Intended for

Mr. Tony Rossi
Executive Director for Facilities Operations
Community Consolidated School District 59

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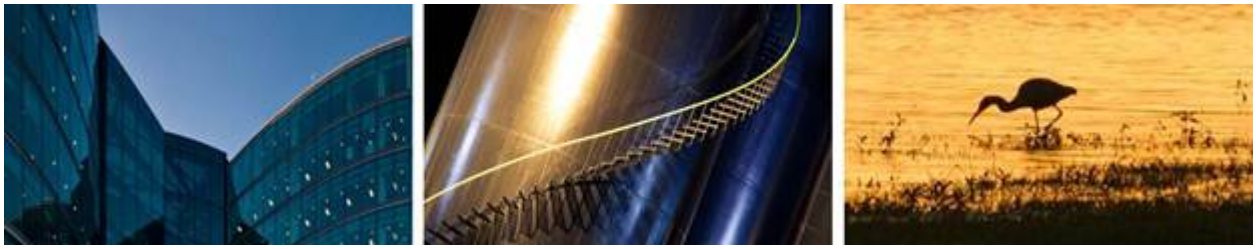
Indoor Environmental Quality Assessment

Community Consolidated School District 59
Frost Elementary School
1308 Cypress Drive
Mount Prospect, Illinois



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Indoor Environmental Quality Assessment
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ACRONYMS AND ABBREVIATIONS

ACGIH	American Conference of Governmental Industrial Hygienists
AIHA	American Industrial Hygiene Association
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers
CO	Carbon Monoxide
CO_2	Carbon Dioxide
District	Community Consolidated School District 59
IAQ	Indoor Air Quality
IEQ	Indoor Environmental Quality
lpm	liters of air per minute
NIOSH	National Institute Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
ppm	parts per million
Ramboll Environ	Ramboll Environ US Corporation
RH	Relative Humidity
spores/m^3	spores per cubic meter of air
USGBC	United States Green Building Council

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EXECUTIVE SUMMARY

An Indoor Environmental Quality (IEQ) assessment was conducted on September 21, 2016 at Frost Elementary School in Mount Prospect, Illinois. The assessment consisted of field observations, environmental measurements for IEQ parameters, and collection of air samples for mold evaluation. The objective was to perform a routine indoor environmental quality (IEQ) assessment at Frost Elementary School. The findings are summarized below, more detailed findings and recommendations are included in the Conclusions and Recommendations section of this report:

Visual Inspection

- *Water damaged drywall was identified in the Learning Center. The water damage was caused by a leaking skylight which has since been repaired. No water infiltration has occurred since the window was sealed. No water stained ceiling tiles were identified in the building.*
- *Visual inspection of the heating, ventilation, and air-conditioning (HVAC) systems found the internal components to be mostly clean. The filters in AHU-2 were loaded and due for replacement. Fins/coils were free of dust accumulation.*
- *No visible mold growth was observed on accessible surfaces.*
- *Photographs of the conditions observed during the assessment can be found in Appendix D.*

IEQ Measurements

Indoor air quality testing parameters included carbon monoxide (CO), carbon dioxide (CO_2), temperature, and relative humidity (RH).

- *Carbon dioxide levels ranged from 466 parts per million (ppm) to 1049 ppm. Indoor CO_2 concentrations were within recommended guidelines in each location where measurements were collected. These measurements suggest that the amount of outside air being brought into the building was sufficient for the number of occupants.*
- *Carbon monoxide testing results were 0.0 ppm throughout the school.*
- *Temperature ranged from 69 degrees Fahrenheit (^0F) to 72^0F throughout the school. These were acceptable temperatures.*
- *Relative humidity (RH) ranged from 54.0 to 65.7* percent (%)*. Levels in Room 119 were slightly above the recommended upper level of 60% but were less than outdoor levels on the day of the assessment.*

Airborne Spore Trap Mold Samples

- *Spore trap mold sample results are unremarkable with concentrations indoors lower than outdoors and common airborne mold types present in both indoor and outdoor samples High outdoor levels measured during this assessment are normal/typical for the season.*

Ventilation Systems

- *There are three air handling units (AHUs) for the building located in the roof penthouse. Overall the AHUs were clean and the filters were in place. The filters in AHU-2 had some dust accumulations present, but are scheduled to be replaced soon.*

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1. INTRODUCTION

An Indoor Environmental Quality (IEQ) assessment was conducted on September 21, 2016 at Frost Elementary School in Mount Prospect, Illinois. The assessment consisted of field observations, environmental measurements for IEQ parameters, and collection of air samples for mold evaluation. The objective was to perform a routine indoor environmental quality (IEQ) assessment at Frost Elementary School.

