BALA

CITY OF NEW BEDFORD SCHOOLS

HVAC SYSTEM ASSESSMENT REPORT FOR WINSLOW SCHOOL RE-OPENING

A. General:

1. The purpose of this report is to provide an overview of the potential measures that may be applied to the building HVAC systems and spaces to make a safer environment for students, teachers and staff to return to school this year. The diversity of space types and systems require several different solutions and strategies to be considered to improve the interior environment.

2. This report does not make recommendations on occupant density, reconfiguration of spaces, cleaning procedures, or implementation of touch-free procedures. The School is urged to seek guidance from the state on these and other issues.

3. This report does not make any certification, determination nor render any opinion, as to whether the building reviewed within this assessment is safe to reoccupy or not. Determination to reoccupy the building is the sole purview of the Superintendent of Schools for the City of New Bedford.

4. Building included within this report:

   a. Winslow Elementary School; visited on 9/3/2020; 12:30 PM. Winslow school delegate present during site tour: Ms. Carolyn Pontes.

B. Potential Strategies:

1. Enhanced Filtration:

   a. The ability to add higher efficiency filters in air systems can provide some level of protection, however most systems are limited. The thickness of the existing filter systems is one factor that can limit the level of efficiency that can be achieved. Another consideration is that higher efficiency filtration typically has a higher pressure drop when compared to the same air flow.

   b. Where filters are limited to 2-inch thickness, a filter efficiency rating of MERV 8 is typically used. The highest efficiency level that can be achieved with 2-inch filters is MERV 13, but these filters must be stored in a dry location to maintain their effectiveness. Filters with a MERV 13 rating can capture up to 75% of aerosolized virus particles.

   c. Where systems have 12-inch cartridge or bag filters, efficiencies of at least MERV 16 may be possible. These filters can capture up to 95% of viruses carried by aerosols.

   d. The high pressure drop associated with higher efficiency filters will cause a reduction in the air handling system air flow capacity. This may not be significant for larger systems but can be noticeable on smaller systems. Variable air volume systems can overcome this additional loss to some degree, but the peak capacity will still be somewhat limited.

   e. HEPA filters would offer even more protection, but they come with an even higher pressure drop and they typically require twice the filter area.

f. It is recommended that appropriate precautions be taken when dirty filters are removed from the systems, since active viruses may be present.

2. Bipolar Ionization:

a. The application of bipolar ionization (BPI) is more developed for in-duct applications and provides an effective means for deactivating airborne viruses by attraction to positive and negative ions which then aggregate into larger particulates in the air and are then either filtered out or drop out of the airstream. In-duct installations for BPI have little restrictions.

b. BPI systems utilize needlepoint ionization or ionization tubes. Like UV-C lamps, ionization tubes have a useful operating life of approximately two years depending on conditions and will therefore need to be replaced periodically. Needlepoint systems also require regular maintenance to clean the elements.

c. In-duct BPI systems should be installed in the supply air duct to deliver the ionized molecules to the occupied space where they can interact with the room air.

d. BPI systems are not reduced in effectiveness when the respective system is operating in economizer mode since it is acting downstream in the space. Therefore, systems with economizer outside air control can continue to benefit from the free cooling as well as the higher amount of outside air.

e. As with UV-C systems, BPI systems should be interlocked to deenergize when the air system is shut down. An airflow switch may be used for this purpose.

f. BPI systems are also available for small air systems such as fan coil units, unit ventilators, ductless split units. These systems can be installed on the fan housing near the air inlet inside the unit.

3. Control Strategies:

a. Control strategies can be used to help reduce the level of virus concentration in occupied spaces. These strategies can include the following: Pre-occupancy and post-occupancy flush-out, extended hours of system operation, override of variable air volume controls, override of demand ventilation controls.

b. In addition to supply air and ventilation air strategies, exhaust systems can also help to reduce the level of virus contamination in spaces. Setting toilet room exhaust systems to operate continuously should be considered, since these spaces can potentially be a source for high contamination. Hands-free faucets and toilet fixtures should also be considered.

c. Classroom exhaust systems can be set to run continuously or at least operate for extended hours before and after occupancy to help flush the space. This should be done in conjunction with the operation of ventilation systems that deliver a corresponding amount of outside air to prevent negative pressurization and associated problems.

