL	BDL	57/46
Library	0	400	0.010	BDL	BDL	BDL	BDL	53/41
Computer Room	0	400	0.010	BDL	BDL	BDL	BDL	55/43
Classroom 13	0	410	0.012	BDL	BDL	BDL	BDL	55/47
Classroom 12	0	400	0.010	BDL	BDL	BDL	BDL	55/49
Classroom 11	0	400	0.010	BDL	BDL	BDL	BDL	55/43
Classroom 10	0	400	0.010	BDL	BDL	BDL	BDL	54/43
Classroom 9A	0	410	0.010	BDL	BDL	BDL	BDL	56/47
Classroom 8A	0	400	0.010	BDL	BDL	BDL	BDL	56/46
Nurse's Office	0	400	0.014	BDL	BDL	BDL	BDL	58/51
Classroom 35	0	400	0.010	BDL	BDL	BDL	BDL	56/47
Marker Space	0	410	0.015	BDL	BDL	BDL	BDL	58/52
Psychologist Office	0	400	0.010	BDL	BDL	BDL	BDL	58/50
Classroom 7A	0	400	0.010	BDL	BDL	BDL	BDL	58/53
Classroom 8	0	410	0.010	BDL	BDL	BDL	BDL	57/48
Classroom 24	0	400	0.012	BDL	BDL	BDL	BDL	57/49
Classroom 25	0	400	0.010	BDL	BDL	BDL	BDL	58/47
Gym #1	0	400	0.010	BDL	BDL	BDL	BDL	59/65
Gym #2	0	400	0.010	BDL	BDL	BDL	BDL	59/65
Classroom 14	0	400	0.011	BDL	BDL	BDL	BDL	54/43
Classroom 22	0	410	0.010	BDL	BDL	BDL	BDL	58/48
Classroom 21	0	400	0.010	BDL	BDL	BDL	BDL	56/45
Teacher's Lounge	0	400	0.011	BDL	BDL	BDL	BDL	56/48
Classroom 2A	0	400	0.010	BDL	BDL	BDL	BDL	59/46
Classroom 5	0	400	0.013	BDL	BDL	BDL	BDL	54/46
Classroom 6	0	400	0.010	BDL	BDL	BDL	BDL	54/52
Classroom 9	0	410	0.010	BDL	BDL	BDL	BDL	56/45
Classroom 7	0	410	0.012	BDL	BDL	BDL	BDL	58/53
Classroom 23	0	400	0.010	BDL	BDL	BDL	BDL	56/48
Art Room	0	400	0.015	BDL	BDL	BDL	BDL	57/48
Classroom 34	0	410	0.010	BDL	BDL	BDL	BDL	56/44
Outdoor #1	0	400	0.010	BDL	BDL	BDL	BDL	56/46
Outdoor #2	0	400	0.010	BDL	BDL	BDL	BDL	58/51

Note: BDL = below detectable limit; PPM = parts per million, F/CC = fibers per cubic meter, N/A = not applicable, pCi = PicoCuries, NO_2 = nitrogen dioxide, CHO = formaldehyde, mg/m^2 = milligrams per cubic meter, TPH = total petroleum hydrocarbons
Overall Uncertainty of detector tubes: NO_2 +/- 15%; O_3 +/- 25%; formaldehyde +/- 25%; TPH +/- 10%

Table 2.4 Bioaerosol Samples (for details see the attached report dated 10/28/17):

Sample Location	Conc. (spores/M^3)	MoldSCORE Compared to Outside Sample #1	MoldSCORE Compared to Outside Sample #2
Main Office	160	116	116
Classroom 4	460	111	118
Classroom 2B	1860	237	249
Cafeteria	630	121	129
Music Room	630	105	124
Classroom 20	490	136	142
Classroom 19	140	112	113
Classroom 18	290	104	108
Library	350	111	114
Computer Room	160	116	117
Classroom 13	290	125	128
Classroom 12	200	106	109
Classroom 11	260	116	118
Classroom 10	330	121	123
Classroom 9A	140	119	119
Classroom 8A	160	104	106
Nurse's Office	220	107	105
Classroom 35	1010	181	191
Marker Space	50	104	104
Psychologist Office	630	157	154
Classroom 7A	680	199	204
Classroom 8	340	137	140
Classroom 24	80	109	110
Classroom 25	340	134	137
Gym #1	230	109	112
Gym #2	120	132	132
Classroom 14	80	111	112
Classroom 22	610	145	153
Classroom 21	330	108	111
Teacher's Lounge	1370	242	250
Classroom 2A	140	104	106
Classroom 5	570	141	147
Classroom 6	130	116	116
Classroom 9	800	165	173
Classroom 7	60	105	106
Classroom 23	390	129	134
		MoldSCORE	**MoldSCORE**

