

Arlington Public Schools Ventilation Assessment – Drew
March 2021

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Final Draft

DRAFT

VENTILATION ASSESSMENT – Drew Elementary School

Arlington Public Schools is in the process of doing additional assessment of ventilation systems in the less ventilated schools to improve conditions as recommended to open schools. The assessment is to review the available ventilation systems and include long-term planning to increase the ventilation in the classrooms to meet expected occupancy of the facilities.

The buildings are conditioned by different types of HVAC systems, even in the same facility. Thus, a “typical” classroom, that was ventilated differently, was reviewed based on system type in the facility. In general, the main system types include dedicated ventilation units serving the classroom HVAC unit or centrally located HVAC units. In rooms where the ventilation rate were below the recommendations, these systems were reviewed to determine methods to increase the ventilation in the classrooms. The continuation of the ventilation study was review schools in which ventilation rates are to be increased to the extent possible. This report addresses the Drew Elementary School.

The current American Society for Heating, Refrigerating and Air Conditioning (ASHRAE) code 62.1-2010 requires ventilation to be calculated based both on the classroom size (square foot of the room) and classroom occupancy. The classroom ventilation was designed as necessary to meet the current code level ventilation unit. As part of the guidelines for opening buildings, ventilation rates should be increased to the extent possible as a method to dilute airborne contaminants to the extent possible. ASHRAE recommends diluting the room air utilizing ventilation to the extent possible while not adversely affecting space air conditioning.

Harvard T.H. Chan’s Guidelines for opening schools recommend that facilities verify the outside air ventilation system is operational and provide adequate ventilation. In addition to outside air ventilation, the guidelines also recommend that the building HVAC systems provide adequate air movement in the classrooms by using a combination of outdoor air and recirculating air. The target air movement rate in a classroom is to cycle the air in a room, 5 times per hour [called air change rates per hour (ACH)]. Having a minimum of 5 ACH would mean the air is cycled 5 times in an hour – or every 12 minutes. The recommendation for cycling air in the classroom is to allow the HVAC systems to filter the air.

Both Harvard and ASHRAE recommend increasing filtration efficiencies to the highest allowable by the limits of the HVAC system. This varies by HVAC system, with MERV 13 equivalence being the minimum recommended filtration level due to its ability to remove 85 percent of the particles larger than 1 micron. While the virus is smaller than 1 micron, the general consensus is that the virus transmits in droplet form with the RNA infectious dose most likely in a size range greater than 1 micron. If the HVAC system isn’t capable of utilizing MERV 13 filtration, the recommendation is to supplement the room with a fan/filter unit capable of using very high-efficient filters (HEPA) to allow better filtration and to increase the effective, clean air in the room.

Dedicated Ventilation and classroom fan/coil style units: Most of the upper floor classrooms at Drew utilize a central type dedicated ventilation/air handling unit located on the roof. These units ventilate all the classrooms throughout the first and second floors. Each classroom includes a fan coil type unit (or unit ventilator) which provides temperature control to maintain space temperature while the dedicated unit provides the necessary outside air ventilation rates. The ventilation in the typical room sizes ranges from 2 to 3 1/2 air changes per hour (average). The complete HVAC system (fan coil/ventilation air) were designed to provide over 8 air changes per hour of filtered/ventilated air (the air is cycled every 7 to 8 minutes). The ventilation systems utilize MERV 8 filtration for the outside air (ventilation). The fan coil or unit ventilator type units utilize a unit mounted, 1/2" to 1" filter bank with maximum filter efficiency of approximately MERV 8. These filters are only capable of filtering approximately 20 percent of the particles, 1 Micron or above.

Central HVAC systems: The first-floor Art, Music area, and Flexible classrooms use central type air conditioning unit (AHU-3) located in dedicated mechanical room. These units provide heating, cooling, and ventilation for several classrooms throughout the first floor. The ventilation for these units operates using ductwork, louvers, dampers and controls directly connected to the outdoors to draw outdoor air through the unit. The unit then heats or cools the ventilation air providing the necessary cooling/heating air to the individual classrooms and spaces. Each classroom includes a terminal unit which provides a constant airflow which is temperature controlled to maintain space temperature while meeting the necessary outside air ventilation rates. The ventilation in these rooms ranges from 1.7 to 2.2 air changes per hour. The HVAC system provides an average of 7 air changes per hour of filtered/ventilated air (the air is cycled every 8 to 9 minutes). The air handling unit is equipped with MERV 8 filters.

Discussion:

Several of the classrooms using the dedicated ventilation with the fan coil style unit do not meet the code required ventilation during full classroom occupancy. While the ventilation system provides air directly to the classroom, the ventilation rate can only support an occupancy of 10-11 persons.

The lower-level classrooms being served by AHU-3 do not provide adequate code level ventilation. The ventilation rate of this system can support less than 9 students.

The HVAC system being designed for MERV 8 filters (or less), would limit the ability to change the filtration levels for the equipment. While MERV 8 filters can usually be upgraded to MERV 11, MERV 11 filters provide lower efficiencies for filtration of smaller particles (when compared to MERV 13). MERV 13 filters cannot be utilized effectively for the HVAC system. To increase the calculated, filtered air change rate, supplemental classroom air filter units would be required. A fan coil style HVAC system has very limited system ability to upgrade filters.

