COMMITMENT & INTEGRITY
DRIVE RESULTS

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Via Electronic Mail

January 24, 2020

Angelus Papageorge
Director of Operations
Fairfield Public Schools
501 Kings Highway East
Fairfield, CT 06825

Re: Indoor Environmental Assessment
Fairfield Ludlowe High School, Fairfield, Connecticut

Dear Mr. Papageorge:

Woodard & Curran performed an indoor environmental assessment at Fairfield Ludlowe High School located at 785 Unquowa Road in Fairfield, Connecticut. The assessment was performed in response to a request to evaluate the general air quality in select locations within the school building and to evaluate the space for the presence of unwanted sources of air contamination. The assessment was performed on the first, second and third floor offices and classrooms including Rooms 202, 301, 338A, 266, 286C 262, 317, 153, 107, 269, 361, and 334. The purpose of the assessment was to review locations of past water leaks and look for possible allergens. On January 14, 2020, a Woodard & Curran representative performed a visual inspection and moisture survey of the areas of concern and collected direct-reading measurements of carbon monoxide, carbon dioxide, volatile organic compounds (VOCs), temperature, relative humidity, and airborne particulate matter.

BACKGROUND

It was reported by Fairfield Public School Operations that rooms 338A (leak from a heater the previous year), 266 (broken sprinkler), 262 (leak from floor above), 153 (exterior water infiltration through wall), 269 (roof leaks), and 361 (air conditioning system leaks in ceiling) experienced water damage in the past. Other rooms were included in the survey because there are general concerns about the indoor air quality in these classrooms and offices. Woodard & Curran conducted this environmental quality assessment to determine if general indoor air quality parameters are satisfactory. Additionally, a visual inspection was conducted to determine if unwanted sources of moisture and/or microbial growth is present.

METHODS

Visual Inspection

Woodard & Curran conducted a visual inspection in select areas of the school to determine if obvious sources of indoor air contaminants or elevated moisture or suspected fungal growth were present. The classrooms, offices, and areas above the suspended ceiling tiles were visually inspected. An inspection of the supply air diffusers in the areas of concern was also performed.

Moisture Survey

The moisture content of building materials was evaluated using a GE Protimeter Surveymaster® digital moisture meter, which has two operating modes: search and measure. In search mode, the instrument uses a non-invasive radio frequency emission technique to locate moisture and can penetrate most wall and floor coverings, including ceramic tiles, to a depth of approximately ¾ inch. It displays a semi-quantitative result on a scale of colored lights. In measure mode, the instrument uses the electrical conductivity of a porous building material to indicate its level of free water. Two electrode pins are inserted into the material and the moisture level is displayed on a digital numeric display in units of wood moisture equivalent (WME). WME is the water content that wood would have if it were in contact with the material being tested for sufficient time to reach moisture equilibrium. It is the ratio of the weight of the water in the wood to the dry weight of the wood, expressed as a percentage. Prior to use, the calibration of the instrument was checked using a Protimeter Check calibration device.

Surface Samples for Mold Content Determination

Surface samples were collected by adhering clear tape onto the surfaces where suspect mold growth was observed and affixing the tape to a microscope slide which was sent via overnight mail to EMLab P&K in Marlton, New Jersey. Samples were analyzed at various magnifications under light microscopy to visually estimate the presence of any fungal growth in the sample and subsequently identify any fungal growth that is detected to Genus or relevant group.

Temperature, Relative Humidity, Carbon Monoxide, and Carbon Dioxide

On the day of the survey, temperature and relative humidity direct-readings measurements were collected throughout select areas of the school with a TSI Q-Trak (Model 7575-X) instrument. This instrument uses a thermistor sensor and thin-film capacitive sensor to measure temperature and relative humidity, respectively. Carbon dioxide is detected with a non-dispersive infrared sensor and carbon monoxide is detected by an electrochemical sensor. These sensors are calibrated prior to using the instrument in the field.

