



Norfolk County Agricultural High School Indoor Air Quality Study and Recommendations

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IAQ STUDY SUMMARY

In light of the recent ongoing health concerns worldwide, Norfolk County Agricultural High School has engaged WB Engineers (WB) to analyze the existing classrooms and offices at Norfolk County Agricultural High School to develop an understanding of the current HVAC system as well as explore methods to maximum the ventilation and increase Indoor Air Quality to help reduce the spread of COVID-19 within the school. In the attached excel file, a description of each room and associated recommendations can be found. Please note this report includes 4 of the 8 total buildings. The remainder will be provided in a separate report.

During the study, WB focused on (2) key improvements, increased outdoor air and increased filtration, to better the indoor air quality and adhere to ASHRAE and CDC recommendations. In order to assess each room on a case by case basis, WB determined if the rooms were served by a central HVAC system (i.e. a roof top unit (RTU) or a central air handling unit (AHU)) and if they were not, if any other means of providing ventilation air in the space existed(i.e. unit ventilators, operable windows, or providing portable air filters). A complete breakdown of our findings can be found in the attached excel file. Below is a brief summary of the excel file. Additionally, please refer to Appendix A for more information regarding the approach to this study.

Buildings 3, 4, and 9 were largely served by heating only unit ventilators and centralized exhaust air fans. Each unit ventilator did have an outdoor air intake and a method of filtration. All buildings discussed in this report were not tied into the Building Management System (BMS). WB recommends that for all unit ventilators the filters be replaced with new and be changed on a regular basis. Additionally, the exhaust air fans speed shall be increased if possible, to account for larger amounts of OA being brought in by the unit ventilators. For outdoor air recommendations for typical school spaces please refer to Table 1 below. Additional outdoor air rates and code requirements can be found in Appendix B.

	Code Required OA (CFM/SF)		Covid-19 Recommendation (CFM/SF)	
	50% Occupancy	100% Occupancy	50% Occupancy	100% Occupancy
Auditoriums	0.44	0.81	0.57	1.05
Classrooms	0.30	0.47	0.38	0.61
Day Care	0.31	0.43	0.40	0.56
Media Center	0.25	0.37	0.32	0.48
Music	0.24	0.41	0.31	0.53
Science Lab	0.31	0.43	0.40	0.56
Wood/Metal Shops	0.28	0.38	0.36	0.49

Table 1: Outdoor air rates per space type within a school based on Table 2 (in Appendix B)

Please note that along with this, WB also recommends opening the windows during the weather permitting months, even if the room is served by a unit ventilator. When the weather prohibits open windows (i.e. rain, snow, colder temperatures), WB recommends the use of portable air cleaners to provide added filtration and air changes even in the rooms with unit ventilators. Please note that for all the spaces served by univents, or heating only AHUs, WB recommends running these units whenever the building is occupied, even if the heating coil is not being utilized, in order to bring in ventilation air. Additionally, for all centralized units that serve these buildings, WB recommends hiring a testing and balancing contractor to determine airflows and damper positions.

Building 1 (Administration):

The Administration (Admin) is a 2-story 15,000 SF mixed use building that mainly houses offices. Most of this building utilizes finned tube radiators (FTR) for heat during the winter months. All perimeter spaces have operable windows for ventilation air. Based on this system type, WB recommends opening all windows in rooms that have them. When opening windows is not feasible (i.e. outdoor conditions), WB recommends providing a portable air cleaner (Refer to Table 3 in Appendix C for more information). For rooms that do not have operable windows, WB recommends providing a portable air cleaner whenever this room is occupied or planning to be in use.

Room 1100, the main conference room, was served by a central heating only AHU. Currently, this unit utilizes MERV 8 filters. WB recommends upgrading the filters to a MERV 13 and verifying that the outdoor air dampers are operational. For a room this size, roughly 1,400 SF, WB's recommendation of outdoor air is 1470 CFM at full occupancy and 800 CFM at 50% occupancy. Based on the outdoor air ductwork size (36"x28") it appears that the unit capable of handling this amount of outdoor air. WB recommends hiring a testing and balancing contractor to get an accurate reading of airflow of this unit. It is worth noting, that even when heating is not required, this unit should be running to bring in ventilation air as well as maintain air changes throughout the conference room.