Issues

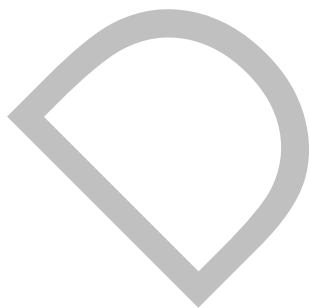
- The method of ventilation air design is impacted by the original design of supplying outside air at lower design airflow rate.
- The existing outside air units would need to be increased in airflow and capacity by 25% to provide the correct ventilation rates.
- AHU-3 will need to be replaced in order to increase the outside air percentage to allow the code level ventilation.

Recommendations:

- Replace the dedicated ventilation unit with larger units to provide the required airflow.
- The ductwork would need to be modified and enlarged or redistributed to accommodate the additional 25 percent ventilation rate.
- The outside airflow rates would need to be measured and set by balanced.
- The classroom HVAC systems will require rebalancing and diffuser adjustments as necessary to accommodate the recommended airflow upgrades.
- Replace all MERV 8 filters with MERV 11.

Art, Music, and Flexible space.

- Replace AHU-3 with dedicated DOAS unit.
- Provide individual, HVAC unit (FCU) for each classroom.
- The outside airflow rates would need to be measured and set by balanced.
- The classroom HVAC systems will require rebalancing and diffuser adjustments as necessary to accommodate the recommended airflow upgrades.
- Replace all MERV 8 filters with MERV 11.



APPENDIX A

Disclaimers

General air change data

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- The information in this document is provided as general guidance based on the current information available utilizing the strategies developed by ASHRAE and Harvard. HVAC systems play only a small role in infectious disease transmission, the airflow information provided in these documents are not mitigation strategies. Additional non-HVAC mitigation strategies to be used includes:
 - **Building Occupancy Levels Allowed**
 - **Face mask requirements**
 - **Social distancing between desks, students, teachers, etc.**
 - **Directional flow for movement through the building**
 - **Personal hygiene**
 - **Cleaning requirements**
 - **Touchless services.**
- It is important to note that HVAC strategies are means to improve the air quality and reduce risk but will not prevent all possibility of virus transmission, user should acknowledge that there is a no “zero risk” scenario. HVAC improvements are intended to be used as part of an overall risk reduction strategy for reopening schools. Each building and situation are unique and the guidance provided doesn’t not equally apply to all buildings or classrooms.
- The information in this report is based on the very latest recommendations but the COVID-19 crisis remains an ever-evolving situation and this assessment and our recommendations are not intended to override or supersede any current or future guidance from health and government experts. This guidance should be used in conjunction with relevant guidance and research from governmental agencies. This information is not a substitute for guidance as recommended by health care professionals.
- CMTA does not warrant the accuracy or completeness of this guidance, by adopting these recommendations for use, each adopter agrees to accept the full responsibility in connection with their use. CMTA assumes no responsibility for any injury, loss, or damage arising out of or in connection with this guidance.

Location		Area	HVAC System Type	Design Year	Number of Class rooms	Classrm Size (SF)	OA CFM per Classrm	Ceiling Height	Room Volume	Room OA ACH	Number of Blue	Blue AIR 211+ Airflow	Equivalent ACH	Harvard Room ACH
11	Drew	1st -1A (AHU-3)	Vocal Muisic Classroom	2000	1	955	306	8.7	8280	2.22	1	350	2.54	4.75
	Elementary	1st -1B (AHU-3)	Art Classroom	2000	1	1230	306	8.7	10664	1.72	2	350	3.94	5.66
		1st -1B (AHU-3)	Flex Space	2000	1	750	204	8.7	6503	1.88	1	350	3.23	5.11
		1st -1B (AHU-2)	Adult Education	2000	1	1150	437	8.7	9971	2.63	1	350	2.11	4.74
		1st -1B (AHU-2)	Adult Education	2000	1	1350	308	8.7	11705	1.58	2	350	3.59	5.17
		2nd - 2A (OAU)	1st grade - FCUS and DOAS	2000	2	825	450	8.7	7153	3.77	1	350	2.94	6.71
		2nd - 2A (OAU)	Montessori - FCUS and DOAS	2000	2	945	280	8.7	8193	2.05	1	350	2.56	4.61
		2nd - 2A (OAU)	Montessori - FCUS and DOAS	2000	1	935	450	8.7	8106	3.33	1	350	2.59	5.92
		2nd - 2B (OAU)	Montessori - FCUS and DOAS	2000	2	935	450	8.7	8106	3.33	1	350	2.59	5.92
		2nd - 2B (OAU)	Kindergarden - FCUS and DOAS	2000	3	925	450	8.7	8020	3.37	1	350	2.62	5.99
		2nd - 2B (OAU)	FCUS and DOAS	2000	7	825	450	8.7	7153	3.77	1	350	2.94	6.71
		3rd Lvl (OAU)	Unit Ventilators	2000	11	825	450	8.7	7153	3.77	1	350	2.94	6.71
					33	23970	419			3.54			2.83	6.37

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