The assessment was completed by Mr. Scott Fountain, Senior Associate with Ramboll Environ US Corporation (Ramboll Environ). Project oversight was provided by Mr. Robert Livingston, RS, LEHP, Manager with Ramboll Environ. The assessment was performed at the request of Community Consolidated School District 59. On-site assistance was provided by Mr. Greg Tvrdy, Maintenance.

This report is representative of observations, conditions, test data, and information obtained on the days of the assessment. The methodology for the investigation can be found in Appendix B.

2. RESULTS

Results are presented and discussed below. Laboratory reports are included in Appendix C.

2.1 Visual Assessment

On the morning of September 21st, a brief meeting was held with the Frost Elementary School Maintenance Staff to discuss the approach to the assessment. A walkthrough survey of the rooms was conducted to identify conditions which could have a negative effect on the indoor environment. Such conditions can include, odors, water damaged building materials, visible mold growth, non-functioning ventilation systems, leaking or broken plumbing lines etc. The Main Office was specifically investigated due to reported concerns by staff members experiencing allergy type symptoms in the area.

In general, the areas throughout the school were clean and free of abnormal dust accumulation on horizontal surfaces. Carpets or rugs in the classrooms and in the corridors appeared to be visually clean. Water damaged drywall was identified in the Learning Center. The cause of the damage was a leaking skylight which has since been repaired with no further leaks reported. No water stained ceiling tiles were identified. There were no obvious indications of visually apparent mold growth on accessible surfaces in the building and no specific findings noted during the visual inspection.

2.2 Air Quality Measurements

2.2.1 Temperature & Relative Humidity

Temperature and RH are physical conditions which can affect perceptions of indoor air quality by affecting human comfort. Temperature and RH measurements were collected in six (6) indoor locations.

Indoor temperatures on the day of the survey ranged from 69 to 72 degrees Fahrenheit (ºF). Indoor temperature measurements made on the day of the survey were typically within American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) recommended levels for comfort. Results are presented in Table I located in Appendix A.

Indoor RH levels ranged from 54.0 to 65.7 percent. The RH levels measured inside the building were within guidelines except for Room 119 where levels were slightly elevated, but lower than outdoors on the day of the assessment. Results are presented in Table I.

2.2.2 Carbon Dioxide

CO_2 is an odorless, nontoxic gas present in the outdoor air in concentrations usually ranging from 300 to 500 ppm. The primary source of CO_2 in the indoor environment is human respiration. CO_2 concentrations in the indoor air are usually diluted by the introduction of outside air through the ventilation system. During this survey, CO_2 concentrations were measured as a surrogate estimate to determine if the amount of outside air entering the rooms was sufficient for the population.

Measurements for CO_2 were taken outdoors for comparison to the recommended guideline of maintaining indoor levels within 700 ppm of outdoor levels. CO_2 outdoors measured around 400 ppm, therefore 1,100 ppm is used as a guideline.

Results are presented in Table I. CO_2 concentrations were measured in the morning and afternoon from six (6) indoor locations. CO_2 concentrations ranged from 466 to 1,049 ppm. Levels were within the guideline throughout locations include in this assessment. This finding indicates that the amount of outside air provided to these rooms was sufficient for the number of occupants.

2.2.3 Carbon Monoxide

CO is an odorless gas and a chemical asphyxiant produced as a result of incomplete combustion. Exhausts from gas powered vehicles and/or malfunctioning gas or oil fired heaters are common sources of CO in indoor environments. At concentrations exceeding government standards, exposure to CO may cause headaches and/or nausea.

CO concentrations on the day of the survey were either below the detection limit in all of the indoor test locations. Results are presented in Table I.

2.3 Airborne Mold Sampling

A summary of airborne mold spore results are presented in Table II in Appendix A. Laboratory reports are presented in Appendix C.

Mold is ubiquitous in the outdoor environment and produces spores as part of its reproductive cycle; these spores are commonly found airborne in both outdoor and indoor air. Due to ventilation system filtration and the fact that indoor conditions in general do not support mold growth, indoor mold spore counts are typically lower than outdoor counts. However, if sufficient moisture is present, mold can proliferate within a building as the nutrients for its growth are readily available. Currently levels of mold spores are not covered by any regulatory standard.

From experience, spore levels indoors should be lower than those measured outdoors. Buildings without significant mold problems typically are 10% to 60% of outdoor counts, depending on such variables as window openings, outdoor weather conditions, and ventilation system filtration etc.

Air samples for total airborne mold spores were collected from six (6) locations inside the building. Two samples (morning and afternoon) were collected at each location to account for daily variations. Three samples were also collected outdoors to allow for comparison.

Airborne mold levels were lower than outdoor. Outdoor levels were high and consistent with expected seasonal mold levels.

2.4 Ventilation Review

A limited review of the ventilation system serving Frost School was conducted during the survey. All air handling units (AHUs) are located in the roof penthouse. AHU-1 serves the original building, AHU-2 serves the Cafeteria and Gym, and RTU-1 serves the new wing.

