



E n v i r o n m e n t a l C o n s u l t i n g G r o u p , I n c .

October 31, 2018

Mr. Guy Schumacher, Ed.D.
Superintendent
Libertyville School District 70
1381 Lake Street
Libertyville, IL 60048

Re: **Indoor Air Quality Assessment**
 Highland Middle School
 310 West Rockland Road
 Libertyville, Illinois 60048


Dear Mr. Schumacher:

Environmental Consulting Group, Inc. (ECG) has completed an indoor air quality assessment at Libertyville SD 70 Highland Middle School, 310 West Rockland Road, Libertyville, Illinois, 60048. The assessment took place on October 23, 2018. This report summarizes the work performed, outlines the sampling methodology, and provides the analytical results along with conclusions.

If you have any questions or need additional information, please contact our office.

Sincerely,

ENVIRONMENTAL CONSULTING GROUP, INC.


Daniel Brust, CIH
Senior Project Manager



E n v i r o n m e n t a l C o n s u l t i n g G r o u p , I n c .

REPORT

**Indoor Air Quality Assessment
Highland Middle School
310 West Rockland Road
Libertyville, Illinois 60048**

Performed for:

Libertyville School District 70
1381 Lake Street
Libertyville, IL 60048

Prepared by:

Environmental Consulting Group, Inc.
105 S. York Road, Suite 250
Elmhurst, Illinois 60126
(630) 607-0060
www.ecgmidwest.com

ECG Project Number: II182651-921
Date: October 31, 2018

EXECUTIVE SUMMARY

On October 23, 2018, Environmental Consulting Group, Inc. (ECG) completed an indoor air quality (IAQ) assessment at Libertyville SD 70 Highland Middle School (HMS), 310 West Rockland Road, Libertyville, Illinois, 60048. Occupants have expressed concern regarding fluctuating temperatures, elevated relative humidity levels and mold growth on materials. Mr. Schumacher, Libertyville SD 70 Superintendent, indicated that mold growth occurred on materials in the building during August 2018, September 2018 and October 2018. Specific Areas of Concern included:

- Rooms 001, 002, 003, 005, 123, 129, 136, 137, 138, 140, 154, 156 (15E & 16E)

A visual inspection for the possible sources of indoor air pollutants was conducted. Evidence of water staining, moisture intrusion and mold growth were noted. Measurements for the following common indoor environmental conditions were collected: Carbon Dioxide (CO₂), Nuisance Dust (PM-10), Temperature and Relative Humidity. Measurements for the following hazardous airborne contaminants were collected: Carbon monoxide (CO), Total Volatile Organic Compounds (TVOCs), Formaldehyde and Ozone. Airborne mold samples were collected to evaluate the spaces for mold.

Temperature, relative humidity, carbon monoxide, formaldehyde, nuisance dust, ozone and TVOCs were within the recommended guidelines. Carbon dioxide and airborne mold spore concentrations were elevated and exceeded one or more guidelines.

The CO₂ levels in the building ranged from 458 ppm to 2,215 ppm, with multiple rooms exceeding the EPA guideline (1,000 ppm) and the ASHRAE guideline (1,161 ppm). Specifically, Rooms 001, 002, 003, 123, 129 (and Hall adjacent to 129), 134, 136, 137, Hall adjacent to 139, 140 (and Hall adjacent to 140), and 144 exceeded the guidelines.

No mold growth was observed by ECG during the assessment. *Aspergillus/Penicillium* sps. concentrations exceeded the recommended guidelines in Rooms 003, 123, 138 and 140, ranging from 1,900 to 13,900 sp/m³ (compared to the Indoor/Outdoor Control concentrations, which ranged from <40 to 1,000 sp/m³).

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1.0 PROJECT BACKGROUND

On October 23, 2018, Environmental Consulting Group, Inc. (ECG) completed an indoor air quality (IAQ) assessment at Libertyville SD 70 Highland Middle School (HMS), 310 West Rockland Road, Libertyville, Illinois, 60048. Occupants have expressed concern regarding fluctuating temperatures, elevated relative humidity levels and mold growth on materials. Mr. Schumacher, Libertyville SD 70 Superintendent, indicated that the following Areas of Concern had been impacted by mold growth during August 2018, September 2018 and October 2018:

- Rooms 001, 002, 003, 005, 123, 129, 136, 137, 138, 140, 154, 156 (15E & 16E)

The assessment was conducted by Mr. David Parry, ECG Environmental Consultant. Mr. Daniel Brust, CIH, ECG Senior Project Manager, evaluated the results and prepared this report.

The following objectives were completed during the assessment:

Visual Inspection

- Visual inspection for the possible sources of indoor air pollutants. Evidence of water staining, moisture intrusion and mold growth were noted.

Environmental Comfort Factors

Measurements for the following common indoor environmental conditions:

- Carbon Dioxide (CO₂)
- Nuisance Dust (PM-10)
- Temperature
- Relative Humidity

Hazardous Air Contaminants

Measurements for the following hazardous airborne contaminants:

- Carbon monoxide (CO) – Source: Products of combustion
- Total Volatile Organic Compounds (TVOCs) – Source: Paints, solvents
- Formaldehyde – Source: Carpets, furniture, adhesives
- Ozone – Source: Electronic office equipment

Airborne Fungal (Mold) Spores

Airborne mold samples were collected to evaluate the spaces for mold.

2.0 RESULTS AND DISCUSSION

ECG measured nine IAQ parameters, including: temperature, relative humidity, carbon monoxide (CO), carbon dioxide (CO₂), formaldehyde, ozone, nuisance dust / particulate matter (PM-10), total volatile organic compounds (TVOCs) and airborne mold (fungal) spore concentrations.

Measurements were collected throughout the building. For comparison purposes, outdoor samples were also collected. Measurements were collected both in the morning and afternoon to evaluate the factors with regard to occupancy levels.

The IAQ results were compared to the following standards and guidelines:

- American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs)
- Indoor air quality standards developed by the American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
- Indoor air quality standards developed by the Environmental Protection Agency (EPA)
- Occupational Safety & Health Administration (OSHA) federal occupational exposure limits

A summary table of IAQ testing results is provided in Appendix A. The airborne fungal spore report is provided in Appendix B. Methodology is provided in Appendix C. Floor plans of the facility is provided in Appendix D.

2.1 Visual Inspection

HMS experienced mold growth on non-building materials during August, September and October 2018. Mold growth occurred on textbooks, posters, photographs and other miscellaneous materials. The mold-impacted items were removed from HMS prior to ECG's assessment.