Airborne Particulate Matter

A TSI DustTrak DRX Aerosol Monitor (model number 8533) was used to measure particulate concentrations in select locations of the school. This instrument uses laser light scattering photometry to measure distinct concentrations of particulate sizes. This unit was zeroed in the field prior to use.

Total Volatile Organic Compounds

VOC measurements were made using a calibrated photo ionization detector (PID) miniRae+ to indicate the levels of total VOCs that have an ionization potential below 10.6 electron volts. This model measures to the parts per million (ppm) level.

RESULTS

Visual Inspection

The following observations were made:

- In the Physics Room, Room 153, one stained ceiling tile was visible, and a repaired gypsum board wall was visible near the teachers' desk. Photograph 1 in Attachment A documents this condition. The tile and wall did not contain elevated moisture. The source of the stained tile was not readily apparent. Also, the metal decking was heavily rusted and rust flakes were visible on the suspended ceiling. Photographs 2 and 3 in Attachment A document this condition.

- In the Physics Room, Room 153, dust was observed on the supply air diffuser fins. Photograph 4 in Attachment A documents this condition. A surface sample for mold content determination was collected from the air diffuser fins in this room and the results indicate that the surface sample collected from this supply air diffuser contains mold growth. The laboratory analytical report detailing these results is included in Attachment B.
- In Classroom 262, three spots of apparent water staining were observed on the ceiling tiles. Photograph 5 in Attachment A documents this condition. One ceiling tile stain in the center of the room appeared to be caused by a leaking pipe, while the cause of the other spots was not immediately obvious.
- In the Conference Room 266E, particulate was observed on the supply air diffuser fins. Photograph 6 in Attachment A documents this condition. A surface sample for mold content determination was collected from the air diffuser fins in this room and the results indicate that the surface sample collected from this supply air diffuser contains mold growth. The laboratory analytical report detailing these results is included in Attachment B.
- In Room 266E, above the suspended ceiling tiles, leaves and debris were settled on the tiles. Suspected animal fur was also visibly mixed in with the leaves. Photograph 7 in Attachment A documents this condition.
- In Room 269 there were no obvious conditions that would be expected to impact the indoor environment. School staff reported that stained tiles, caused by leaks, had recently been replaced in this room.

Moisture Survey

Woodard & Curran conducted a moisture survey in areas noted above on January 14, 2020. The moisture survey was performed in the locations specified above and included ceiling and wallboard materials and carpeting. The moisture survey indicated that the moisture content was less than 15%, indicating dry conditions in each location evaluated.

Direct reading measurements of Temperature and Relative humidity

Indoor temperature levels for occupied areas should be maintained within the thermal comfort envelope suggested by the American Society of Heating Refrigerating and Air Conditioning Engineers (ASHRAE). ASHRAE specifies conditions in which 80% or more of building occupants should find the thermal environment acceptable. ASHRAE suggests temperatures of 68 to 75 degrees Fahrenheit (°F), during winter months, for people in typical seasonal clothing during light sedentary activity. For summer, the temperature should be in the range of 73 to 79 °F.

On the day of the survey, temperature and relative humidity readings throughout the school were made with a direct-reading instrument. The temperature readings in areas intended for occupancy ranged between 69.7 and 78.0°F indicating that the temperature in the areas measured were generally within the guideline of 68 to 75 °F recommended by ASHRAE for thermal comfort for winter months. Several of the locations were slightly above the optimal suggested comfort range for winter months.

The indoor relative humidity readings in occupied portions of the building, also measured with the TSI Q-Trak, ranged from 19.0 to 29.2%. All of the of relative humidity readings were within the guideline of less than 65% recommended by ASHRAE for occupant comfort and for the prevention of microbial growth. It should be noted that these recommended ranges are guidelines and can vary depending on building occupancy, heating system, and seasonal temperature differential.

A summary of the direct-reading measurements for temperature and relative humidity is provided in the Table in Attachment C.

