



Occupational Health & Safety, Environmental Consultants

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September 21, 2020

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

RE: Volumetric Air Flow Evaluation
Millbury Public Schools

emailed to: rbedard@millburyschools.org

Dear Mr. Bedard:

OccuHealth, Inc. (OHI) is presenting this report to document the results of a study of the volumetric air flow rates in selected rooms of the Millbury Public Schools. The assessment was conducted on September 16, 2020 by Mr. Jay McNeff, Senior Project Manager of OHI under the direction of Thomas E. Hamilton, CIH. The assessment involved the measurement of air flow rates in nearly every classroom in the Millbury Junior/Senior High School located at 12 Martin Street, the Shaw Elementary School located at 58 Elmwood Street and the Elmwood Street Elementary School located at 40 Elmwood Street all in Millbury, Massachusetts.

The purpose of the work was to determine if the number of air changes per hour provided by the air handling equipment meets the current guidelines for air exchange rates as recommended by consensus groups and the Harvard School of Public Health in response to the Covid-19 pandemic. This assessment was requested and authorized by Mr. Rick Bedard of the Millbury Public Schools.

In summary, OHI found that the rate of air changes per hour in the measured classrooms varies. The study shows there are a few rooms that are in need of additional volumetric air flow to meet the target rate of four to six air changes per hour. At this time it may be possible to meet the target rate by opening windows and doors to get additional air changes. The practice of opening windows will help to meet the current need for additional air changes until the outdoor weather requires that the windows be closed. This gives the facilities staff approximately six additional weeks of time to effect changes to improve the air change rates in the rooms that require extra amounts of volumetric air flow.

MEASUREMENTS

Background Information

Mr. Bedard contracted with OHI to evaluate classrooms in the schools to determine if the air exchange rates (air changes per hour) provided by the mechanical systems were adequate. For evaluation of the data, OHI compared the results to the current guidelines which are available for reopening of schools. One set of guidelines were published by the ASHRAE Epidemic Task Force to provide guidance for schools and universities on the operation of HVAC systems to help mitigate the airborne transmission of SARS-CoV-2 as schools prepare to reopen for the fall academic year. In their publication, ASHRAE recommends that air handling systems provide a minimum of 6 air changes per hour to locations such as nurses offices. The full document can be found at:

<https://www.ashrae.org/about/news/2020/ashrae-introduces-updated-reopening-guide-for-schools-and-universities>

In another study, the Harvard T. H. Chan School of Public Health recommends that schools provide up to 5 air changes per hour for classroom and that the opening of windows can provide between 2 to 10 additional air changes per hour above that provided by the school mechanical systems. Their recommendations state that for schools the minimum standard is 3 air changes per hour, that 4 changes is good, 5 is excellent and 6 is ideal. A discussion of the Harvard study can be found at:

<https://www.hsph.harvard.edu/news/features/coronavirus-covid-19-press-conference-with-joseph-allen-09-02-20/>

Harvard also states that you may supplement HVAC systems with portable air cleaners if necessary by using HEPA filtered air cleaning devices. If this is done, you may quickly see the effect on air changes per hour by entering the rated cfm of the units into the spreadsheet prepared for this work in the column listed as “HEPA recirculated air.”

Measured Air Flows

OHI collected air flow measurements in nearly all of the classroom in the four schools and calculated the air changes per hour for each. The results are shown in the charts in the appendix. They show that there are some rooms that are in need of additional volumetric air flow to meet the target rate of 4 to 6 air changes per hour or at least the minimum of 3 air changes per hour. This can be accomplished in the short term (until the heating season) by opening windows and doors in the rooms/classrooms which will add at least 2 air changes per hour to the room. Other options include mechanical repair/upgrade or simple speed increase of existing units. AC units can also recirculate air to increase a room ACH. A long term solution would be to install free standing HEPA air cleaning devices. This method of enhancing air flow in rooms is recommended by all consensus agencies such as ASHRAE, the CDC, and by Harvard.