Building 3 (Kemp)

The Kemp building is a single story 22,000 SF mixed use building that mainly houses classrooms. Most of the classrooms have unit ventilators (univents) with a central exhaust system. The univents have operating outdoor air dampers and heating coils to provide ventilation and heat to the classrooms. Additionally, each room has an exhaust grille (to ensure proper air changes) and operable windows. Based on this system type, WB recommends opening all operable windows and opening the outdoor air dampers for the univents. Additionally, all exhaust fans (and univents) shall operate when the building is occupied. When opening windows is not feasible (i.e. outdoor conditions), WB recommends providing a portable air cleaner (Refer to Table 3 in Appendix C for more information). For rooms that do not have operable windows, WB recommends providing a portable air cleaner whenever this room is occupied or planning to be in use.

Room 3105, the chem lab, is served by a separate RTU. Currently, this unit utilizes MERV 8 filters. WB recommends upgrading the filters to a MERV 13 rating. Along with this, WB recommends increasing the outdoor air of this RTU, please refer to Table 1 for more information.

The gym and locker rooms utilize similar heating only units with outdoor air dampers. WB recommends increasing the filters to MERV 13 and opening the outdoor air dampers as much as possible. When opening the dampers to 100% is not feasible due to weather, WB recommends using portable air cleaners in these spaces.

Building 4 (Café/Library)

The Café/Library building is a 2-story 20,000 SF mixed use building that houses the cafeteria and library. Most of the building has Finned Tube Radiators (FTR) with operable windows. While the cafeteria and library have univents with operable windows. For the cafeteria, room 4109 (dining areas) and the main library WB recommends opening windows and opening the outdoor air dampers in the univents to 100% (as allowable by outdoor air temperature). In addition to this, WB also recommends providing portable air cleaners that will supplement the windows and univents due to the sizes of the space.

For the remainder of the spaces and offices, WB recommends a combination of opening windows and providing portable air cleaners to maintain air changes in the rooms.

Building 9 (Plant Science)

The Plant Science building is a single story 23,000 SF mixed use building that mainly houses classrooms and labs. Most of the classrooms have unit ventilators with a central exhaust system. The univents have operating outdoor air dampers and heating coils to provide ventilation and heat to the classrooms/labs. Additionally, each room has an exhaust grille (to ensure proper air changes) and operable windows. Based on this system type, WB recommends opening all operable windows and opening the outdoor air dampers for the univents. Additionally, all exhaust fans (and univents) shall operate when the building is occupied. When opening windows is not feasible (i.e. outdoor conditions), WB recommends providing a portable air cleaner (Refer to Table 3 in Appendix C for more information). For rooms that do not have operable windows or univents, WB recommends providing a portable air cleaner whenever this room is occupied or planning to be in use.

As previously mentioned, the attached excel file documents the exact recommendation for each room throughout the school.

APPENDICES

Appendix A:

HEALTHY BUILDINGS 

Healthy building strategies that improve air quality and clean surfaces should be incorporated as part of a layered defense against COVID-19. For improving indoor air quality, we recommend prioritizing control strategies – ventilation, filtration, supplemental air cleaning – and verifying system performance regularly. For more detailed and technical guidance, we recommend reviewing the materials produced by the ASHRAE Epidemic Task Force. Schools should work with facilities managers and outside professionals to tailor these recommendations for their unique building systems.