Carbon Monoxide

Common sources of carbon monoxide within indoor environments include internal combustion engines such as motor vehicle and forklift exhaust. Other sources may include tobacco smoke, space heaters, improperly adjusted oil or gas burners and other processes that result in incomplete combustion. The Environmental Protection Agency (EPA) has established a National Ambient Air Quality Standard of 9 ppm for carbon monoxide averaged over an 8-hour period. Typical average concentrations found in a commercial building range from 0 to 6 ppm.

Carbon monoxide readings in select areas of the school were made with a direct-reading instrument. Carbon monoxide readings were all less than the instrument limit of detection of 3 ppm in the occupied interior locations and therefore, were within the EPA's guideline for carbon monoxide.

A summary of the direct-reading measurements for carbon monoxide is provided in the Table in Attachment C.

Carbon Dioxide

Carbon dioxide is a normal constituent of the atmosphere and ranges from about 350 to 500 parts per million (ppm) in outdoor air. The major source of excess carbon dioxide in the indoor environment is human respiration. Other sources can include open-flame heaters, fermentation processes, and motor vehicles. Carbon dioxide itself is not normally a cause of indoor air quality problems but is typically used as an indicator of the adequacy of fresh air ventilation. As the concentration of carbon dioxide increases, so do the background levels of other air contaminants.

Carbon dioxide readings in the areas tested were made with a direct-reading instrument. The interior carbon dioxide concentration for occupied areas was observed to be between 449 and 605 ppm. Interior carbon dioxide levels will fluctuate according to building occupancy.

To minimize air quality complaints, ASHRAE has proposed that the carbon dioxide concentration within an occupied workspace be maintained at or below 700 ppm above ambient exterior (outdoor) levels. For example, on the day of the survey the average outside carbon dioxide level was determined to be 422 ppm. Therefore, ASHRAE would recommend that interior carbon dioxide concentrations be at or below 1,122 ppm. All the carbon dioxide levels measured in occupied areas of the building were found to be within ASHRAE's guideline.

A summary of the direct-reading measurements for carbon dioxide is provided in the Table in Attachment C.

Airborne Particulate

Airborne particulate is a mixture of solid particles and liquid droplets found in the air. Some particles, such as dust, dirt, soot, or smoke, are large or dark enough to be seen with the naked eye. Others are so small they can only be detected using an electron microscope and can be irritating to the respiratory system. Various size particles were measured throughout the occupied areas of the building. The US EPA NAAQS standard for airborne particulate PM-2.5 and PM-10 (airborne particulate matter with size diameters 2.5 and 10 micrometers) is 0.035 mg/m^3 and 0.150 mg/m^3 respectively, measured over a 24-hour period.

Airborne particulate was measured in select areas of the school. The DustTrak DRX can measure airborne particulate with different size ranges including particles that are 1, 2.5, and 10 micrometers in diameter size as well as respirable sized particulate and total particulate. Particulate concentrations of PM-2.5 ranged from 0.001 to 0.010 mg/m^3 and PM-10 from 0.003 to 0.015 mg/m^3 indoors. Measurements of PM-2.5 and PM-10 were all below reference levels in the building.

A summary of the direct-reading measurements for airborne particulate is provided is provided in the Table in Attachment C.

Total Volatile Organic Compounds

VOCs comprise a broad category of chemicals that include components of many common office supplies and products such as paints, solvents, mothballs, some janitorial supplies, photocopiers, insecticides, and building materials such as construction adhesives. Although U. S. Occupational Safety and Health Administration (OSHA) permissible exposure limits (PELs) have been established for many of these individual chemicals, concentrations in typical non-industrial indoor air seldom exceed these limits.

VOC measurements were made using a calibrated photo ionization detector (PID) to indicate the levels of total VOCs that have an ionization potential below 10.6 electron volts. The PID is useful for detecting VOCs to a lower limit of 0.1 ppm calibration gas equivalent. Total VOC levels were all less than the instrument limit of detection of 0.1 ppm in each of the areas evaluated.

