OHI

Occupational Health & Safety, Environmental Consultants

OccuHealth, Inc.
44 Wood Avenue
Mansfield, MA 02048

Tel. (508) 339-9119
Tel. (800) 729-1035
Fax (508) 339-2893
j_mcneff@occuhealth.com

November 6, 2020

Millbury Schools
Mr. Rick Bedard
12 Martin Street
Millbury, MA 01527

RE: October 2020 Report for Indoor Air Quality Assessment
Shaw, Elmwood, Middle & High Schools
Millbury, Massachusetts

emailed to: rbedard@millburyschools.org

Dear Mr. Bedard:

OccuHealth, Inc. (OHI) is submitting the enclosed report that documents the results of indoor air quality assessments for carbon monoxide, carbon dioxide, temperature and relative humidity conducted on October 29, 2020 in the Shaw, Elmwood, High School and Middle Schools in Millbury, Massachusetts.

Please call either of the undersigned at (508) 339-9119 with any questions. Thank you for the opportunity to be of continued service.

Regards,
OCCUHEALTH, INC.

Jay McNeff
Senior Project Manager

Thomas E. Hamilton, CIH

JTM/mew

Enclosure

OccuHealth

October 2020 Report for
2020 Indoor Air Quality Assessments
Shaw, Elmwood, Middle & High Schools
Millbury, Massachusetts

Prepared for:

Mr. Rick Bedard
Millbury Public Schools
12 Martin Street
Millbury, MA 01527

Conducted by:

OccuHealth, Inc.
44 Wood Avenue
Mansfield, MA 02048
(508) 339-9119
OHI Project Number: 20-10595

Report Date:

November 6, 2020

October 2020 REPORT FOR
2020 INDOOR AIR QUALITY ASSESSMENTS
SHAW, ELMWOOD, MIDDLE & HIGH SCHOOLS
MILLBURY, MASSACHUSETTS

TABLE OF CONTENTS

EXECUTIVE SUMMARY

OccuHealth, Inc. (OHI) has completed the indoor air quality (IAQ) testing for the Shaw, Elmwood, Middle and High Schools in Millbury, MA. The indoor air quality in the four buildings meets industry standards for the four measured parameters with some minor exceptions noted below. A thorough explanation of the testing protocol and test results are presented in the report.

The measured levels of carbon monoxide and carbon dioxide were well within normal ranges. As discussed in the report, carbon dioxide is an indirect indicator of fresh air supply versus occupancy. Since occupancy is lower than normal and at times additional fresh air is being supplied through open windows, this parameter was found to be at relatively low levels compared to levels we normally experience.

The acceptable levels for temperature and relative humidity are subjective as they relate to human comfort. OccuHealth found that temperatures were generally lower than normally seen in schools due the extra opening of windows to increase ventilation rates to assist with Covid-19 protocols. There appears to be an adjustment period in progress in tuning the heating systems to balance with the extra cold air being supplied from outdoors. In the case of the Middle School, those temperatures were found to be the lowest, most likely due to the earliness in the day for testing combined with the recent transition into heating season.

Recommendations

1. **OHI recommends that Millbury Schools continue to review and modify the HVAC control systems to minimize conditions where the heat is below 65 ºF during occupied hours. The focus of this effort should currently be in the Middle School.**

2. **Millbury Schools can continue to review the Air Changes per Hour (ACH) to see if rooms are sufficiently ventilated and may have the option to close some or all windows to help with the temperature control in the rooms.**

1.0 INTRODUCTION

OccuHealth, Inc. (OHI) was requested to conduct indoor air quality (IAQ) assessments in the Shaw, Elmwood, Middle and High School buildings in Millbury, Massachusetts. During this assessment, OHI measured carbon dioxide concentrations, carbon monoxide levels, temperature, and relative humidity.

This assessment was conducted by Jay McNeff, Senior Project Manager of OHI. This project was requested by Mr. Rick Bedard of Millbury Public Schools.

2.0 CARBON DIOXIDE CONCENTRATIONS

Background

Carbon dioxide (CO_2) in indoor environments is a by-product of human respiration and by itself does not pose an acute health hazard. Elevated levels of CO_2 may serve as an indicator of an insufficient intake of fresh air to the HVAC system or insufficient number of air changes in the environment, and so it is used as a surrogate measurement. The normal ambient (outdoor) level of CO_2 was 415 parts per million by volume (ppm) for the daily reading. CO_2 concentrations typically fluctuate according to the population density, with maximum concentrations occurring at times of high population.

The American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) currently recommends that CO_2 levels be maintained below a maximum of 700 ppm above the measured outdoor level for occupant comfort (ASHRAE 62-2001, Ventilation for Acceptable Indoor Air Quality). The Massachusetts Department of Labor and Workforce Development, Division of Occupational Safety (DOS) recommends that CO_2 levels be maintained below a maximum of 800 ppm during occupied periods.