The filters in the AHUs are typically replaced every 1-2 months unless maintenance recognizes filter loading prior to that time. In that case filters are changed as needed. During this survey most of the filters were in place and clean. Dust loading was noted on the AHU-2 filters, however these filters are due for replacement so some dust accumulation is expected.

3. CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and recommendations are offered for consideration. They are intended to promote good environmental quality within the school. Implementation of these recommendations are not required by any regulatory agency but would be considered good practice. They should not be construed as the only options available or inclusive of all potential environmental quality parameters within the school.

Findings and recommendations are as follows:

Visual Inspection

- Water damaged drywall was identified in the Learning Center. The source of the water damage (skylight window) has since been fixed with no additional leaks reported. No water stained ceiling tiles were identified in the building. *Monitor the skylights in the Learning Center during and after heavy storms to insure that the leaking skylight has been successfully repaired and that no other skylights develop the same issue.*
- No visual mold growth was observed in accessible areas of the school.
- Visual inspection of the heating, ventilation, and air-conditioning (HVAC) systems found the internal components to be clean. The filters in the AHU's were all clean with the exception of AHU-2 where accumulations of dust are present on the filters. *The filters in AHU-2 are due for replacement so some dust accumulation is to be expected.*
- Photographs of the conditions observed during the assessment can be found in Appendix D.

IEQ Comfort Parameter Testing

Indoor air quality testing parameters included carbon monoxide (CO), carbon dioxide (CO_2), temperature, and relative humidity (RH).

- Carbon dioxide levels ranged from 466 parts per million (ppm) to 1,049 ppm. Indoor CO_2 concentrations were within recommended guidelines in each location where measurements were collected.

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- Carbon monoxide testing results were 0.0 ppm throughout the school. *No recommendation necessary.*
- Temperature ranged from 68.9 degrees Fahrenheit (^{0}F) to 71.7^{0}F throughout the school. *These were acceptable temperatures.*
- Relative humidity (RH) ranged from *54.2 to 65.7%.* Levels throughout the building were acceptable, with the exception of Room 119 where levels exceeded the recommended level of 60%. Although above 60%, this level is consistent with the outdoor readings on the day of the assessment.

Airborne Spore Trap Mold Samples

- Spore trap mold sample results are unremarkable with low airborne mold concentrations. *No recommendation necessary.*

4. CONFIDENTIALITY

Results of this survey are based on conditions present on the day of the survey. This survey was conducted for Community Consolidated School District 59. All aspects of this survey have been treated as strictly confidential. No information has been released to employees or government bodies.

Please contact our office if you have any questions regarding the above report. Ramboll Environ thanks you for the opportunity to be of service.

Sincerely,

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APPENDIX A
DATA TABLES

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Table I
CO_2, CO, Temperature, and Relative Humidity
Frost Elementary School
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September 21, 2016

Location	Time	CO_2 (ppm)	CO (ppm)	Temp (°F)	Relative Humidity (%)
Outside – Main Entrance (south of building)	AM	413	0.0	69.9	76.5
	Noon	375	0.0	74.1	75.7
	PM	400	0.0	78.1	72.6
Learning Center	AM	466	0.0	69.7	58.8
	PM	692	0.0	71.2	54.0
Main Office	AM	466	0.0	70.1	57.0
	PM	710	0.0	71.4	55.4
Room 108	AM	536	0.0	68.9	56.1
	PM	713	0.0	71.7	54.9
Room 119	AM	982	0.0	69.8	64.8
	PM	1049	0.0	70.9	65.7
Room 207	AM	1035	0.0	70.9	59.9
	PM	984	0.0	70.5	58.4
Room 200	AM	830	0.0	71.0	57.4
	PM	927	0.0	71.2	55.5

Table II
Airborne Mold Spore Trap Sample Results
Frost Elementary School
Mount Prospect, Illinois
September 21, 2016

Location	Sample ID	Concentration (spores/m³)
Outside – Main Entrance (south of building)	SF-0921-01	33,660
	SF-0921-08	15,400
	SF-0921-15	13,560
Learning Center	SF-0921-02	600
	SF-0921-09	200
Main Office	SF-0921-03	140
	SF-0921-10	120
Room 108	SF-0921-04	1,840
	SF-0921-11	100
Room 119	SF-0921-05	1,760
	SF-0921-12	460
Room 207	SF-0921-06	3,420
	SF-0921-13	1,420
Room 200	SF-0921-07	2,180
	SF-0921-14	2,360

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APPENDIX B
METHODOLOGY & STANDARDS & GUIDELINES

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METHODOLOGY

The survey included a visual inspection of the areas of concern and areas of no concern, as well as the collection of comfort parameters including temperature, RH, CO, and CO_2 in both areas. The collection of air samples for potential mold contamination was used as a tool to assess the potential for hidden indoor mold growth.