The following is a summary narrative of the findings for each school:

- The Shaw Elementary School had 2 classrooms (7 and 18) and the Band room (29) with measured ACH less than 4, but all three rooms have existing supplemental window AC units which would bring the ACH level to 4 or above if they were operating. A few other non-classrooms also had low ACH values due to an HVAC unit that was not operational or none existed.
- The Elmwood School had no classrooms with an ACH below 4 and only a few office or miscellaneous rooms with ACH below 4.
- The High School only had two classrooms with an ACH of less than 3 (room B224 was turned off) with only a few others between 3 and 4 and the balance above 4. A few rooms in the high school could not be measured due to high ceilings or blocked placement of diffusers.
- The Junior High School had no rooms found with an ACH below 4.

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.

Thank you for the opportunity to be of service. Please call either of the undersigned at 508-339-9119 with any questions regarding this report.

Regards,
OCCUHEALTH, INC.



Jay McNeff, Sr. Project Manager



Thomas E. Hamilton, CIH

ATTACHMENTS

Shaw School ACH Data Sheets

Elmwood School ACH Data Sheets

High School ACH Data Sheets

Junior High School ACH Data Sheet

Shaw School Page 1												
16-Sep-20												
Room #	AC?	Width	Length	Square Footage	Height	Room Volume Cubic Feet	Room Volume Net cubic feet	Supply Air cfm	HEPA Recirculated air cfm	Total Air Flow cfm	ACH changes per hour	Notes
1	Y	30	31	930	8	7440	7440	500		500	4.0	
2		30	28	840	8	6720	6720	480		480	4.3	
3	Y	30	30	900	8	7200	7200	490		490	4.1	AC 530cfm
4	Y	30	28	840	8	6720	6720	450		450	4.0	
5		25	30	750	8	6000	6000	430		430	4.3	AC 520 cfm
6		30	28	840	8	6720	6720	520		520	4.6	
7	Y	30	27	810	8	6480	6480	160		160	1.5	AC 420
8	Y	30	37	1110	8	8880	8880	650		650	4.4	AC 540
9	Y	27	27	729	8	5832	5832	490		490	5.0	
10		30	27	810	8	6480	6480	470		470	4.4	
11		30	27	810	8	6480	6480	530		530	4.9	
12		30	27	810	8	6480	6480	520		520	4.8	
13	Y	30	27	810	8	6480	6480	400		400	3.7	
14	Y	30	27	810	8	6480	6480	450		450	4.2	
15		30	27	810	8	6480	6480	520		520	4.8	
16	Y	30	26	780	8	6240	6240	510		510	4.9	
17		30	27	810	8	6480	6480	450		450	4.2	
18	Y	30	27	810	8	6480	6480	170		170	1.6	AC 600
19		30	27	810	8	6480	6480	530		530	4.9	
20	Y	30	27	810	8	6480	6480	450		450	4.2	
21		30	27	810	8	6480	6480	540		540	5.0	
22A		16	32	512	8	4096	4096	470		470	6.9	
22B		16	32	512	8	4096	4096	0		0	0.0	
23		30	27	810	8	6480	6480	580		580	5.4	
24	Y	30	27	810	8	6480	6480	590		590	5.5	
25		30	28	840	8	6720	6720	620		620	5.5	
26 Lounge	Y	30	27	810	8	6480	6480	570		570	5.3	
27	Y	32	47	1504	8	12032	12032	625		625	3.1	AC - ceiling unit
28 Eddie	Y	30	36	1080	8	8640	8640	540		540	3.8	
29 Band	Y	30	30	900	12	10800	10800	320		320	1.8	AC 400