Symptoms of inadequate supply of fresh air include headaches, dizziness, lightheadedness, and drowsiness often accompanied by a sensation of stuffiness. These effects vary widely from person to person. However, most individuals do not have measurable effects until CO_2 levels exceed 800 ppm.

Monitoring Results

OHI recorded carbon dioxide measurements using a Fluke 975 AirMeter Test Tool, which expresses the concentration of the gas in parts per million (ppm). The carbon dioxide monitoring data are presented by survey date in Appendix A. Based on the recorded outdoor level on the survey date, the applicable ASHRAE-recommended maximum concentrations is 1,115 ppm. The indoor measured carbon dioxide concentrations were below the applicable ASHRAE-recommended maximum concentration. OHI offers no recommendations to further reduce the carbon dioxide concentrations in any of the four buildings.

3.0 CARBON MONOXIDE LEVELS

Background

Carbon monoxide is a by-product of (incomplete) combustion, and is often associated with improperly vented space heaters, boilers, and hot water heaters. Carbon monoxide may also occur from combustion of tobacco products. The current Occupational Safety and Health Administration (OSHA) Permissible Exposure Limit (PEL) for carbon monoxide is 50 ppm, expressed as an eight-hour time-weighted average exposure. Outdoor levels of up to 4 ppm are frequently measured in urban environments.

Monitoring Results

Levels of carbon monoxide were measured using the Fluke 975 AirMeter, which expresses the concentration of the gas in ppm. The carbon monoxide monitoring data are presented by survey date in Appendix A.

All measured carbon monoxide concentrations were less than the instrument detection limit of 0.05 ppm and are reported as 0.0 ppm on the spreadsheets. In OHI's opinion, the carbon monoxide levels are not an indoor air quality concern in any of the four school buildings.

4.0 TEMPERATURE AND RELATIVE HUMIDITY

Background

As stated in ASHRAE Standard 55-2004 Thermal Environmental Conditions for Human Occupancy, there are no established lower humidity limits for thermal comfort; consequently, this standard does not specify a minimum relative humidity level. However, non-thermal comfort factors, such as skin drying, irritation of mucus membranes, dryness of the eyes, and static electricity generation, may place limits on the acceptability of very low humidity environments.

OHI recommends that relative humidity levels be maintained above 30% in order to avoid these problems. During the heating season in New England, very low indoor relative humidity levels are common.

Monitoring Results

The temperature and relative humidity were measured using the Fluke 975 AirMeter. Temperature is expressed in degrees Fahrenheit (°F). Relative humidity is expressed as a percent (%) of saturation. The monitoring results for the IAQ surveys are depicted in the IAQ survey data spreadsheets that are organized by survey date and provided in Appendix A.

The recorded temperatures and relative humidity levels during the assessments in the four buildings are summarized by building below.

Indoor Air Quality Measurements
Milford Public Schools

School	Temperature Range °F	Relative Humidity %	Comments
Shaw	65.3-70.7	45.5-55.1	Acceptable
Elmwood	68.0-75.2	41.0-52.7	Acceptable
High School	65.3-72.5	44.1-53.5	Acceptable
Middle School	61.7-67.1	49.1-59.0	Temperatures on the low side, school transitioning to heating season 1 outlier room (E130) at 56.3 °F and 64.1% RH

For each event, the combined temperature and relative humidity readings generally met the ASHRAE-defined "acceptable range of operative temperature and humidity." The recorded temperature ranges are considered acceptable, but a little low in the Middle School. OHI's perception was the school was transitioning into the heating season and is still adjusting to compensate for open windows being used to provide extra ventilation for the Covid-19 issue.

The first readings of the day were obtained in the Middle School which may account for the early day colder readings. The relative humidity levels were below the levels which can be supportive of a mold growth environment except the one outlier in room E130. This room seemed to have a higher volume of outdoor air (cold) than the others.

5.0 LIMITATIONS

The contents of this report are based on OccuHealth, Inc.'s best professional judgement, comparison of collected data with established industry guidelines, and information obtained from our client.