A summary of the direct-reading measurements for total VOCs is provided in the Table in Attachment C.

RECOMMENDATIONS

Based on industry guidelines and best management practices, it is recommended that the following steps be taken:

- In the Physics Room, Room 153, the water stained ceiling tile should be replaced and the rust that has fallen from the ceiling deck should be cleaned in a manner that minimizes generation of airborne dust such as using a high efficiency particulate air (HEPA) vacuum. Identify and repair the source of rust on the ceiling deck.
- Wipe clean the supply air diffuser fins in Room 153 and continue to monitor for debris build up on supply air vents.
- In Classroom 262, the water stained ceiling tiles should be replaced. Identify and repair the source of the water staining.
- Wipe clean the supply air diffuser fins in Conference Room 266E and continue to monitor for debris build up on supply air vents.
- In the Conference Room 266E, identify the source of the leaves, debris and suspect fur that was observed above the suspended ceiling and clean this debris in a manner that minimizes generation of airborne dust such as using a high efficiency particulate air (HEPA) vacuum.
- Review the school's rodent control procedures and ensure procedures are being implemented throughout the school.
- In Room 269 identify and repair any roof leaks that could allow water to penetrate into the room.
- Since carpets can act as reservoirs for dirt, debris and allergens, consider replacing the carpet at regular intervals in rooms with carpet, especially older carpet or carpet that has gotten wet. Note that the School's Asbestos Hazard Emergency Response Act (AHERA) records should be reviewed prior to disturbing any building materials.
- As a way to increase occupant comfort during winter months identify ways to keep rooms cooler, by lowering the temperature to the ASHRAE suggests temperatures.

Woodard & Curran appreciates the opportunity to assist you on this project. If you have any questions or require further information, please feel free to email me at whenderson@woodardcurran.com or call me at (781) 251-0489.

Sincerely,

WOODARD & CURRAN INC.

William Henderson, CIH
Project Scientist

Raymond M. Cowan, CIH
Senior Project Manager

Attachment A: Photo Log
Attachment B: Surface Sample Analytical Laboratory Report
Attachment C: Table of Direct-Reading Measurements