4. Other Strategies:

a. Other strategies include humidification, increased outside air flow, and airflow pressurization.

b. Increasing the minimum outside airflow settings for air handling systems would generally be limited to a 10% to 30% increase at the expense of higher energy use and a reduction in system capacity available for space cooling. Increasing minimum outside air settings only provides a marginal improvement at the space level. Where other technology-based solutions are applied, there would be little reason to increase outside air flow.

c. Controlling pressure relationships between spaces can provide a small measure of protection but would require a detailed evaluation to determine if there is an overall benefit.

C. Strategies for Various System Types:

1. Mixed/Recirculation Air Systems:

a. These systems typically provide supply air to multiple spaces using ductwork. A portion of the supply air includes outside air that is mixed with return air in the air handling unit before it is delivered to the space. These systems may also provide economizer cooling using up to 100% outside air when ambient conditions permit. Since these systems recycle air and serve multiple spaces, they provide an opportunity to apply centralized solutions. Rooftop units fall into the category or mixed air systems.

b. Provide enhanced filtration wherever possible. Since these systems at the school have 2-inch filters, MERV 13 filters should be considered. Note that these filters will collect more particulates and may tend to load up quicker than low efficiency filters. Therefore, more frequent filter changes should be planned.

c. Bipolar ionization systems should generally be considered over UV-C systems. These can be readily applied to all different system sizes with little restrictions.

d. Consider extended hours of operation after occupancy to further reduce airborne concentrations, especially where bipolar ionization is applied. Up to four hours of extended operation should be considered.

2. Unit Ventilators:

a. Unit ventilators are mixed air systems, but they deliver supply air to the space directly without ductwork. These systems are typically connected to an exterior louver to bring in fresh air. Outside air control includes minimum outside air and 100% outside air economizer.

b. The filters for these units are 1-inch or 2-inch thick. Where they are 2-inch thick, consider installing MERV 13 filters. While 1-inch MERV 13 filters are available, but they have a higher pressure drop than the 2-inch filters and may degrade the air performance to an unacceptable level.

c. Small bipolar ionization units are available for installation inside unit ventilators. These are typically mounted on the fan housing near the fan inlet.

d. It is recommended that the damper operation and linkages be inspected for each unit to verify that the outside air function is operating properly.

D. Winslow School HVAC systems description (based on room type):

1. Typically, all classrooms are provided with steam radiators (without protection covers) for heating and operable windows for natural ventilation. The original building design utilized vertical shafts to convey naturally ventilated air upwards through the building utilizing the natural buoyancy of air. Based upon the amount of foreign matter and storage items occupying the inlet of the fresh air shafts it is the opinion of Bala that this ventilation system has been inoperable for years.

Picture #1 & 2: Typical obstructions to natural ventilation system

2. Corridors are provided with no means of ducted or natural ventilation. The only HVAC system that was readily apparent were wall mounted steam radiators for heating purposes.

3. Toilet rooms located on the bottom floor possess ducted of exhaust air; however, no means of ventilation air is apparent.

4. The cafeteria located on the bottom floor is served by steam radiators to provide heat to the space. There is an existing, large, duct that appears to have formally provided ventilation air to the space. This system appears to have been inoperable for years. At present time there is no ventilation air in this space.

Picture #3: Cafeteria

5. The Gymnasium / Auditorium space is provided with natural ventilation (similar to the classrooms ventilation system); it appears that this system has been inoperable for years. At present time there is no ventilation air to this room.

6. Administrative spaces are served by steam radiators for heat and operable windows for natural ventilation. Some offices also utilize window units for air conditioning.

Picture #4: Typical Administrative Office

7. COVID Mitigation Measures to implement:

   a. Open operable windows to increase natural ventilation to the classrooms and administrative space. Employ the use of portable, floor mounted, air filtration devices. Re-commission the existing natural ventilation shafts to supplement the natural ventilation from the operable windows.

   b. The corridor / lobby space does not have any ventilation system other than a few operable windows. It is recommended that an energy recovery ventilator (ERV) be installed to provide the code required ventilation air or greater to offset any exhaust systems in the building with makeup air. A BPI (bipolar ionization) unit is recommended to be provided in the supply air from the ERV and the unit is recommended to include 4-inch MERV 13 filters if possible, or 2-inch MERV 13 at a minimum. It may also be possible to increase the overall size of the ERV to provide forced (ducted) ventilation air into the classrooms.

   c. Gymnasium, Cafeteria, and Auditorium are recommended to also install energy recovery ventilators (ERV) to provide the code required ventilation air to the spaces, or greater, to offset any exhaust systems in the building with makeup air. A BPI (bipolar ionization) unit is recommended to be provided in the supply air from the ERV and the unit is recommended to include 4-inch MERV 13 filters if possible, or 2-inch MERV 13 at a minimum.