Shaw School Page 2												
Room #	AC?	Width	Length	Square Footage	Height	Room Volume Cubic Feet	Room Volume Net cubic feet	Supply Air cfm	HEPA Recirculated air cfm	Total Air Flow cfm	ACH changes per hour	Notes
24B		15	35	525	8	4200	4200	690		690	9.9	
Library Office		15	19	285	8	2280	2280	270		270	7.1	
34		16	30	480	8	3840	3840	0		0	0.0	No air
33		16	30	480	8	3840	3840	0		0	0.0	No air
Tamar 4131?		12	14	168	8	1344	1344	320		320	14.3	
35		16	12	192	8	1536	1536	320		320	12.5	
36		16	12	192	8	1536	1536	310		310	12.1	
4230 Conf Room		10	32	320	8	2560	2560	480		480	11.3	
Front Office	Y	16	16	256	8	2048	2048	550		550	16.1	
Bowles	Y	12	8	96	8	768	768	170		170	13.3	
Isolation Room	Y	12	8	96	8	768	768	180		180	14.1	
Nurse back	Y	12	24	288	8	2304	2304	270		270	7.0	
Nurse office	Y	12	8	96	8	768	768	150		150	11.7	
Nurse lobby	Y	12	8	96	8	768	768	140		140	10.9	
Main office	Y	14	30	420	8	3360	3360	630		630	11.3	
Office conf room	Y	14	10	140	8	1120	1120	210		210	11.3	
Vault Room	Y	14	10	140	8	1120	1120	245		245	13.1	
Principal	Y	10	16	160	9	1440	1440	270		270	11.3	
Vice Principal	Y	10	16	160	9	1440	1440	180		180	7.5	
OTPT	Y	12	20	240	8	1920	1920	150		150	4.7	
Psych Room		19	15	285	8	2280	2280	190		190	5.0	

Elmwood School Page 1

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Room #	AC?	Width	Length	Square Footage	Height	Room Volume Cubic Feet	Room Volume Net cubic feet	Supply Air cfm	HEPA Recirculated air cfm	Total Air Flow cfm	ACH Air changes per hour	Notes
119		32	28	896	8.5	7616	7616	720		720	5.7	
118		32	28	896	8.5	7616	7616	730		730	5.8	
117		32	28	896	8.5	7616	7616	820		820	6.5	
116		32	28	896	8.5	7616	7616	610		610	4.8	
115		32	40	1280	8.5	10880	10880	1000		1000	5.5	
114		32	40	1280	8.5	10880	10880	1120		1120	6.2	
126		32	28	896	8.5	7616	7616	880		880	6.9	
125		32	28	896	8.5	7616	7616	940		940	7.4	
124		32	28	896	8.5	7616	7616	1000		1000	7.9	
122		32	28	896	8.5	7616	7616	900		900	7.1	
121		32	28	896	8.5	7616	7616	540		540	4.3	
120		32	28	896	8.5	7616	7616	700		700	5.5	
102		28	40	1120	8	8960	8960	620		620	4.2	
104		28	40	1120	8	8960	8960	960		960	6.4	
105		28	40	1120	8	8960	8960	760		760	5.1	
107		28	40	1120	8	8960	8960	980		980	6.6	
108		28	40	1120	8	8960	8960	650		650	4.4	
110		28	40	1120	8	8960	8960	640		640	4.3	
Food Service		10	24	240	8	1920	1920	100		100	3.1	
Gym Office		10	24	240	8	1920	1920	240		240	7.5	
211		28	40	1120	8	8960	8960	840		840	5.6	
209		28	40	1120	8	8960	8960	580		580	3.9	
208		28	40	1120	8	8960	8960	780		780	5.2	
204		28	40	1120	8	8960	8960	760		760	5.1	
203		28	40	1120	8	8960	8960	790		790	5.3	
202		32	28	896	8	7168	7168	780		780	6.5	
221		32	28	896	8	7168	7168	830		830	6.9	
222		32	28	896	8	7168	7168	990		990	8.3	
223		32	28	896	8	7168	7168	930		930	7.8	
224		32	28	896	8	7168	7168	740		740	6.2	
225		32	28	896	8	7168	7168	820		820	6.9	
226		32	28	896	8	7168	7168	820		820	6.9	