Appendix A: IAQ Survey Data Spreadsheets for October 2020
Shaw Elementary
Elmwood School
Millbury Middle School
Millbury High School

	Shaw School Page 1						
	29-Oct-20						
	CO2	CO	Temp	Relative	Area	Comments	
	(ppm)	(ppm)	Dry	Humidity	Loading		
Room #			(F)	(%)	(People)		
1	612	0	68.0	48.5	0		
2	634	0	67.1	48.4	0		
3	677	0	66.2	54.8	14		
4	714	0	68.0	55.1	14		
5	722	0	67.1	51.6	12		
6	670	0	67.1	52.3	9		
7	639	0	65.3	52.2	1		
8	624	0	67.1	52.7	4		
9	626	0	66.2	51.8	14		
10	615	0	66.2	50.6	11		
11	588	0	65.3	49.9	8		
12	585	0	68.0	50.1	12		
13	631	0	66.2	50.4	8		
14	618	0	65.3	50.7	7		
15	593	0	66.2	50.4	3		
16	612	0	67.1	49.8	3		
17	557	0	65.3	50.5	3		
18	601	0	66.2	51.9	0		
19	558	0	68.0	50.9	2		
20	617	0	68.0	49.5	8		
21	631	0	68.9	48.1	10		
22A	621	0	68.0	47.5	1		
22B	660	0	69.8	48.3	2		
23	687	0	69.8	47.4	8		
24	645	0	68.9	47.2	0		
25	607	0	68.9	47.4	0		
26 Lounge	628	0	69.8	47.8	0		
27	642	0	70.7	46.6	4		
28 Eddie	660	0	69.8	46.7	1		
29 Band	609	0	67.1	48.2	1		

	Shaw School Page 2					
	29-Oct-20					
	CO2	CO	Temp	Relative	Area	Comments
	(ppm)	(ppm)	Dry	Humidity	Loading	
Room #			(F)	(%)	(People)	
24B	626	0	68.9	47.1	5	
Library Office	578	0	68.0	48.1	0	
34	529	0	68.0	48.2	0	
33	622	0	68.0	47.9	0	
Tamar 4131?	594	0	68.0	47.8	1	
35	560	0	68.0	47.9	0	
36	594	0	68.0	47.7	0	
4230 Conf Room	639	0	69.8	47.1	1	
Front Office	581	0	68.9	47.3	0	
Bowles	585	0	67.1	47.2	0	
Isolation Room	606	0	69.8	46.2	0	
Nurse back	616	0	69.8	45.8	0	
Nurse office	696	0	69.8	46.2	0	
Nurse lobby	600	0	69.8	45.5	0	
Main office	601	0	68.0	47.0	4	
Office conf room	646	0	68.9	48.6	2	
Vault Room	612	0	68.9	46.7	0	
Principal	605	0	66.2	49.1	0	
Vice Principal	576	0	67.1	47.5	0	
OTPT	609	0	69.8	45.5	0	
Psych Room	715	0	68.0	47.5	0	

Elmwood School Page 1

29-Oct-20

Room #	CO2 (ppm)	CO (ppm)	Temp Dry (F)	Relative Humidity (%)	Area Loading (People)	Comments
119	589	0	69.8	52.4	12	
118	606	0	69.8	52.7	12	
117	620	0	69.8	49.6	13	
116	615	0	68.9	51.1	0	
115	600	0	69.8	48.2	1	
114	558	0	68.0	51.2	13	
126	582	0	68.9	50.0	1	
125	555	0	68.9	49.2	15	
124	544	0	69.8	48.3	1	
122	550	0	70.7	49.0	14	
121	567	0	69.8	48.2	2	
120	580	0	71.6	46 . 3	1	
102	590	0	69.8	48.0	12	
104	592	0	73.4	46.0	13	
105	707	0	73.4	43.3	5	
107	475	0	71.6	45.0	10	
108	426	0	68.9	48.2	9	
110	509	0	69.8	48.2	14	
Food Service	705	0	70.7	46.1	1	
Gym Office	451	0	69.8	46.9	1	
211	522	0	70.7	46.4	2	
209	567	0	69.8	47.1	10	
208	533	0	68.9	48.2	8	
204	511	0	71.6	45.7	11	
203	519	0	72.5	44.6	9	
202	549	0	74.3	43.6	12	
221	530	0	74.3	42.4	2	
222	572	0	75.2	42.3	5	
223	587	0	74.3	44.8	2	
224	700	0	74.3	43.7	1	
225	601	0	73.4	44.8	11	
226	620	0	73.4	44.3	1	

Elmwood School Page 2

29-Oct-20

Room #	CO2 (ppm)	CO (ppm)	Temp Dry (F)	Relative Humidity (%)	Area Loading (People)	Comments
215	604	0	73.4	44.7	1	
216	657	0	72.5	45.7	0	
217	671	0	73.4	43.9	0	
218	581	0	73.4	44.3	2	
219	536	0	74.3	43.3	2	
220	630	0	76.1	41.0	0	
Speech	590	0	75.2	42.7	6	
OT	613	0	73.4	43.3	0	
OT Office	591	0	73.4	43.4	2	
Math Office	618	0	74.3	42.4	1	
Conf Room	562	0	74.3	42.0	0	
Ecc Office	570	0	73.4	43.3	1	
Teacher's Lounge	590	0	74.3	42.0	0	
IT Office	561	0	72.5	44.3	0	
Main Office	558	0	71.6	45.9	2	
Principal	582	0	71.6	45.1	0	
Psych office	605	0	71.6	44.8	0	
Vice Princ.	570	0	71.6	45.1	1	
Nurse (3 rms)	566	0	71.6	45.6	1	
Nurse Exam	602	0	71.6	45.3	0	
Café office	642	0	71.6	43.8	0	