A visual inspection of the interior spaces was conducted to identify historical and current mold or moisture intrusion that has impacted building materials. No mold, water-stained building materials or unusual odors were observed during the assessment. ECG observed several employee-owned and maintained live plants in the building. Some employees may experience respiratory issues due to live plants.

2.2 Temperature and Relative Humidity

Temperatures in the building ranged from 69°F to 75°F. The outdoor temperatures ranged from 57°F to 62°F.

ASHRAE Standard 55-2013 recommends temperatures ranging from 67-83°F; EPA recommends temperatures ranging from 68-80°F. Temperatures throughout the building were within the guidelines.

Relative humidity levels in the building ranged from 22% to 37%. The outdoor relative humidity levels ranged from 28% to 31%.

ASHRAE Standard 62.1-2013 recommends that relative humidity levels not exceed 65%; EPA recommends relative humidity levels ranging from 20-60%. ASHRAE and EPA guidelines are primarily for occupant comfort, but the ASHRAE guidelines are also established for the prevention of undesirable microbial growth. Relative humidity levels throughout the building were within the guidelines.

2.3 Carbon Monoxide (CO)

CO concentrations in the building were all less than the instruments' limit of detection (less than 3 parts per million [<3 ppm]). Outdoor CO concentrations were all <3 ppm. All CO levels were within the accepted guidelines.

2.4 Carbon Dioxide (CO₂)

The CO₂ levels in the building ranged from 458 ppm to 2,215 ppm. The average outdoor level was 461 ppm. EPA recommends indoor CO₂ levels below 1,000 ppm; ASHRAE recommends CO₂ levels not exceed 700 ppm plus average outdoor concentrations, equivalent to 1,161 ppm. These results indicate that the CO₂ levels were above the accepted guidelines.

2.5 Formaldehyde

Formaldehyde concentrations in the building were all less than the instruments' limit of detection (<0.050 ppm). Outdoor formaldehyde concentrations were all <0.050 ppm. This indicates a normal condition.

2.6 Nuisance Dust / Particulate Matter (PM-10)

PM-10 dust levels in this building ranged from 0.003 to 0.061 milligrams per cubic meter (mg/m³). Outdoor concentrations of PM-10 ranged from 0.006 to 0.032 mg/m³.

All PM-10 levels were within the accepted guidelines, except for one reading (Room 134, 12:09 PM, 0.061 mg/m³). Although one PM-10 concentration was above the desired range, the average PM-10 concentration in Room 134 (throughout the day) was 0.040 mg/m³ and the average PM-10 concentration throughout the building (throughout the day) was 0.012 mg/m³. Intermittent dust concentrations that slightly exceed a guideline level are common. The PM-10 concentrations indicate a normal indoor environment.

2.7 Ozone (O₃)

Ozone concentrations in the building ranged from <0.008 ppm to 0.024 ppm. Outdoor ozone concentrations ranged from 0.022 ppm to 0.066 ppm. All ozone levels were within the accepted guidelines.

2.8 Total Volatile Organic Compounds (TVOC)

TVOC concentrations in the building were all less than the instruments' limit of detection (<0.1 ppm). Outdoor TVOC concentrations were all <0.1 ppm. All TVOC levels were within the accepted guidelines.

2.9 Airborne Mold Spores

Indoor concentrations are typically equal to or below outdoor concentrations, with similar genera (type) being identified.

Samples were collected in the following areas:

- Areas of Concern
 - Rooms 001, 002, 003, 005, 123, 129, 136, 137, 138, 140, 154, 156 (15E & 16E)
- Indoor Control Areas
 - Rooms 134, 144
- Outdoor Control Areas
 - Outdoors, adjacent building entrances

**Indoor Air Quality Assessment
Highland Middle School**

Environmental Consulting Group, Inc.

630-607-0060

Currently, there are no federal standards or guidelines that stipulate acceptable exposure concentrations to airborne mold. Therefore, the standard approach for interpreting the results of airborne mold sampling involves comparison of indoor vs. outdoor mold concentrations and types. In general, results are considered to be acceptable when:

- Total indoor (Area of Concern) airborne mold concentrations are lower than—or roughly equal to—Indoor Control / Outdoor Control concentrations, and;
- No individual mold type is identified in appreciable quantities in Area of Concern samples that isn't also identified in the Control samples.
- A difference of 5 raw spores or approximately 200 sp/m³ is considered insignificant.

The following table compares the total mold spore concentrations and the predominant spore type concentrations:

Sample ID #	Location	Total Spore Concentrations (sp/m ³)	Predominant Spore Type (sp/m ³)	
02	Room 138	14,240	<i>Aspergillus/Penicillium</i> sps. – 13,900	
03	Room 001	290	<i>Aspergillus/Penicillium</i> sps. – 200	
04	Room 002	960	<i>Aspergillus/Penicillium</i> sps. – 870	
05	Room 003	2,220	<i>Aspergillus/Penicillium</i> sps. – 1,900	
06	Room 005	1,160	<i>Aspergillus/Penicillium</i> sps. – 1,000	
07	Room 129	520	<i>Aspergillus/Penicillium</i> sps. – 200	
09	Room 137	370	<i>Aspergillus/Penicillium</i> sps. – 200	
10	Room 136	250	<i>Aspergillus/Penicillium</i> sps. – 40	
11	Room 123	2,080	<i>Aspergillus/Penicillium</i> sps. – 1,500	
12	Room 140	8,950	<i>Aspergillus/Penicillium</i> sps. – 8,740	
13	Room 156 (North Gym)	880	<i>Aspergillus/Penicillium</i> sps. – 300	
14	Room 156 (Locker Rm)	1,040	<i>Aspergillus/Penicillium</i> sps. – 100	
01	Indoor	Room 144	170	<i>Aspergillus/Penicillium</i> sps. – <40
08	Controls	Room 134	350	<i>Aspergillus/Penicillium</i> sps. – 100
15	Outdoor	Outdoors	1,820	<i>Aspergillus/Penicillium</i> sps. – 200
16	Controls	Outdoors	2,480	<i>Aspergillus/Penicillium</i> sps. – 1,000

Rooms 003, 123, 138 and 140 had elevated *Aspergillus/Penicillium* sps. concentrations. No mold, water-stained building materials or unusual odors were observed during the assessment.

3.0 CONCLUSIONS AND RECOMMENDATIONS

Temperature, relative humidity, carbon monoxide, formaldehyde, nuisance dust, ozone and TVOCs were within the recommended guidelines. Carbon dioxide and airborne mold spore concentrations were elevated and exceeded one or more guidelines.