Airborne Mold Sampling

Air testing for airborne mold spores and fungal components were conducted using two methods; total and culturable airborne mold. The total airborne mold samples provides more accurate concentrations since all spores can be identified regardless of whether they are viable or can grow on agar. Culture analysis provides better identification of mold types, often to the species level.

Total mold sampling was conducted using a Burkard spore trap device, which is a slit impactor. The Burkard spore trap uses a pre-greased microscope slide that is inserted into the Burkard and turned on for a pre-determined period of time (typically between 3 and 7 minutes) at a flow rate of 10 liters of air per minute (lpm). The slides are removed, placed in a plastic holding case, and sent to the laboratory for analysis. Samples were analyzed by light microscopy to provide a count and classification for fungal components trapped on the slide.

When mold is not visually apparent and there is no evidence of water intrusion (such as water stains, bubbling paint, efflorescence, etc.), sample results with normal concentrations and genus/species distribution can provide additional confidence that mold growth is not a concern in the test areas. Airborne mold spore levels fluctuate dramatically over time and short term samples should not be interpreted to have the ability of identifying all potential sources of mold. In general airborne mold sampling is subject to false negative results and is therefore used only to augment the visual assessment. Total mold spore analysis was performed via light microscopy by EMLab P&K. in Naperville, Illinois.

Carbon Dioxide

CO_2 is a by-product of human respiration (exhaled air). Measurements of CO_2 concentrations within a building are often used as a surrogate for determining the adequacy of outside air ventilation provided to the space. Measurements for CO_2 were taken at the same times and locations as the airborne mold spore samples were taken. All measurements were made with a TSI Q-Trak. Model 8551.

Temperature & Relative Humidity

Temperature and RH are comfort parameters which are important to the perception of air quality. Temperature and RH readings were obtained at the same locations and times as CO_2 measurements as described above. All measurements were made with a TSI Q-Trak, Model 8551.

Carbon Monoxide

CO is a contaminant gas which may enter an indoor environment from vehicle exhaust gas infiltration, cracked furnace heat exchangers, cross contamination from exhaust stacks, etc. Excess exposure can cause nausea, shortness of breath and headaches. Tests for CO were conducted at the same locations and times as the occupant comfort parameters using the TSI Q-Trak, Model 8551. The calibration certificate is available upon request.

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STANDARDS & GUIDELINES

Many of the airborne contaminants selected for testing have maximum levels of acceptable exposure which are set by various authoritative agencies. Some of the standards, such as those provided by the Occupational Safety and Health Administration (OSHA), American Conference of Governmental Industrial Hygienists (ACGIH), and the National Institute of Occupational Safety and Health (NIOSH) were designed for industrial work environments and are not appropriate for use when assessing IEQ in schools. More stringent voluntary standards which are more suitable for assessing office & educational facility IEQ are available from agencies such as the U.S. Green Building Council (USGBC), American Society of Heating Refrigeration and Air-conditioning Engineers (ASHRAE), and the AIHA.

The following chart, Table I, includes a comparison of various standards for select contaminants and test parameters included in this survey.

Table I
Recommended Exposure Limits and IAQ Guidelines

	Industrial Workplace (Health Based) Standards			Appropriate Standards for Office Environments (Comfort Based)		
Parameter	**OSHA**	**ACGIH**	**NIOSH**	**AIHA**	**ASHRAE**	**USGBC**
Carbon dioxide	5,000 ppm	5,000 ppm	5,000 ppm		Outdoors +700 ppm	-
Temperature	-	-	-	68–76 °F	68–76 °F	-
Relative humidity	-	-	-	30–60% (20% typical during winter)	Variable	-
Carbon monoxide	50 ppm	25 ppm	35 ppm	-	-	9 ppm or 2 above outside

Key: **ppm** =parts per million
IAQ = Indoor Air Quality

Currently, there are no specific State of Illinois or Federal standards for airborne mold. As discussed previously, the current approach to the interpretation of airborne mold sample results relies on comparisons of indoor vs. outdoor results and professional judgment. In general, indoor levels should be lower than outdoor levels with a similar distribution of mold types.

Regarding outdoor mold levels, ambient mold levels fluctuate greatly throughout the year depending upon factors such as geographic location, temperature, humidity, wind velocity, season, precipitation and other variables. In addition to comparing total spore concentrations for indoor versus outdoor samples, it is also important to assess the diversity of mold spores present in sample sets. If the types of mold identified indoors are similar to those identified outdoors, then it is likely the mold identified in the indoor air was present as a result of being brought in from outdoors. If there are substantial differences between the types of mold identified indoors when compared to outdoors, then a source of indoor mold growth is possible even if the total levels are less than outdoors.

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APPENDIX C
LABORATORY REPORTS

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APPENDIX D
PHOTOGRAPHS