Middle School

29-Oct-20

Room #	CO2 (ppm)	CO (ppm)	Temp Dry (F)	Relative Humidity (%)	Area Loading (People)	Comments
Olivieri	565	0	66.2	50.5	0	
E233	548	0	66.2	51.4	5	
E229	565	0	65.3	52.8	5	
E228	547	0	64.4	52.2	4	
E227	552	0	64.4	52.6	1	
E224	598	0	67.1	50.8	10	
E223	553	0	62.6	53.9	0	
E204	551	0	67.1	49.1	0	
Teachers Lounge	538	0	62.6	53.6	0	
E205	518	0	65.3	52.1	2	
E206	580	0	65.3	51.8	0	
E213	605	0	67.1	52.3	11	
E212	567	0	65.3	53.7	7	
E211	571	0	63.5	53.1	8	
E210	577	0	65.3	52.8	9	
E110	576	0	64.4	53.2	3	
E105	556	0	63.5	53.4	6	
E104	522	0	63.5	53.7	5	
E103	515	0	61.7	54.5	0	univent off?
Guidance	561	0	64.4	53.4	1	
Jr High office	564	0	61.7	55.7	1	
Asst Prin	520	0	64.4	52.5	1	
E138	544	0	63.5	54.1	10	
E136	551	0	61.7	59.0	11	
E135	554	0	62.6	54.7	3	
E133	531	0	64.4	53.3	0	
E130	537	0	56.3	64.1	14	
Outdoors	415	0	54.5	68.9		

High School Page 1

29-Oct-20

Room #	CO2 (ppm)	CO (ppm)	Temp Dry (F)	Relative Humidity (%)	Area Loading (People)	Comments
Athletic Director	551	0	68.9	46.7	1	
D110	572	0	70.7	48.4	11	
Faculty Lounge	587	0	69.8	47.3	0	
Nurse	525	0	70.7	53.5	2	
Covid Room	570	0	70.7	48.6	0	
C132	625	0	73.4	45.8	3	
C135	600	0	70.7	48.2	6	
C124	677	0	70.7	47.3	6	
C120	641	0	67.1	49.2	1	
C115	611	0	68.0	49.7	11	
Tech Ed	625	0	68.9	47.0	0	
Music Room	553	0	67.1	51.9	0	
Band Office	521	0	67.1	47.3	1	
TV Studio	454	0	68.0	47.3	0	
IT	549	0	69.8	47.1	1	
A145	547	0	69.8	47.2	0	
Office	578	0	70.7	45.5	2	
Vice Prin	548	0	70.7	46.4	1	
Conf Room	554	0	71.6	44.1	0	
Guidance	628	0	69.8	46.3	1	
Psychology	555	0	68.9	47.9	2	
Principal	653	0	69.8	47.1	2	
Pupil Services	575	0	68.0	48.7	1	
B112	582	0	72.5	45.2	0	
B133	546	0	67.1	50.8	6	
B131	598	0	67.1	49.3	12	
Home Making	560	0	70.7	48.2	12	
Caf A	558	0	67.1	49.9	0	
Library	586	0	68.0	48.2	7	
AA115	591	0	69.8	47.3	1	
A114	545	0	68.9	48.2	1	

High School Page 2

29-Oct-20

Room #	CO2 (ppm)	CO (ppm)	Temp Dry (F)	Relative Humidity (%)	Area Loading (People)	Comments
A113	692	0	68.9	49.9	14	
A110	683	0	67.1	50.2	4	
A106	627	0	68.0	49.0	6	
A103	637	0	68.9	48.2	1	
A215	677	0	67.1	49.3	9	
A201	683	0	68.0	48.9	12	
A203	660	0	68.0	49.1	13	
A205	650	0	68.0	48.9	8	
A207	676	0	68.9	48.3	6	
A208	660	0	71.6	46.4	9	
A209	659	0	70.7	46.6	7	
A211	646	0	68.9	47.8	8	
B201	599	0	67.1	50.5	11	
B202	651	0	68.9	48.7	10	
B205	636	0	68.9	47.7	11	
B206	583	0	65.3	51.0	11	
B207	584	0	65.3	50.5	9	
B209	564	0	67.1	49.5	10	
Art	626	0	66.2	50.3	5	
B216	586	0	66.2	50.1	1	
Foreign Lang	605	0	66.2	49.7	0	
B220	536	0	66.2	51.0	10	
B222	594	0	68.9	50.3	13	
B224	651	0	68.0	49.1	4	