Carbon Dioxide (CO₂)

The CO₂ levels in the building ranged from 458 ppm to 2,215 ppm, with multiple rooms exceeding the EPA guideline (1,000 ppm) and the ASHRAE guideline (1,161 ppm). Specifically, Rooms 001, 002, 003, 123, 129 (and Hall adjacent to 129), 134, 136, 137, Hall adjacent to 139, 140 (and Hall adjacent to 140), and 144 exceeded the guidelines. In many of these locations, occupancy levels were greater than 20 to 30 persons.

The main source of carbon dioxide is human expiration. Indoor CO₂ levels are usually controlled through adequate fresh air ventilation. Two main factors control the CO₂ concentrations indoors: occupancy levels and fresh air through the air handling units (AHUs) and unit ventilators. When CO₂ concentrations exceed the guidelines, it indicates that an insufficient amount of fresh air is being delivered to the areas. Increasing the amount of fresh air will reduce these concentrations to acceptable levels. This can be achieved by opening the dampers for the fresh air intakes.

Airborne Mold Spores

HMS experienced mold growth on non-building materials during August, September and October 2018. Mold growth occurred on textbooks, posters, photographs and other miscellaneous materials. The mold-impacted items were removed from HMS prior to ECG's assessment. No mold growth was observed by ECG during the assessment. *Aspergillus/Penicillium* sps. concentrations exceeded the recommended guidelines in Rooms 003, 123, 138 and 140, ranging from 1,900 to 13,900 sp/m³ (compared to the Indoor/Outdoor Control concentrations, which ranged from <40 to 1,000 sp/m³). Potential conditions for elevated mold spore concentrations indoors include:

- Live plants in the building, which may harbor mold spores
- Tracking mold spores into a building (occupants' clothing/shoes) and inadequate housekeeping, allowing mold spores to accumulate
- Mold removal / cleaning that was not complete

Effective housekeeping and MERV 8 filters can prevent build-up of mold spores in the indoor environment. ECG recommends additional airborne mold spore testing, following a thorough cleaning of the affected areas.

**Indoor Air Quality Assessment
Highland Middle School**

Environmental Consulting Group, Inc.

630-607-0060

4.0 QUALIFICATIONS

ECG believes this study was developed in general accordance with the technical standards of practice for indoor air testing at the time the study was conducted. The standard of care exercised for this study was in accordance with generally accepted practices, and a reasonable effort was made to ensure that the information presented in this report is materially complete and accurate.

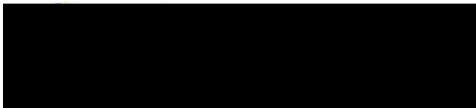
The conclusions presented in this report are professional opinions based solely upon visual observations of the site, analytical data, and other research as described in this report. They are intended for the sole use of our client. The scope of services performed in execution of this assessment may not be appropriate to satisfy the need of other users, and any use or reuse of this document of the findings, conclusions, or recommendations presented herein is at the sole risk of said user.

Therefore, we cannot be responsible for independent conclusions, opinions or recommendations of others based on our study. If additional information from the site is generated, it should be provided to us so that we may evaluate its impact on our conclusions.

If you have any questions or need additional information, please contact our office.

Sincerely,

ENVIRONMENTAL CONSULTING GROUP, INC.



Daniel Brust, CIH
Senior Project Manager



Appendix A

Summary Table of IAQ Testing Results

Table 1: Summary of Indoor Air Quality Results

Highland Middle School
 310 West Rockland Avenue
 Libertyville, Illinois
 Date: 10-23-2018

Sample Location	Time	Temp. (°F)	Relative Humidity (%)	Carbon Monoxide (CO) (ppm) ^a	Carbon Dioxide (CO ₂) (ppm)	Nuisance Dust PM-10 (mg/m ³) ^b	Formaldehyde (ppm)	Ozone (ppm)	TVOCs ^c (ppm)	Occupancy
IAQ Limits & Guideline Levels										
ACGIH-2018		NE	NE	25	5,000	10	0.1	0.1	100	
ASHRAE 62.1-2016 / 55-2013		67-83	<65	9	1161*	0.050	0.0073	0.050	NE	
EPA		68-80	20-60	9	1,000	0.150	0.1	0.075	NE	
OSHA		NE	NE	50	5,000	15	0.75	0.1	500	
Outdoors	9:20	62	28	<3	462	0.006	<0.050	0.022	<0.1	-
	11:52	57	31	<3	460	0.032	<0.050	0.066	<0.1	-
Room 144	9:26 AM	69	31	<3	824	0.003	<0.050	0.009	<0.1	2
	12:17 PM	72	35	<3	1505	0.013	<0.050	<0.008	<0.1	30+
Hallway outside Room 139	9:37 AM	70	27	<3	678	0.004	<0.050	<0.008	<0.1	2
	12:13 PM	72	33	<3	1483	0.011	<0.050	<0.008	<0.1	2
Room 138	9:43 AM	71	36	<3	1909	0.003	<0.050	<0.008	<0.1	30+
	12:12 PM	72	35	<3	1574	0.005	<0.050	<0.008	<0.1	30+
Room 001	9:56 AM	70	32	<3	1303	0.003	<0.050	<0.008	<0.1	3
	11:58 AM	71	33	<3	1142	0.006	<0.050	0.011	<0.1	2
Room 002	10:04 AM	71	29	<3	974	0.003	<0.050	<0.008	<0.1	3
	12:00 PM	71	31	<3	1023	0.005	<0.050	0.010	<0.1	1
Room 003	10:14 AM	72	30	<3	1137	0.005	<0.050	<0.008	<0.1	3
	12:01 PM	71	32	<3	1230	0.004	<0.050	0.021	<0.1	5
Room 005	10:22 AM	72	27	<3	719	0.003	<0.050	0.021	<0.1	17
	12:02 PM	71	28	<3	892	0.008	<0.050	<0.008	<0.1	3
Room 129	10:29 AM	72	32	<3	1472	0.015	<0.050	0.021	<0.1	20+
	12:04 PM	71	36	<3	1691	0.022	<0.050	<0.008	<0.1	20+
Hallway outside Room 129	10:31 AM	72	30	<3	1055	0.015	<0.050	<0.008	<0.1	6
	12:05 PM	71	32	<3	1018	0.023	<0.050	<0.008	<0.1	2
Room 134	10:37 AM	72	32	<3	1463	0.019	<0.050	<0.008	<0.1	3
	12:09 PM	71	35	<3	1404	0.061	<0.050	<0.008	<0.1	30+
Room 137	10:48 AM	73	31	<3	1801	0.003	<0.050	<0.008	<0.1	4
	12:11 PM	71	33	<3	1470	0.007	<0.050	<0.008	<0.1	2

ppm = parts per million
 mg/m³ = milligrams per cubic meter of air
 TVOCs = Total Volatile Organic Compounds