ATTACHMENT A: PHOTO LOG

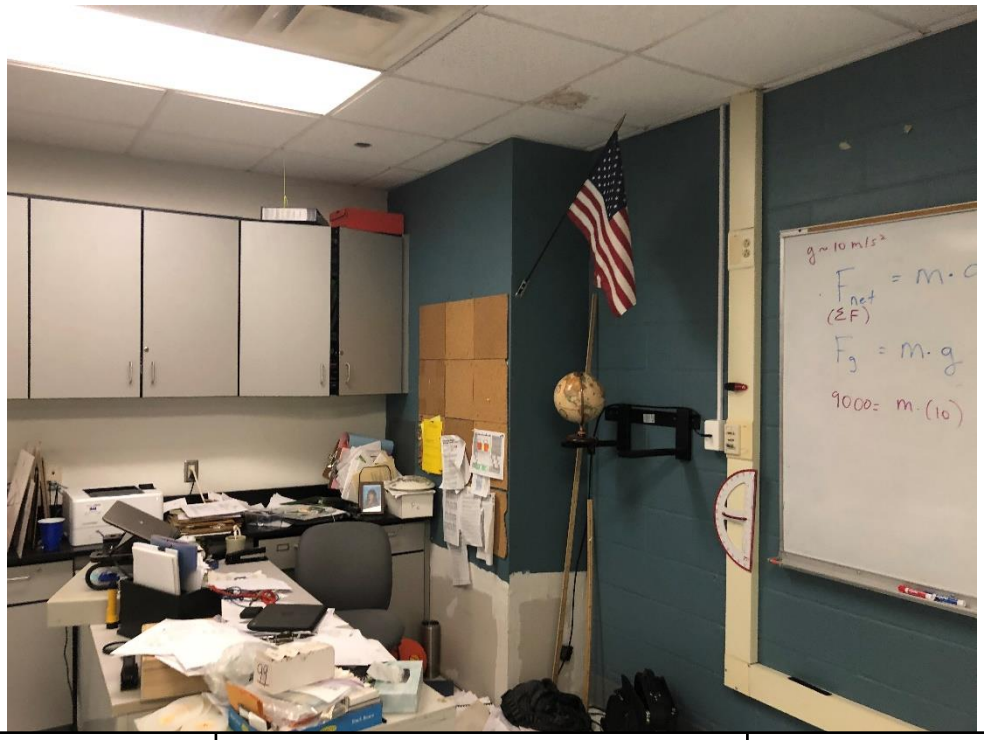

Photo Number: 1	Location: Room 153	Date: January 14, 2020
Description: Stained ceiling and repairs to gypsum board wall		

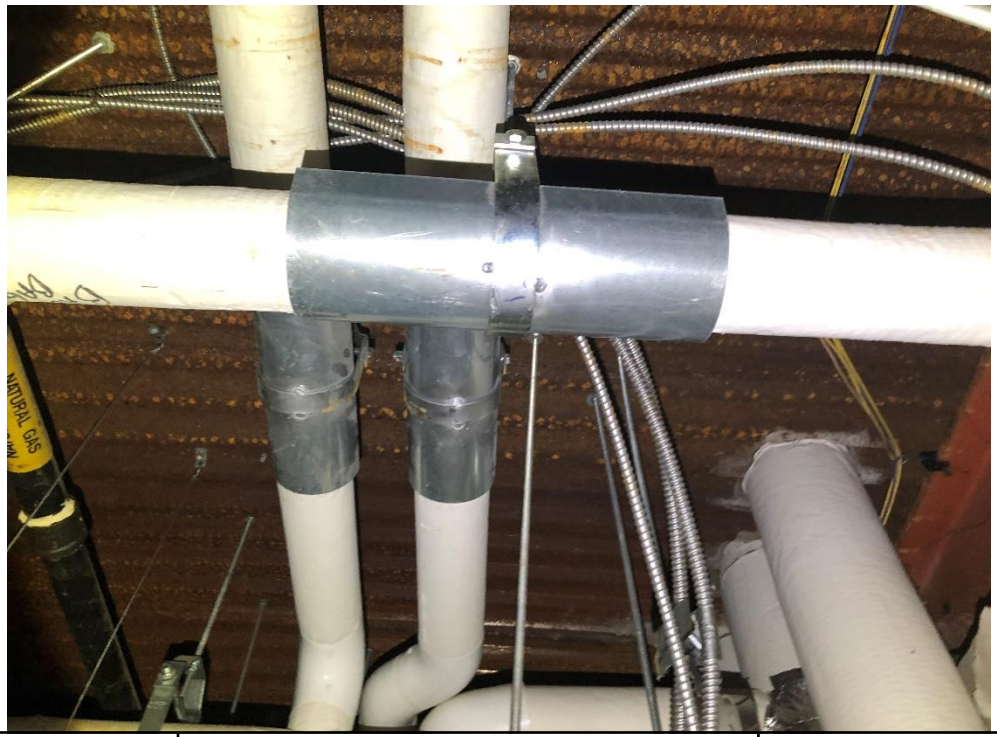

Photo Number: 2	Location: Room 153	Date: January 14, 2020
Description: Rust on ceiling deck		

Photo Number: 3	Location: Room 153	Date: January 14, 2020
Description: Rust particulate on ceiling tiles		

Photo Number: 4	Location: Room 153	Date: January 14, 2020
Description: Particulate on supply air diffuser fins		

Photo Number: 5	Location: Room 262	Date: January 14, 2020
Description: Stained ceiling tile		

Photo Number: 6	Location: Room 266E	Date: January 14, 2020
Description: Particulate on supply air diffuser fins		