Elmwood School Page 2

Room #	AC?	Width	Length	Square Footage	Height	Room Volume Cubic Feet	Room Volume Net cubic feet	Supply Air cfm	HEPA Recirculated air cfm	Total Air Flow cfm	ACH Air changes per hour	Notes
215		32	28	896	8.5	7616	7616	870		870	6.9	
216		32	28	896	8.5	7616	7616	900		900	7.1	
217		32	28	896	8.5	7616	7616	730		730	5.8	
218		32	28	896	8.5	7616	7616	850		850	6.7	
219		32	28	896	8.5	7616	7616	1010		1010	8.0	
220		32	28	896	8.5	7616	7616	780		780	6.1	
Speech		24	34	816	8.5	6936	6936	660		660	5.7	
OT		22	34	748	8.5	6358	6358	740		740	7.0	
OT Office		10	12	120	8.5	1020	1020	250		250	14.7	
Math Office		22	24	528	8.5	4488	4488	340		340	4.5	
Conf Room		20	24	480	8.5	4080	4080	450		450	6.6	
Ecc Office		12	12	144	8.5	1224	1224	220		220	10.8	
Teacher's Lounge		24	24	576	8.5	4896	4896	310		310	3.8	
IT Office		10	25	250	8.5	2125	2125	220		220	6.2	
Main Office		16	40	640	8.5	5440	5440	200		200	2.2	
Principal		16	12	192	8.5	1632	1632	200		200	7.4	
Psych office		15	10	150	8.5	1275	1275	0		0	0.0	
Vice Princ.		26	12	312	8.5	2652	2652	125		125	2.8	
Nurse (3 rms)		20	20	400	8.5	3400	3400	135		135	2.4	
Nurse Exam		10	20	200	8.5	1700	1700	70		70	2.5	
Café office		6	12	72	8.5	612	612	90		90	8.8	

High School Page 1												
Room #	AC?	Width	Length	Square Footage	Height	Room Volume Cubic Feet	Room Volume Net cubic feet	Supply Air cfm	HEPA Recirculated air cfm	Total Air Flow cfm	ACH changes per hour	Notes
Athletic Director		8	24	192	8	1536	1536	320		320	12.5	
D110		24	30	720	8	5760	5760	600		600	6.3	
Faculty Lounge		24	31	744	8	5952	5952	780		780	7.9	
Nurse		10	16	160	8	1280	1280	390		390	18.3	
Covid Room		10	8	80	8	640	640	0		0	0.0	
C132		36	24	864	9	7776	7776	600		600	4.6	
C135		36	24	864	9	7776	7776	610		610	4.7	
C124		36	24	864	9	7776	7776	590		590	4.6	
C120		34	32	1088	9	9792	9792	930		930	5.7	
C115		36	40	1440	10	14400	14400	260		260	1.1	could not do 4 diff up high
Tech Ed		34	20	680	9	6120	6120	340		340	3.3	
Music Room				0		0	0	0		0	#DIV/0!	high ceiling
Band Office				0		0	0	0		0	#DIV/0!	high ceiling
TV Studio		26	28	728	9	6552	6552	600		600	5.5	estimate, 2 diffusers partly blocked
IT		16	30	480	8	3840	3840	750		750	11.7	
A145		34	30	1020	8	8160	8160	860		860	6.3	
Office		16	26	416	7	2912	2912	460		460	9.5	
Vice Prin		12	20	240	7	1680	1680	250		250	8.9	
Conf Room		24	11	264	7	1848	1848	640		640	20.8	
Guidance		32	12	384	7	2688	2688	165		165	3.7	
Psychology		33	12	396	7	2772	2772	234		234	5.1	
Principal				0		0	0	0		0	#DIV/0!	slot diffusers inaccessible to measure
Pupil Services		39	20	780	7	5460	5460	610		610	6.7	
B112		16	24	384	8	3072	3072	740		740	14.5	
B133		25	32	800	8	6400	6400	890		890	8.3	
B131		25	32	800	8	6400	6400	550		550	5.2	
Home Making		22	50	1100	8	8800	8800	720		720	4.9	
Caf A		68	40	2720	9	24480	24480	5200		5200	12.7	
Library				0		0	0	0		0	#DIV/0!	high ceiling
AA115		30	30	900	8.5	7650	7650	650		650	5.1	
A114		30	28	840	8.5	7140	7140	650		650	5.5	