NE = Not Established
 < = Less Than

*ASHRAE CO2 Indoor < 700 ppm + Outdoor

Table 1: Summary of Indoor Air Quality Results

Highland Middle School
 310 West Rockland Avenue
 Libertyville, Illinois
 Date: 10-23-2018

Sample Location	Time	Temp. (°F)	Relative Humidity (%)	Carbon Monoxide (CO) (ppm) ^a	Carbon Dioxide (CO ₂) (ppm)	Nuisance Dust PM-10 (mg/m ³) ^b	Formaldehyde (ppm)	Ozone (ppm)	TVOCs ^c (ppm)	Occupancy
IAQ Limits & Guideline Levels										
ACGIH-2018		NE	NE	25	5,000	10	0.1	0.1	100	
ASHRAE 62.1-2016 / 55-2013		67-83	<65	9	1161*	0.050	0.0073	0.050	NE	
EPA		68-80	20-60	9	1,000	0.150	0.1	0.075	NE	
OSHA		NE	NE	50	5,000	15	0.75	0.1	500	
Outdoors	9:20	62	28	<3	462	0.006	<0.050	0.022	<0.1	-
	11:52	57	31	<3	460	0.032	<0.050	0.066	<0.1	-
Room 136	10:55 AM	72	32	<3	1768	0.004	<0.050	<0.008	<0.1	2
	12:10 PM	71	34	<3	1479	0.008	<0.050	<0.008	<0.1	20+
Room 123	11:06 AM	73	30	<3	1078	0.022	<0.050	<0.008	<0.1	5
	12:18 PM	72	32	<3	1157	0.017	<0.050	<0.008	<0.1	7
Room 140	11:13 AM	74	37	<3	2215	0.012	<0.050	<0.008	<0.1	23
	12:14 PM	72	35	<3	1523	0.007	<0.050	<0.008	<0.1	20+
Hallway outside Room 140	11:15 AM	73	32	<3	1524	0.033	<0.050	<0.008	<0.1	5
	12:15 PM	71	34	<3	1548	0.018	<0.050	<0.008	<0.1	2
North Gym Room 156	11:22 AM	74	23	<3	542	0.014	<0.050	<0.008	<0.1	2
	12:20 PM	72	22	<3	488	0.003	<0.050	<0.008	<0.1	2
Locker Room Room 156	11:29 AM	75	23	<3	537	0.014	<0.050	<0.008	<0.1	1
	12:21 PM	72	23	<3	458	0.004	<0.050	0.024	<0.1	2

ppm = parts per million
 mg/m³ = milligrams per cubic meter of air
 TVOCs = Total Volatile Organic Compounds

NE = Not Established
 < = Less Than

*ASHRAE CO2 Indoor < 700 ppm + Outdoor

Appendix B

Fungal/Mold Laboratory Report & Chain of Custody



EMSL Analytical, Inc.

4140 Litt Drive Hillside, IL 60162
Tel/Fax: (773) 313-0099 / (773) 313-0139
<http://www.EMSL.com> / chicagolab@emsl.com

EMSL Order: 261811091
Customer ID: ENCG51
Customer PO:
Project ID:

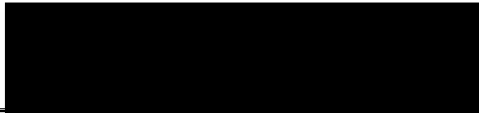
Attn: David Parry
Environmental Consulting Group
105 South York Street
Suite 250
Elmhurst, IL 60126
Project: II182651-921

Phone: (708) 510-0543
Fax: (630) 607-0650
Collected: 10/23/2018
Received: 10/23/2018
Analyzed: 10/24/2018

Test Report: Air-O-Cell(™) Analysis of Fungal Spores & Particulates by Optical Microscopy (Methods MICRO-SOP-201, ASTM D7391)

Lab Sample Number:	261811091-0001			261811091-0002			261811091-0003		
Client Sample ID:	01			02			03		
Volume (L):	75			75			75		
Sample Location	ROOM 144			ROOM 138			ROOM 001		
Spore Types	Raw Count	Count/m ³	% of Total	Raw Count	Count/m ³	% of Total	Raw Count	Count/m ³	% of Total
Alternaria (Ulocladium)	-	-	-	2*	30*	0.2	-	-	-
Ascospores	1*	10*	5.9	-	-	-	-	-	-
Aspergillus/Penicillium	-	-	-	335	13900	97.6	4	200	69
Basidiospores	2	80	47.1	1	40	0.3	1	40	13.8
Bipolaris++	-	-	-	-	-	-	-	-	-
Chaetomium	-	-	-	-	-	-	-	-	-
Cladosporium	-	-	-	3	100	0.7	1	40	13.8
Curvularia	-	-	-	-	-	-	-	-	-
Epicoccum	-	-	-	1*	10*	0.1	-	-	-
Fusarium	-	-	-	-	-	-	-	-	-
Ganoderma	-	-	-	-	-	-	-	-	-
Myxomycetes++	1	40	23.5	1	40	0.3	-	-	-
Pithomyces++	-	-	-	1	40	0.3	-	-	-
Rust	-	-	-	1	40	0.3	1*	10*	3.4
Scopulariopsis/Microascus	-	-	-	-	-	-	-	-	-
Stachybotrys/Memnoniella	-	-	-	-	-	-	-	-	-
Unidentifiable Spores	1	40	23.5	2*	30*	0.2	-	-	-
Zygomycetes	-	-	-	-	-	-	-	-	-
Nigrospora	-	-	-	1*	10*	0.1	-	-	-
Torula-like	-	-	-	-	-	-	-	-	-
Total Fungi	5	170	100	348	14240	100	7	290	100
Hyphal Fragment	-	-	-	-	-	-	2*	30*	-
Insect Fragment	-	-	-	-	-	-	-	-	-
Pollen	-	-	-	-	-	-	-	-	-
Analyt. Sensitivity 600x	-	42	-	-	42	-	-	42	-
Analyt. Sensitivity 300x	-	13*	-	-	13*	-	-	13*	-
Skin Fragments (1-4)	-	3	-	-	3	-	-	3	-
Fibrous Particulate (1-4)	-	1	-	-	1	-	-	1	-
Background (1-5)	-	1	-	-	2	-	-	1	-

++ Includes other spores with similar morphology; see EMSL's fungal glossary for each specific category.