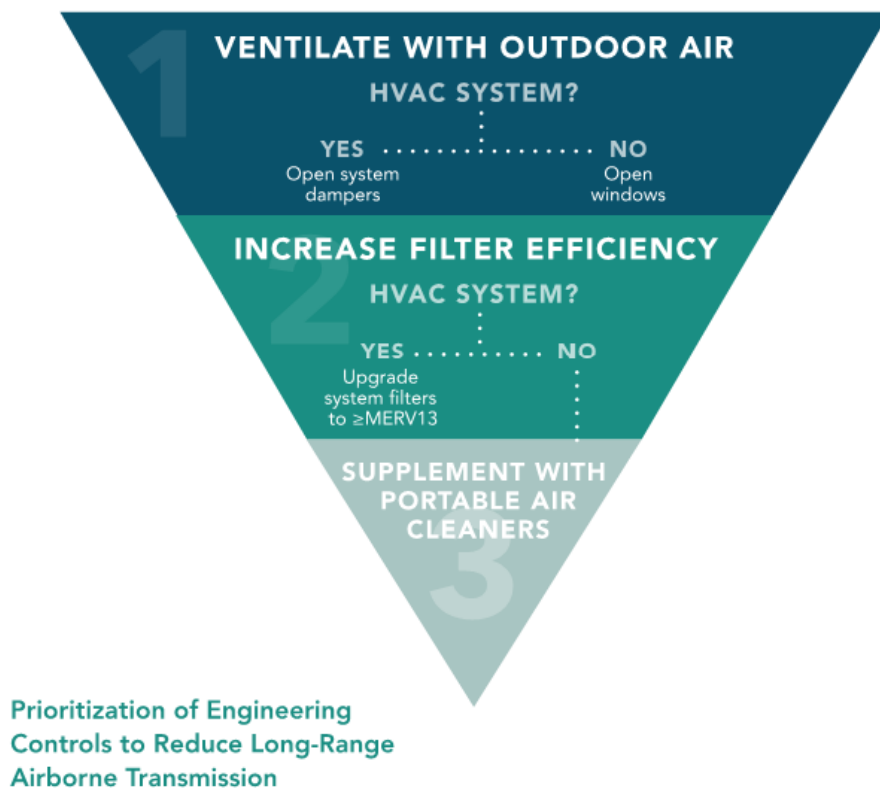


Figure 1: Harvard School of Public Health’s healthy buildings summary.

Appendix B:

**TABLE 403.3.1.1
MINIMUM VENTILATION RATES**

OCCUPANCY CLASSIFICATION	OCCUPANT DENSITY #/1000 FT ² ^a	PEOPLE OUTDOOR AIRFLOW RATE IN BREATHING ZONE, <i>R_p</i> CFM/PERSON	AREA OUTDOOR AIRFLOW RATE IN BREATHING ZONE, <i>R_a</i> CFM/FT ² ^a
Education			
Art classroom ^g	20	10	0.18
Auditoriums	150	5	0.06
Classrooms (ages 5-8)	25	10	0.12
Classrooms (age 9 plus)	35	10	0.12
Computer lab	25	10	0.12
Corridors (see public spaces)	—	—	—
Day care (through age 4)	25	10	0.18
Lecture classroom	65	7.5	0.06
Lecture hall (fixed seats)	150	7.5	0.06
Locker/dressing rooms ^g	—	—	—
Media center	25	10	0.12
Multiuse assembly	100	7.5	0.06
Music/theater/dance	35	10	0.06
Science laboratories ^g	25	10	0.18
Smoking lounges ^b	70	60	—
Sports locker rooms ^g	—	—	—
Wood/metal shops ^g	20	10	0.18

Table 2: IMC 2015 Table 403.3.1.1 Minimum Ventilation Rates

Appendix C:

Air Cleaner	SF Range (SF)	Typical Room Height	Air Cleaner Flow rate (CFM)	Air Change Rate (ACH)	Price Point
Blueair Classic 205	Up to 250	10	200	4.8	\$350
Whirlpool WPPRO2000	250-500	10	328	3.9	\$430
Blueair Classic 605	500-900	10	500	3.3	\$830
Blueair PRO L	500-900	10	630	4.2	\$980
Carrier FN1AAF	Up to 3000 SF	10	1500	3.0	Quote from Manuf. Required

Table 3: Recommended portable air cleaners and associated air change rates.

Notes:

1. Calculated air change rates were calculated based on max SF range and the typical room height of 10 ft. Actual room heights and square footage may yield a better air change rate than calculated above. Below is the equation used to calculate air changes per hour (ACH).

$$ACH = \frac{CFM \times 60}{Area \times Height_{ceiling}}$$

2. As the air cleaners get larger in size (size of the room increases) they do become louder. The Carrier FN1AAF may not be suitable for a classroom environment but rather a gymnasium or cafeteria.

3. The above units are some of the recommended air cleaners but not all, there are a variety that will work in these circumstances.