Sample Location	Conc. (spores/M^3)	Compared to Outside Sample #1	Compared to Outside Sample #2
Art Room	360	110	107
Classroom 34	140	104	106
Outdoor #1	3030	NA	NA
Outdoor #2	11320	NA	NA

Note: CFU/M^3= Colony-forming units per cubic meter; NA = not applicable; BDL = below detectable limit; Spores/M3 = spores per cubic meter

3.0 OBSERVATIONS AND DISCUSSION

3.1 Carbon dioxide: The average indoor CO_2 concentration was greater than the outdoor concentration as is expected from occupied/previously occupied enclosed spaces and is not a health concern. The CO_2 levels were below the ASHRAE guidelines of 1000 ppm.

3.2 Carbon monoxide: The average indoor CO concentration is equal to the outdoor concentration.

3.3 Nitrogen dioxide: The average indoor NO_2 concentration is below or equal to the comparison sample and the outdoor concentration. No standards have been agreed upon for nitrogen dioxides in indoor air. ASHRAE and the EPA National Ambient Air Quality Standards list 0.053 ppm as the average 24-hour limit for NO_2 in outdoor air.

3.4 Ozone: The average indoor O_3 concentration is below or equal to the comparison sample and the outdoor concentration. Maximum allowable ozone concentration recommended by ASHRAE in an air conditioned and ventilated space 0.001 to 0.125 ppm.

3.5 Formaldehyde: The average indoor formaldehyde concentration is below or equal to the comparison sample and the outdoor concentration.

3.6 Total Petroleum Hydrocarbons: The average indoor total petroleum hydrocarbons concentration is equal to the non-compliant area and the outdoor concentration. There is no OSHA standard for the amount of petroleum oil vapors allowed in homes or workplaces. Most people can smell oil vapors at levels as low as 0.1 parts per million (ppm) in air.

3.7 Total nuisance dust: The average indoor total dust concentration is below or equal to the comparison sample and the outdoor concentration.

3.8 Temperature and Humidity: Humidity, like temperature exerts a powerful effect on building inhabitants. The direct consequence of high humidity is discomfort. Highly saturated warm air reduces the body's ability to lose heat and can increase levels of body odors. The chief problem with high indoor humidity from a health standpoint is the

potential for mold growth. Humidity levels greater than 30% increase the potential for mold growth and high humidity, 60% or greater can cause biological contamination. Dry air can affect the human body by causing respiratory ailments such as asthma, bronchitis, sinusitis, and nosebleeds, or general dehydration since the body fluids are depleted during respiration. Skin moisture evaporation can cause skin irritations and eye itching and the "apparent temperature" of the air is lower than what the thermometer indicates and the body "feels" colder. The humidity level in the building is typical of building without mechanical ventilation during the autumn months.

Recommended Ranges of Temperature and Relative Humidity

Relative Humidity	Winter Temperature	Summer Temperature
30%	68.5°F – 75.5°F	74.0°F – 80.0°F
40%	68.0°F – 75.0°F	73.5°F – 80.0°F
50%	68.0°F – 74.5°F	73.0°F – 79.0°F
60%	67.5°F – 74.0°F	73.0°F – 78.5°F

3.9 Bioaerosols: Samples were collected from selected areas in the building and an outside sample was collected to determine the organisms that occupy the ambient air (mycoflora) at the time of the investigation.

Because there can be such variation in spore trap samples the statistical significance from collecting few samples is very limited and no single particulate sample is representative of any environment (the particles are never randomly distributed in the space, especially when the particles are bioaerosols), therefore, two (2) outdoor air samples were collected. Two outdoor air samples will help provide a more complete picture of what is in the air that may be entering the building through windows and doors at times when they are open.

Samples were collected in pre-identified areas in the building. The organisms identified in the majority of the indoor air samples collected are typically those found in the air from the exterior of the building and no action is required.