Andrei Poluchowicz, Microbiology Technical Manager
or other approved signatory

High levels of background particulate can obscure spores and other particulates leading to underestimation. Background levels of 5 indicate an overloading of background particulates, prohibiting accurate detection and quantification. Present = Spores detected on overloaded samples. Results are not blank corrected unless otherwise noted. The detection limit is equal to one fungal spore, structure, pollen, fiber particle or insect fragment. "" Denotes particles found at 300X. "*" Denotes not detected. Due to method stopping rules, raw counts in excess of 100 are extrapolated based on the percentage analyzed. EMSL maintains liability limited to cost of analysis. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. Samples received in good condition unless otherwise noted.

Samples analyzed by EMSL Analytical, Inc. Hillside, IL AIHA-LAP, LLC--EMLAP Lab 102992

Initial report from: 10/24/2018 14:33:25

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Customer ID: ENCG51
Customer PO:
Project ID:

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Project: II182651-921

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Fax: (630) 607-0650
Collected: 10/23/2018
Received: 10/23/2018
Analyzed: 10/24/2018

Test Report: Air-O-Cell™ Analysis of Fungal Spores & Particulates by Optical Microscopy (Methods MICRO-SOP-201, ASTM D7391)

Lab Sample Number:	261811091-0004			261811091-0005			261811091-0006		
Client Sample ID:	04			05			06		
Volume (L):	75			75			75		
Sample Location	ROOM 002			ROOM 003			ROOM 005		
Spore Types	Raw Count	Count/m ³	% of Total	Raw Count	Count/m ³	% of Total	Raw Count	Count/m ³	% of Total
Alternaria (Ulocladium)	1*	10*	1	-	-	-	1	40	3.4
Ascospores	-	-	-	-	-	-	-	-	-
Aspergillus/Penicillium	21	870	90.6	46	1900	85.6	24	1000	86.2
Basidiospores	-	-	-	-	-	-	2	80	6.9
Bipolaris++	-	-	-	-	-	-	-	-	-
Chaetomium	-	-	-	-	-	-	-	-	-
Cladosporium	1*	10*	1	1	40	1.8	-	-	-
Curvularia	-	-	-	-	-	-	-	-	-
Epicoccum	-	-	-	-	-	-	-	-	-
Fusarium	-	-	-	-	-	-	-	-	-
Ganoderma	-	-	-	-	-	-	-	-	-
Myxomycetes++	2*	30*	3.1	2	80	3.6	1	40	3.4
Pithomyces++	-	-	-	-	-	-	-	-	-
Rust	1	40	4.2	-	-	-	-	-	-
Scopulariopsis/Microascus	-	-	-	-	-	-	-	-	-
Stachybotrys/Memnoniella	-	-	-	-	-	-	-	-	-
Unidentifiable Spores	-	-	-	4	200	9	-	-	-
Zygomycetes	-	-	-	-	-	-	-	-	-
Nigrospora	-	-	-	-	-	-	-	-	-
Torula-like	-	-	-	-	-	-	-	-	-
Total Fungi	26	960	100	53	2220	100	28	1160	100
Hyphal Fragment	1	40	-	1	40	-	1	40	-
Insect Fragment	-	-	-	-	-	-	-	-	-
Pollen	-	-	-	-	-	-	-	-	-
Analyt. Sensitivity 600x	-	42	-	-	42	-	-	42	-
Analyt. Sensitivity 300x	-	13*	-	-	13*	-	-	13*	-
Skin Fragments (1-4)	-	3	-	-	3	-	-	3	-
Fibrous Particulate (1-4)	-	1	-	-	1	-	-	1	-
Background (1-5)	-	1	-	-	1	-	-	1	-

++ Includes other spores with similar morphology; see EMSL's fungal glossary for each specific category.

Andrei Poluchowicz, Microbiology Technical Manager
or other approved signatory

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Phone: (708) 510-0543
Fax: (630) 607-0650
Collected: 10/23/2018
Received: 10/23/2018
Analyzed: 10/24/2018

Test Report: Air-O-Cell(™) Analysis of Fungal Spores & Particulates by Optical Microscopy (Methods MICRO-SOP-201, ASTM D7391)

Lab Sample Number:	261811091-0007			261811091-0008			261811091-0009		
Client Sample ID:	07			08			09		
Volume (L):	75			75			75		
Sample Location	ROOM 129			ROOM 134			ROOM 137		
Spore Types	Raw Count	Count/m ³	% of Total	Raw Count	Count/m ³	% of Total	Raw Count	Count/m ³	% of Total
Alternaria (Ulocladium)	-	-	-	-	-	-	-	-	-
Ascospores	1	40	7.7	-	-	-	-	-	-
Aspergillus/Penicillium	5	200	38.5	3	100	28.6	4	200	54.1
Basidiospores	-	-	-	2	80	22.9	1	40	10.8
Bipolaris++	-	-	-	-	-	-	-	-	-
Chaetomium	-	-	-	-	-	-	-	-	-
Cladosporium	4	200	38.5	1	40	11.4	-	-	-
Curvularia	-	-	-	-	-	-	-	-	-
Epicoccum	-	-	-	-	-	-	1	40	10.8
Fusarium	-	-	-	-	-	-	-	-	-
Ganoderma	-	-	-	-	-	-	-	-	-
Myxomycetes++	-	-	-	1	40	11.4	1	40	10.8
Pithomyces++	-	-	-	-	-	-	-	-	-
Rust	2	80	15.4	1*	10*	2.9	1*	10*	2.7
Scopulariopsis/Microascus	-	-	-	-	-	-	-	-	-
Stachybotrys/Memnoniella	-	-	-	-	-	-	-	-	-
Unidentifiable Spores	-	-	-	2	80	22.9	1	40	10.8
Zygomycetes	-	-	-	-	-	-	-	-	-
Nigrospora	-	-	-	-	-	-	-	-	-
Torula-like	-	-	-	-	-	-	-	-	-
Total Fungi	12	520	100	10	350	100	9	370	100
Hyphal Fragment	2	80	-	1	40	-	-	-	-
Insect Fragment	-	-	-	-	-	-	-	-	-
Pollen	-	-	-	-	-	-	-	-	-
Analyt. Sensitivity 600x	-	42	-	-	42	-	-	42	-
Analyt. Sensitivity 300x	-	13*	-	-	13*	-	-	13*	-
Skin Fragments (1-4)	-	3	-	-	3	-	-	2	-
Fibrous Particulate (1-4)	-	1	-	-	1	-	-	1	-
Background (1-5)	-	1	-	-	1	-	-	1	-

++ Includes other spores with similar morphology; see EMSL's fungal glossary for each specific category.