Photo Number: 7	Location: Room 266E	Date: January 14, 2020
Description: Leaves, debris, and suspected fur above the suspended ceiling		

ATTACHMENT B: SURFACE SAMPLE ANALYTICAL LABORATORY REPORT

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Report for:

Will Henderson
Woodard & Curran
980 Washington Street
Suite 325
Dedham, MA 02026

Regarding: Project: Fairfield Ludlowe H.S.; Indoor Environmental Assessment
EML ID: 2335407

Approved by:

Technical Manager
Ariunaa Jalsrai

Dates of Analysis:
Direct microscopic exam (Qualitative): 01-16-2020

Service SOPs: Direct microscopic exam (Qualitative) (EM-MY-S-1039)
AIHA-LAP, LLC accredited service, Lab ID #103005

All samples were received in acceptable condition unless noted in the Report Comments portion in the body of the report. Due to the nature of the analyses performed, field blank correction of results is not applied. The results relate only to the samples as received.

Eurofins EMLab P&K ("the Company") shall have no liability to the client or the client's customer with respect to decisions or recommendations made, actions taken or courses of conduct implemented by either the client or the client's customer as a result of or based upon the Test Results. In no event shall the Company be liable to the client with respect to the Test Results except for the Company's own willful misconduct or gross negligence nor shall the Company be liable for incidental or consequential damages or lost profits or revenues to the fullest extent such liability may be disclaimed by law, even if the Company has been advised of the possibility of such damages, lost profits or lost revenues. In no event shall the Company's liability with respect to the Test Results exceed the amount paid to the Company by the client therefor.

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Eurofins EMLab P&K
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(866) 871-1984 Fax (856) 334-1040 www.emlab.com

Client: Woodard & Curran
C/O: Will Henderson
Re: Fairfield Ludlowe H.S.; Indoor Environmental Assessment

Date of Sampling: 01-14-2020
Date of Receipt: 01-16-2020
Date of Report: 01-17-2020

DIRECT MICROSCOPIC EXAMINATION REPORT

Background Debris and/or Description	Miscellaneous Spores Present*	MOLD GROWTH: Molds seen with underlying mycelial and/or sporulating structures†	Other Comments††	General Impression
Lab ID-Version‡: 11117874-1, Analysis Date: 01/16/2020: Tape sample 01: Diffuser 266E				
Light	None	1+ *Cladosporium* species (spores, hyphae, conidiophores)	None	Mold growth
Lab ID-Version: 11117875-1, Analysis Date: 01/16/2020: Tape sample 02: Diffuser 153				
Light	None	1+ *Cladosporium* species (spores, hyphae, conidiophores)	None	Mold growth

* Indicative of normal conditions, i.e. seen on surfaces everywhere. Includes basidiospores (mushroom spores), myxomycetes, plant pathogens such as ascospores, rusts and smuts, and a mix of saprophytic genera with no particular spore type predominating. Distribution of spore types seen mirrors that usually seen outdoors.

† Quantities of molds seen growing are listed in the MOLD GROWTH column and are graded <1+ to 4+, with 4+ denoting the highest numbers.

†† Some comments may refer to the following: Most surfaces collect a mix of spores which are normally present in the outdoor environment. At times it is possible to note a skewing of the distribution of spore types, and also to note "marker" genera which may indicate indoor mold growth. Marker genera are those spore types which are present normally in very small numbers, but which multiply indoors when conditions are favorable for growth.

‡ A "Version" indicated by -"x" after the Lab ID# with a value greater than 1 indicates a sample with amended data. The revision number is reflected by the value of "x".
The limit of detection is < 1+ when mold growth is detected.