The non-classroom side of the basement had a MoldSCORE that ranged from 104 - 300. Outside sample #1 was collected in the outside stairwell from the courtyard to the basement. The stairwell is littered with leaves and the floor drain is clogged. The MoldSCORE is higher in the stairwell then the courtyard where outside sample #2 was collected, and it is assumed that there is mold growth occurring in the leaf litter on the stairwell floor. The custodial staff routinely open the door to allow outside air to enter the basement where their office is located. There was visual evidence of mold growth in the basement boiler room. The MoldSCORE along with visual observations have concluded that fungal growth has occurred in the basement boiler room. A MoldSCORE rating greater than 150 indicates a moderate probability that the spores originated from inside the building and greater than 250 indicates a high probability.

The organisms identified in the indoor air samples collected in the Psychologist Office, classroom 7A and room 9, had a MoldSCORE range from164 - 204, consisting of Smuts, Periconia and Myxomycetes, which are typically outdoor organism/plant pathogens. The MoldSCORE for these classrooms is an artificiality and can occur when specific spore types are high outdoors and infiltrate into a building on a certain day (as does pollen) but remain indoors and then exceed outdoor levels that have subsequently decreased. This can be and is commonly seen with obligate plant parasites, such as rust fungi or tree pathogens that never colonize indoor spaces, yet can occur indoors in excess of outdoor levels on given days. Therefore, the organisms identified in the indoor air samples are those found in the air from the exterior of the building and no action is required.

The organism identified in classroom 2B, classroom 22, classroom 35 and the Teacher's Lounge had a MoldScore range from 191 – 250, which indicates that there is a moderate probability that the spores originated inside the rooms. Mold growth was visually identified in the Teacher's Lounge, beneath the contact paper in the cabinet beneath the sink.

Bioaerosol sampling only represents a snap shot in time and the "true" average concentration of microorganisms may differ.

Molds are part of the natural environment, and can be found everywhere, indoors and outdoors. They are found in schools, homes, hospitals, industry etc. Outdoors, molds play a part in nature by breaking down dead organic matter such as fallen leaves and dead trees. It is impossible to get rid of all mold and mold spores indoors; some mold spores will be found floating through the air and in house/school dust. However, mold is not usually a problem, unless it begins growing indoors and not appropriately corrected. Mold exposure can irritate the eyes, skin, nose, throat, and lungs of both mold-allergic and non-allergic people. Symptoms other than the allergic and irritant types are not commonly reported as a result of inhaling mold. The bioaerosol results for Greenacres School are typical of findings that RegCom has identified in other public schools, hospitals etc. over the past 20 years. Greenacres school has a few isolated areas that need attention or further investigation if recommended actions fail to correct the situation.

The presence of fungi in the air does not necessitate that people will be or exhibit health effects. In order for humans to be exposed indoors, fungal spores, fragments, or metabolites must be released into the air and inhaled, physically contacted (dermal exposure), or ingested. Whether or not symptoms develop in people exposed to fungi depends on the nature of the fungal material (e.g., allergenic, toxic, or infectious), the amount of exposure, and the susceptibility of exposed persons. Susceptibility varies with the genetic predisposition (e.g., allergic reactions do not always occur in all individuals), age, state of health, and concurrent exposures. For this reason and because measurements are not standardized and biological markers of exposures to fungi are largely unknown, it is not possible to determine a "safe" or "unsafe" levels of exposure for people in general. Science there is no biological concentration standards or permissible exposure limits (PELs) against which to compare a particular bioaerosol result, we are forced to use several tools to assist in the interpretation of the bioaerosol results.

The current approach relies on the comparisons of indoor vs. outdoor results and complaint vs. non-complaint area results.

1. Indoor levels that are below outdoor levels are usually not a concern, unless the speciazation identifies an opportunistic pathogen.
2. Compare the total concentrations form indoor, outdoor, complaint and non-complaint areas. Indoor levels may be greater than the exterior sample concentration (a concentration effect might be occurring or the outdoor environmental conditions may be prohibiting reproduction or removing the spores from the air).
3. Compare fungal genera and species, similar genera and species should be present in the exterior and interior samples, complaint and non-complaint samples.