Andrei Poluchowicz, Microbiology Technical Manager
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Test Report: Air-O-Cell(™) Analysis of Fungal Spores & Particulates by Optical Microscopy (Methods MICRO-SOP-201, ASTM D7391)

Lab Sample Number:	261811091-0010			261811091-0011			261811091-0012		
Client Sample ID:	10			11			12		
Volume (L):	75			75			75		
Sample Location	ROOM 136			ROOM 123			ROOM 140		
Spore Types	Raw Count	Count/m ³	% of Total	Raw Count	Count/m ³	% of Total	Raw Count	Count/m ³	% of Total
Alternaria (Ulocladium)	-	-	-	-	-	-	-	-	-
Ascospores	-	-	-	-	-	-	-	-	-
Aspergillus/Penicillium	1	40	16	37	1500	72.1	210	8740	97.7
Basidiospores	-	-	-	1	40	1.9	1	40	0.4
Bipolaris++	-	-	-	-	-	-	-	-	-
Chaetomium	-	-	-	-	-	-	-	-	-
Cladosporium	2	80	32	11	460	22.1	-	-	-
Curvularia	-	-	-	-	-	-	-	-	-
Epicoccum	1	40	16	-	-	-	-	-	-
Fusarium	-	-	-	-	-	-	-	-	-
Ganoderma	-	-	-	-	-	-	-	-	-
Myxomycetes++	1*	10*	4	-	-	-	-	-	-
Pithomyces++	1	40	16	-	-	-	1	40	0.4
Rust	-	-	-	1	40	1.9	1*	10*	0.1
Scopulariopsis/Microascus	-	-	-	-	-	-	-	-	-
Stachybotrys/Memnoniella	-	-	-	-	-	-	-	-	-
Unidentifiable Spores	1	40	16	1	40	1.9	2	80	0.9
Zygomycetes	-	-	-	-	-	-	-	-	-
Nigrospora	-	-	-	-	-	-	1	40	0.4
Torula-like	-	-	-	-	-	-	-	-	-
Total Fungi	7	250	100	51	2080	100	216	8950	100
Hyphal Fragment	1	40	-	-	-	-	2	80	-
Insect Fragment	-	-	-	-	-	-	-	-	-
Pollen	-	-	-	-	-	-	-	-	-
Analyt. Sensitivity 600x	-	42	-	-	42	-	-	42	-
Analyt. Sensitivity 300x	-	13*	-	-	13*	-	-	13*	-
Skin Fragments (1-4)	-	2	-	-	3	-	-	3	-
Fibrous Particulate (1-4)	-	1	-	-	1	-	-	1	-
Background (1-5)	-	1	-	-	1	-	-	2	-

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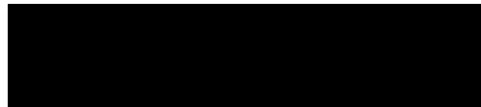
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Fax: (630) 607-0650
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Test Report: Air-O-Cell™ Analysis of Fungal Spores & Particulates by Optical Microscopy (Methods MICRO-SOP-201, ASTM D7391)

Lab Sample Number:	261811091-0013			261811091-0014			261811091-0015		
Client Sample ID:	13			14			15		
Volume (L):	75			75			75		
Sample Location	ROOM 156 (GYM)			LOCKER ROOM			OUTDOORS		
Spore Types	Raw Count	Count/m ³	% of Total	Raw Count	Count/m ³	% of Total	Raw Count	Count/m ³	% of Total
Alternaria (Ulocladium)	-	-	-	-	-	-	1*	10*	0.5
Ascospores	1	40	4.5	-	-	-	4	200	11
Aspergillus/Penicillium	7	300	34.1	3	100	9.6	5	200	11
Basidiospores	8	300	34.1	14	580	55.8	18	750	41.2
Bipolaris++	-	-	-	-	-	-	-	-	-
Chaetomium	-	-	-	-	-	-	-	-	-
Cladosporium	3	100	11.4	5	200	19.2	12	500	27.5
Curvularia	-	-	-	-	-	-	-	-	-
Epicoccum	1	40	4.5	1	40	3.8	3*	40*	2.2
Fusarium	-	-	-	-	-	-	-	-	-
Ganoderma	-	-	-	-	-	-	-	-	-
Myxomycetes++	1*	10*	1.1	1	40	3.8	2	80	4.4
Pithomyces++	-	-	-	1	40	3.8	-	-	-
Rust	1*	10*	1.1	1	40	3.8	-	-	-
Scopulariopsis/Microascus	-	-	-	-	-	-	-	-	-
Stachybotrys/Memnoniella	-	-	-	-	-	-	-	-	-
Unidentifiable Spores	1	40	4.5	-	-	-	1	40	2.2
Zygomycetes	-	-	-	-	-	-	-	-	-
Nigrospora	-	-	-	-	-	-	-	-	-
Torula-like	3*	40*	4.5	-	-	-	-	-	-
Total Fungi	26	880	100	26	1040	100	46	1820	100
Hyphal Fragment	2	80	-	1	40	-	1	40	-
Insect Fragment	-	-	-	-	-	-	-	-	-
Pollen	-	-	-	-	-	-	-	-	-
Analyt. Sensitivity 600x	-	42	-	-	42	-	-	42	-
Analyt. Sensitivity 300x	-	13*	-	-	13*	-	-	13*	-
Skin Fragments (1-4)	-	2	-	-	3	-	-	1	-
Fibrous Particulate (1-4)	-	1	-	-	1	-	-	1	-
Background (1-5)	-	1	-	-	1	-	-	1	-

++ Includes other spores with similar morphology; see EMSL's fungal glossary for each specific category.