High School Page 2												
16-Sep-20												
Room #	AC?	Width	Length	Square Footage	Height	Room Volume Cubic Feet	Room Volume Net cubic feet	Supply Air cfm	HEPA Recirculated air cfm	Total Air Flow cfm	ACH Air changes per hour	Notes
A113		46	30	1380	8.5	11730	11730	320		320	1.6	low speed?
A110		30	38	1140	8.5	9690	9690	630		630	3.9	
A106		42	30	1260	8.5	10710	10710	540		540	3.0	
A103		28	30	840	8.5	7140	7140	640		640	5.4	
A215		28	50	1400	8.5	11900	11900	2610		2610	13.2	
A201		28	30	840	8.5	7140	7140	750		750	6.3	
A203		38	30	1140	8.5	9690	9690	610		610	3.8	
A205		38	30	1140	8.5	9690	9690	600		600	3.7	
A207		38	30	1140	8.5	9690	9690	550		550	3.4	
A208		28	30	840	8.5	7140	7140	830		830	7.0	
A209		30	30	900	8.5	7650	7650	610		610	4.8	
A211		32	28	896	8.5	7616	7616	590		590	4.6	
B201		24	32	768	8.5	6528	6528	510		510	4.7	
B202		24	32	768	8.5	6528	6528	500		500	4.6	
B205		24	32	768	8.5	6528	6528	530		530	4.9	
B206		24	32	768	8.5	6528	6528	520		520	4.8	
B207		24	32	768	8.5	6528	6528	510		510	4.7	
B209		24	32	768	8.5	6528	6528	730		730	6.7	
Art		38	36	1368	8.5	11628	11628	600		600	3.1	
B216		26	12	312	8	2496	2496	240		240	5.8	
Foreign Lang		16	12	192	8	1536	1536	260		260	10.2	
B220		30	26	780	8.5	6630	6630	590		590	5.3	
B222		26	32	832	8.5	7072	7072	560		560	4.8	
B224		26	36	936	8.5	7956	7956	0		0	0.0	off

Junior High School												
Room #	AC?	Width	Length	Square Footage	Height	Room Volume Cubic Feet	Room Volume Net cubic feet	Supply Air cfm	HEPA Recirculated air cfm	Total Air Flow cfm	ACH changes per hour	Notes
Oliveri		8	10	80	8	640	640	50		50	4.7	
E233		26	36	936	8.5	7956	7956	700		700	5.3	
E229		26	38	988	8.5	8398	8398	580		580	4.1	
E228		32	38	1216	8.5	10336	10336	740		740	4.3	
E227		24	36	864	8.5	7344	7344	510		510	4.2	
E224		26	32	832	8.5	7072	7072	880		880	7.5	
E223		24	36	864	8.5	7344	7344	800		800	6.5	
E204		24	36	864	8.5	7344	7344	1380		1380	11.3	
Teachers Lounge		26	20	520	8.5	4420	4420	900		900	12.2	
E205		36	24	864	8.5	7344	7344	600		600	4.9	
E206		36	24	864	8.5	7344	7344	710		710	5.8	
E213		36	24	864	8.5	7344	7344	550		550	4.5	
E212		36	24	864	8.5	7344	7344	710		710	5.8	
E211		36	24	864	8.5	7344	7344	610		610	5.0	
E210		38	24	912	8.5	7752	7752	970		970	7.5	
E110		38	24	912	8	7296	7296	780		780	6.4	
E105		36	24	864	8	6912	6912	700		700	6.1	
E104		36	24	864	8	6912	6912	930		930	8.1	
E103		36	24	864	8	6912	6912	780		780	6.8	
Guidance		12	24	288	8	2304	2304	900		900	23.4	
Jr High office		16	24	384	8	3072	3072	200		200	3.9	
Asst Prin		14	14	196	8	1568	1568	135		135	5.2	
E138		36	24	864	8	6912	6912	700		700	6.1	
E136		40	24	960	8	7680	7680	860		860	6.7	
E135		34	38	1292	8	10336	10336	990		990	5.7	
E133		34	24	816	8	6528	6528	740		740	6.8	
E130		36	24	864	8	6912	6912	860		860	7.5	