Another tool that was developed by EM Laboratory Inc, is a proprietary statistical calculation called a MoldSCORE ™. The MoldSCORE ™ is a specliazed method for examining air-sampling spore data only data. The statistical valves lay between 100 and 300, the lower the score the greater the likihood that the indoor spores originated from the outdoors. The organisms identified in the indoor air samples are typically those found in the air from the exterior of the building. The MoldSCORE $^{TM.}$ suggest that the mold identified in the areas surveyed is from an exterior source.

It must be noted that these numerical values are only an assumption based on experience and scientific literature. The numbers are artificial and should not be used as a health and safety standard. It should also be noted, that rather than focusing on specific kinds of fungi or on quantitative measurements of fungal prevalence, the ACGIH approach has been to emphasize that actual fungal growth in indoor environments is inappropriate and may lead to exposure and adverse health affect.

3.10 Carpets, throw rugs and upholstery (throw cushions): Carpets are generally used in the classroom or hallways to reduce the noise levels or to create a softer walking surface and throw rugs are commonly used in classrooms to crate a soft-sitting surface for younger students. However, carpets and throw rugs require maintenance and they do not clean as well as hard non-porus surfaces (floor tile). These fleecy materials become sinks or reservoirs where microorganisms accumulate (dust mites, bacteria and mold). If this material becomes wet and does not dry within 48 hours or if an object is placed on a wet carpet, preventing it from drying, fungus and bacterial will grow. Cleaning a carpet with fungal growth is difficult to accomplish and therefore, removal is usually the best option. Therefore, it is important that the throw carpet and pillows be periodically removed and cleaned. If occupants of the classroom develop an allergy the practice of using carpet and/or cushions should be discontinued.

3.11 Asthma: A number of occupants openly indicted that they were either asthmatic or suffered from allergies or other respiratory illness. Americans spend up to 90% of their time indoors. Therefore, indoor allergens and irritants can play a significant role in triggering asthma attacks. Some of the most common indoor asthma triggers include

secondhand smoke, dust mites, mold, cockroaches and other pests, household pets, and combustion byproducts.

3.13 Building Inspection:

3.13.1 Internal Building Inspection: The affected rooms were inspected and appeared to be dry, with the exception of minor water intrusion in the boiler room area. The mechanical room next to the PTA storage room has an active sump pump. Overall, the basement is used as a storage and shop area, custodial office space and the boiler room. The basement is below grade and isolated from the remainder of the basement. The is a portion of the basement that is student occupied (classrooms) was found to be clean and dry. The other areas of the building that were inspected also found to be clean and dry with the exception of water damaged cabinet floor beneath the sink in rooms 2B and 35. There is communication between the crawl space, the kiln room and the art room through the hatch way door opening. Air was moving from the crawl space into the classroom.

4.0 CONCLUSION

The MoldSCORE along with visual observations have concluded that fungal growth was occurring in the boiler room in the basement and in the Teacher's Lounge. There are a number of areas where the MoldSCORE indicate that there is a moderate probability that the spore originated interior to the building.

The average concentration for nuisance dust, formaldehyde, ozone, nitrogen dioxide carbon monoxide, carbon dioxide and total petroleum hydrocarbons were below or equal to the outside sample.

None of the information contained herein should be construed as medical advice. Only a qualified physician should make any decision relative to medical significance.

5.0 RECOMMENDATIONS

Basement (non-classroom areas):

1. Inspect and remove material that appears moldy, this includes wood, paper products etc.

2. Clean and disinfect the areas.

3. Remove debris an ensure floor drain is working properly in the courtyard basement stairwell.

4. Install dehumidifiers, if humidity can't be controlled.

5. Ensure areas where sump pumps are located are ventilated to the outside.

6. Ventilate the basement (non-classroom areas).

7. Seal penetrations between the basement and the first floor.

8. Inspect the area for water intrusion and correct if identified.

Classroom 35, 22, 2B and the Teacher's Lounge:

1. Inspect and remove material that appears moldy, this includes wood, paper products etc.

2. Clean and disinfect the areas.

3. Install dehumidifiers, if humidity can't be controlled.

4. Inspect the area for water intrusion and correct if identified.

5. Inspect and clean window AC units.

6. Clean and disinfect the cabinets beneath the sink and replace cabinet floors beneath the sinks as needed.

7. Clean and disinfect the ventilation grills.

8. Inspect and clean unit ventilators/replace filters as needed.

9. Seal the penetration (floor hatch) to the crawl space in the Art room/kiln room.

Microbiological Sample Results