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Test Report: Air-O-Cell(™) Analysis of Fungal Spores & Particulates by Optical Microscopy (Methods MICRO-SOP-201, ASTM D7391)

Lab Sample Number:	261811091-0016			261811091-0017		
Client Sample ID:	16			17		
Volume (L):	75					
Sample Location	OUTDOORS			Blank		
Spore Types	Raw Count	Count/m ³	% of Total	Raw Count	Count/m ³	% of Total
Alternaria (Ulocladium)	-	-	-	-	-	-
Ascospores	1	40	1.6	-	-	-
Aspergillus/Penicillium	24	1000	40.3	-	-	-
Basidiospores	19	790	31.9	-	-	-
Bipolaris++	1	40	1.6	-	-	-
Chaetomium	-	-	-	-	-	-
Cladosporium	9	400	16.1	-	-	-
Curvularia	-	-	-	-	-	-
Epicoccum	2*	30*	1.2	-	-	-
Fusarium	-	-	-	-	-	-
Ganoderma	-	-	-	-	-	-
Myxomycetes++	3	100	4	-	-	-
Pithomyces++	1	40	1.6	-	-	-
Rust	-	-	-	-	-	-
Scopulariopsis/Microascus	-	-	-	-	-	-
Stachybotrys/Memnoniella	-	-	-	-	-	-
Unidentifiable Spores	1	40	1.6	-	-	-
Zygomycetes	-	-	-	-	-	-
Nigrospora	-	-	-	-	-	-
Torula-like	-	-	-	-	-	-
Total Fungi	61	2480	100	-	No Trace	-
Hyphal Fragment	6	300	-	-	-	-
Insect Fragment	-	-	-	-	-	-
Pollen	-	-	-	-	-	-
Analyt. Sensitivity 600x	-	42	-	-	0	-
Analyt. Sensitivity 300x	-	13*	-	-	0*	-
Skin Fragments (1-4)	-	1	-	-	-	-
Fibrous Particulate (1-4)	-	1	-	-	-	-
Background (1-5)	-	1	-	-	-	-

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261811091
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HILLSIDE, IL 60162
PHONE: 773-313-0099

Company: ECG		EMSL-Bill to: <input checked="" type="checkbox"/> Same <input type="checkbox"/> Different If Bill to is Different please note in Comments**			
Street: 105 South York Street		<i>Third Party Billing requires written authorization from third party</i>			
City: Elmhurst	State/Province: IL	Zip/Postal Code: 60126	Country: USA		
Report To (Name): David Parry		Fax #:			
Telephone #: 630 607 0060		E-mail Address: dparry@envcg.com			
Project Name/ Number: <u>II 182651-921</u>		EMSL Rep: Lisa Parker			
Please Provide Results: <input type="checkbox"/> Fax <input checked="" type="checkbox"/> E-mail		PO#	State Samples Taken:		
Turnaround Time (TAT) Options* - Please Check					
<input type="checkbox"/> 3 Hour	<input type="checkbox"/> 6 Hour	<input checked="" type="checkbox"/> 24 Hour	<input type="checkbox"/> 48 Hour	<input type="checkbox"/> 72 Hour	<input type="checkbox"/> 96 Hour
<input type="checkbox"/> 1 Week	<input type="checkbox"/> 2 Week				
<small>*Analysis completed in accordance with EMSL's Terms and Conditions located in the Analytical Price Guide. TATs are subject to methodology requirements</small>					
Non Culturable Air Samples (Spore Traps)					
<ul style="list-style-type: none"> • M001 Air-O-Cell • M049 BioSIS • M030 Micro 5 	<ul style="list-style-type: none"> • M173 Allegro M2 • M003 Burkard • M174 MoldSnap 	<ul style="list-style-type: none"> • M004 Allergenco • M043 Cyclex • M176 Relle Smart 	<ul style="list-style-type: none"> • M032 Allergenco-D • M002 Cyclex-d • M130 Via-Cell 	<ul style="list-style-type: none"> • M172 Versa Trap 	
Other Microbiology Test Codes					
<ul style="list-style-type: none"> • M041 Fungal Direct Examination • M005 Viable Fungi ID and Count • M006 Viable Fungi ID and Count (Speciation) • M007 Culturable Fungi • M008 Culturable Fungi (Speciation) • M009 Gram Stain Culturable Bacteria • M010 Bacterial Count and ID - 3 Most Prominent • M011 Bacterial Count and ID - 5 Most Prominent • M013 Sewage Contamination in Buildings 	<ul style="list-style-type: none"> • M014 Endotoxin Analysis • M015 Heterotrophic Plate Count • M180 Real Time Q-PCR-ERMI 36 Panel • M018 Total Coliform (Membrane Filtration) • M020 Fecal Streptococcus (Membrane Filtration) • M210-215 Legionella Detection • M026 Recreational Water Screen • M027 Mycotoxin Analysis 	<ul style="list-style-type: none"> • M029 Enterococci • M019 Fecal Coliform • M133 MRSA Analysis • M028 Cryptococcus neoformans Detection • M120 Histoplasma capsulatum Detection • M033-39 Allergen Testing • M044 Group Allergen (Cat, Dog, Cockroach, Dustmites) • Other See Analytical Price Guide 			
Preservation Method (Water):					
Name of Sampler: <u>DAVID PARRY</u>			Signature of Sampler:		
Sample #	Sample Location	Sample Type	Test Code	Volume/Area	Date/Time Collected
01	Room 144	M001	AIR	75	10/23/18
02	Room 138	↓	↓	↓	
03	Room 001				
04	Room 002				
05	Room 003				
06	Room 005				
07	Room 129				
08	Room 134				
09	Room 137				
10	Room 136				
Client Sample # (s): <u>01 - 17</u>					Total # of Samples: <u>17</u>
Relinquished (Client):		Date: <u>10/23/18</u>	Time: <u>14:55</u>		
Received (Client):		Date: <u>10/23/18</u>	Time: <u>14:55</u>		
Comments: <u>W1.</u>					



EMSL ANALYTICAL, INC.
LABORATORY • PRODUCTS • TRAINING

11091
EMSL Order Number (Lab Use Only):

EMSL ANALYTICAL, INC.
4140 LITT DR.
HILLSIDE, IL 60162
PHONE: 773-313-0099

Additional Pages of the Chain of Custody are only necessary if needed for additional sample information

Sample #	Sample Location	Sample Type	Test Code	Volume/Area	Date/Time Collected
11	ROOM 123				
12	Room 140				
13	ROOM 156 (GYM)				
14	LOCKER ROOM				
15	OUTDOORS				
16	OUTDOORS				
17	BLANK				
**Comments/Special Instructions					

Appendix C

Methodology

Temperature and Relative Humidity

Temperature and relative humidity are occupant comfort parameters that play an important role in the perceived quality of an indoor work environment. Buildings with large window areas sometimes have acute problems of discomfort due to radiant heat gains and losses. Humidity also has an impact on thermal comfort. Elevated relative humidity levels reduce a person's ability to dissipate heat through perspiration and evaporation. Humidity extremes can also create other IAQ problems. Excessively high or low relative humidity can produce discomfort, while high relative humidity can promote the growth of mold, bacteria, and dust mites, which can aggravate allergies and asthma.