ATTACHMENT C: INDOOR AIR QUALITY DIRECT-READING MEASUREMENTS

Indoor Air Quality Direct-Reading Measurements
Fairfield Ludlowe High School
785 Unquowa Rd., Fairfield CT
January 14, 2020

Location	Time	CO (ppm)	CO_2 (ppm)	VOC (ppm)	Temp (ºF)	Relative Humidity (%rh)	Dust Particulate (mg/m^3)				
							PM 1	PM 2.5	RESP	PM 10	Total
Outside	2:20 p	< 3	422	< 0.1	48.9	38.2	0.012	0.012	0.012	0.017	0.017
Room 107	10:45 a	< 3	469	< 0.1	71.0	27.4	0.009	0.010	0.010	0.013	0.013
Room 153	10:56 a	< 3	532	< 0.1	69.7	29.2	0.007	0.007	0.008	0.008	0.008
Room 263	11:15 a	< 3	529	< 0.1	73.4	26.6	0.003	0.003	0.003	0.003	0.003
Room 262	11:19 a	< 3	480	< 0.1	73.1	23.6	0.003	0.003	0.003	0.003	0.003
Office 266E	11:28 a	< 3	503	< 0.1	72.6	25.9	0.005	0.005	0.005	0.007	0.008
Office 266B	11:39 a	< 3	536	< 0.1	72.0	26.6	0.002	0.002	0.005	0.015	0.015
Room 269	11:45 a	< 3	575	< 0.1	72.9	25.1	0.004	0.004	0.004	0.006	0.012
Room 344	11:58 a	< 3	485	< 0.1	72.1	23.1	0.001	0.001	0.002	0.004	0.004
Office 338A	12:07 p	< 3	514	< 0.1	72.1	23.4	0.004	0.004	0.004	0.006	0.014
Room 361	12:15 p	< 3	449	< 0.1	73.5	20.0	0.004	0.004	0.005	0.005	0.006
Room 317	12:27 p	< 3	594	< 0.1	73.9	21.8	0.005	0.005	0.006	0.006	0.006
Room 301	12:39 p	< 3	491	< 0.1	76.5	21.5	0.002	0.002	0.003	0.007	0.007

Location	Time	CO (ppm)	CO_2 (ppm)	VOC (ppm)	Temp (ºF)	Relative Humidity (%rh)	Dust Particulate (mg/m³)				
							PM 1	PM 2.5	RESP	PM 10	Total
Office 286	12:47 p	< 3	605	< 0.1	74.1	19.4	0.003	0.003	0.003	0.008	0.008
Room 202	1:01 p	< 3	515	< 0.1	78.0	19.5	0.003	0.005	0.005	0.006	0.007
Room 107	1:11 p	< 3	452	< 0.1	74.1	19.3	0.003	0.005	0.005	0.007	0.007
Room 153	1:16 p	< 3	499	< 0.1	70.9	20.5	0.004	0.004	0.007	0.007	0.007
Room 262	1:24 p	< 3	518	< 0.1	73.5	18.7	0.003	0.003	0.003	0.004	0.005
Office 266E	1:29 p	< 3	495	< 0.1	69.8	23.5	0.003	0.004	0.004	0.005	0.006
Room 269	1:33 p	< 3	499	< 0.1	73.8	21.0	0.003	0.003	0.003	0.003	0.003
Room 344	1:37 p	< 3	452	< 0.1	72.9	19.1	0.003	0.004	0.006	0.006	0.007
Office 338A	1:47 p	< 3	468	< 0.1	71.3	20.9	0.004	0.004	0.006	0.006	0.008
Room 317	1:54 p	< 3	504	< 0.1	73.2	20.9	0.006	0.006	0.007	0.008	0.008
Room 361	1:58 p	< 3	522	< 0.1	73.5	19.7	0.005	0.005	0.006	0.007	0.007
Room 301	2:02 p	< 3	530	< 0.1	74.8	22.0	0.005	0.006	0.006	0.007	0.008
Office 286	2:07 p	< 3	548	< 0.1	75.3	19.5	0.005	0.006	0.006	0.007	0.008
Room 202	2:11 p	< 3	560	< 0.1	76.6	19.0	0.005	0.005	0.007	0.007	0.007