Testing Methodology

Temperature and relative humidity readings were obtained using a TSI Q-Trak indoor air quality monitor. The TSI Q-Trak simultaneously monitors, displays, and records a multitude of IAQ parameters, including CO, CO₂, temperature, and relative humidity. In each test location, the instrument was set on a surface in the room within the breathing zone, and a single 1-minute average reading was obtained.

Carbon Dioxide

Carbon Dioxide (CO₂) is produced by human metabolism and exhaled through the lungs. CO₂ can serve as a surrogate for measuring the adequacy of ventilation and outside fresh air intake. Normal CO₂ levels for occupied buildings range from 300 to 1,000 ppm. Levels exceeding 1,000 ppm suggest an inadequate rate of ventilation.

Testing Methodology

CO₂ readings were obtained using a TSI Q-Trak indoor air quality monitor. The TSI Q-Trak simultaneously monitors, displays, and records a multitude of IAQ parameters, including CO, CO₂, temperature, and relative humidity. In each test location, the instrument was set on a surface in the room within the breathing zone, and a single 1-minute average reading was obtained.

Carbon Monoxide

Carbon Monoxide (CO) is an odorless, colorless, asphyxiant gas that is the product of incomplete combustion. Potential indoor sources include unvented gas heaters, leaking furnaces, gas stoves, automobile exhaust fumes, and environmental tobacco smoke. Concentrations greater than 9 parts per million (ppm) may indicate the presence of exhaust gases in the indoor environment and should be investigated.

At low concentrations, CO can cause fatigue in healthy people and chest pains in people with heart disease. At higher concentrations, CO can cause impaired vision and coordination, headaches, dizziness, confusion, and nausea. At very high concentrations, CO can be fatal.

Testing Methodology

CO readings were obtained using a TSI Q-Trak indoor air quality monitor. The TSI Q-Trak simultaneously monitors, displays, and records a multitude of IAQ parameters, including CO, CO₂, temperature, and relative humidity. In each test location, the instrument was set on a surface in the room within the breathing zone, and a single 1-minute average reading was obtained.

Particulate Matter (PM-10)

Total Suspended Particulate (TSP) matter is generally considered to consist of all airborne particles less than a few hundred micrometers in diameter. In general, the concentration of TSP is significantly lower indoors than outdoors.

Certain portions of TSP consist of inhalable, thoracic, and respirable fractions. Inhalable particulate consists of particles of any size that may deposit anywhere in the respiratory tract. Thoracic particulate consists of particles, generally less than 10µm in diameter (PM-10), which may deposit in the lung airways or gas-exchange region. Respirable particulate consists of particles, generally less than 4µm in diameter, which may deposit in the gas-exchange region of the lungs.

Testing Methodology

ECG obtained PM-10 dust measurements with a DustTrak II Aerosol Monitor 8530 (DustTrak). The DustTrak is a desktop battery-operated, data-logging, light-scattering laser photometer that gives you real-time aerosol mass readings. It uses a sheath air system that isolates the aerosol in the optics chamber to keep the optics clean for improved reliability and low maintenance.

It is suitable for clean office settings as well as harsh industrial workplaces, construction and environmental sites, and other outdoor applications. The DustTrak II Aerosol Monitor measures aerosol contaminants such as dust, smoke, fumes, and mists.

Total Volatile Organic Compounds

Airborne volatile organic compounds (VOCs) can be present in the workplace as a result of office supplies, commercial cleaners and solvents, paints, new building materials, furnishings, and consumable products, etc. A variety of organic materials can exist in the indoor air, including aliphatic, aromatic, and chlorinated hydrocarbons. While some organics have been suggested as possible carcinogens (e.g. benzene and tetrachloroethylene), the actual health implications for many other VOCs are not presently well defined.

Because the specific identities of individual VOCs in the building are unknown, this study focused on measuring total volatile organic compound (TVOC) levels.

There is insufficient evidence that TVOC measurements can be used to predict health or comfort effects. In addition, odor and irritation responses to VOCs are highly variable. Furthermore, no single method currently in use measures all individual VOCs that may be of interest. Setting target concentrations for specific VOCs of concern is the preferred practice when the presence of a specific VOC is known. In general, setting target concentrations for TVOCs is not recommended; however such broad guidelines do exist.

Testing Methodology

Total volatile organic compounds (TVOC) were measured using an Aeroqual 500 VM photo ionization detector (PID). The Aeroqual VM is a direct-read instrument, which provides an instantaneous measurement of TVOC concentrations.

Formaldehyde

Formaldehyde is a gas that may be emitted from many indoor sources, such as wood particleboard, plywood, fiberboard, glues and adhesives, carpeting, permanent pressed fabrics, and combustion sources. These materials may release formaldehyde into the air, usually when they are newer. This process, commonly referred to as “off-gassing,” may cause short-term health effects with symptoms including eye, nose, throat, and skin irritation, nausea, headache, allergic sensitization, and exacerbation of asthma.

Testing Methodology

Formaldehyde measurements were obtained with an Aeroqual 500 EF single-gas direct-read meter. The Aeroqual 500 EF measures gases utilizing electro-chemical sensors in conjunction with a battery-powered internal air pump to provide instantaneous measurements of formaldehyde levels. Results are provided immediately upon sample completion through a digital LCD display. In each test area, the Aeroqual 500 EF was set on a surface within the breathing zone and left until readings stabilized.

Ozone

Most people recognize ozone from its presence in the ozonosphere, or ozone layer, where it functions to protect the Earth from harmful ultraviolet rays. Ozone on the ground level occurs when sunlight reacts with volatile organic compounds, which exist in sources such as hydrocarbon vehicle emissions. Electrical sparks which create ozone may occur inside the home in any equipment which uses high voltage or ultraviolet light. These items include electric motors, high power office equipment (photocopiers or laser printers), or electronic air filters which have been improperly installed.

However, indoor concentrations should be monitored since they can adversely affect building occupants, and the gas can have more serious effects if a buildup occurs.

Testing Methodology

Ozone measurements were obtained using an Aeroqual Series 500 OZL ozone gas monitor. The series 500 monitor and datalogger with Ozone sensor is capable of datalogging up to 8,000 data points. The meter allows direct-read measurements via a LCD display. In each test area, the Aeroqual monitor was set on a surface within the breathing zone and left until readings stabilized.

Appendix D
Floor Plans