Wilmington Public Schools
Middle School
Wilmington, MA

2020

HVAC System Evaluation

Prepared For:

Town of Wilmington
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GENERAL

Wilmington Public Schools engaged BLW Engineers to evaluate the Wilmington Middle School HVAC system relative to its current operating conditions, re-opening to the building to the public and potential considerations relative to COVID-19. BLW performed an initial site visit on August 14, 2020 as well as reviewed the original construction documents and supporting building documentation provided by the Town of Wilmington.

While at the site, BLW Engineers met with the facilities operator who reported the HVAC systems receives regular preventative maintenance which includes filter replacement, grease motors and bearings, replace fan belts and verify damper and valve operation.

The Wilmington Middle School is located at 25 Carter Lane, originally constructed circa 2000; the school comprises approximately 149,800 square feet of educational space.

HVAC SYSTEM EVALUATION

Existing Conditions

General
The space heat throughout the building is provided from the central boiler plant within the first floor Mechanical room. The boiler plant consists of (3) Burnham Oil-Fired, Cast Iron Sectional Boilers each with a gross output of 2957 MBH. Boiler system includes water specialties, insulated hot water distribution piping system, boiler breeching system and DDC controls. Insulated hot water distribution system from the boilers provides heating hot water into the insulated hot water distribution piping system throughout the building. (2) Primary circulator pumps are rated for 300 GPM at 75 FT HD.

Library and Media Center
RTU-1 is located on the roof and has a design airflow capacity of 6,000 CFM with 1,500 CFM outdoor air for hydronic heating, packaged DX air conditioning and ventilation of the Library and Media Center areas. The original ventilation air design exceeds current code requirements (Ventilation = 10 CFM x Occupant + 0.12 CFM x SF). RTU-1 is equipped with an Economizer. The unit is a variable air volume system providing conditioned air for each space terminating into the variable air volume (VAV's) terminal units that are controlled by local space sensors. Exterior VAV zones have been provided with hot water reheat coils at various locations. The VAV units provide supply air temperature for the worst case zone requiring air conditioning and the variable air volume terminal unit and reheat coil should modulate open as required to maintain space temperature setpoint in both the summer and winter months. Each terminal unit is provided with a sound attenuator. The rooftop unit is provided with a variable speed return fan that varies linearly with the supply fan, returning air from each space from a ceiling return register to a return duct distribution system to the rooftop unit on the roof where the return fan either mixes the return with the outdoor air to be reused by the rooftop unit or exhausts it to the outdoors. The unit was designed with MERV13 filters.

Cafeteria
RTU-2 is located on the roof and has a design airflow capacity of 6,000 CFM with 4,500 CFM outdoor air for hydronic heating and ventilation of the Cafeteria space. The original ventilation air design exceeds current code requirements (Ventilation = 7.5 CFM x Occupant + 0.18 CFM x SF). RTU-2 is equipped

with an Economizer and operates as a single zone constant volume system with a dedicated local space temperature sensor. The unit includes a 401.8 MBH hot water heat coil and is heat only. Supply air is distributed via ceiling registers and is returned at the opposite side of the cafeteria. Finned tube radiation is provided at the exterior wall assembly. The unit was designed with MERV13 filters.

Gymnasium

RTU-3 is located on the roof and is a sidewall discharge configuration. The system has a design airflow capacity of 21,000 CFM with 10,500 CFM outdoor air for heating and ventilation of the Gym. RTU-3 is equipped with an Economizer and operates as a single zone constant volume system with a local space temperature sensor. The unit includes a 1112 MBH hot water heat coil and is heat only. Supply air is distributed via exposed spiral ductwork with high velocity ceiling diffusers. There are (2) gravity relief vents that allow pressure relief from the space. The unit was designed with MERV13 filters.

Administration (Part-A)

RTU-4 is located on the roof and has a design airflow capacity of 9,000 CFM with 1,800 CFM outdoor air for hydronic heating, packaged DX air conditioning and ventilation of the administration office areas. RTU-4 is equipped with an Economizer. The unit includes a 126.4 MBH hot water heat coil and 320 MBH packaged DX cooling capacity. The unit is a variable air volume system providing conditioned air for each space terminating into the variable air volume (VAV's) terminal units that are controlled by local space sensors. Exterior VAV zones have been provided with hot water reheat coils at various locations. The VAV units provide supply air temperature for the worst case zone requiring air conditioning and the variable air volume terminal unit and reheat coil should modulate open as required to maintain space temperature setpoint in both the summer and winter months. Each terminal unit is provided with a sound attenuator. The rooftop unit is provided with a variable speed return fan that varies linearly with the supply fan, returning air from each space from a ceiling return register to a return duct distribution system to the rooftop unit on the roof where the return fan either mixes the return with the outdoor air to be reused by the rooftop unit or exhausts it to the outdoors. The unit was designed with MERV13 filters.

Administration (Part-C)

RTU-5 is located on the roof and has a design airflow capacity of 4,300 CFM with 1,300 CFM outdoor air for heating, packaged DX air conditioning and ventilation of the administration office areas. RTU-5 is equipped with an Economizer. The unit includes a 93.0 MBH hot water heat coil and 171 MBH packaged DX cooling capacity. The unit is a variable air volume system providing conditioned air for each space terminating into the variable air volume (VAV's) terminal units that are controlled by space sensors. Exterior VAV zones have been provided with hot water reheat coils at various locations. The VAV units provide supply air temperature for the worst case zone requiring air conditioning and the variable air volume terminal unit and reheat coil should modulate open as required to maintain space temperature setpoint in both the summer and winter months. Each terminal unit is provided with a sound attenuator. The rooftop unit is provided with a variable speed return fan that varies linearly with the supply fan, returning air from each space from a ceiling return register to a return duct distribution system to the rooftop unit on the roof where the return fan either mixes the return with the outdoor air to the rooftop unit or exhausts it to the outdoors. The unit was designed with MERV13 filters.

Auditorium

RTU-6 is located on the roof and has a design airflow capacity of 10,000 CFM with 7,500 CFM outdoor air for hydronic heating, packaged DX air conditioning and ventilation of the administration office areas.

RTU-4 is equipped with an Economizer. The original ventilation air design exceeds current code requirements (Ventilation = 5 CFM x Occupant + 0.06 CFM x SF). The unit includes a 756.0 MBH hot water heat coil and 508 MBH packaged DX cooling capacity. The unit is a has a staged blower assembly and has been equipped with a bypass damper. The unit was designed with MERV13 filters.

Classrooms

Typical Classrooms are provided with unit ventilators to provide classroom heating and ventilating. Classroom Unit ventilators each have a total airflow capacity of 1,250 CFM and 450 CFM of outdoor air (OA). Classroom ventilation exceeds current code required ventilation (Classroom Ventilation = 10 CFM x Occupant + 0.12 CFM x SF or for a typical 1,000 classroom with 25 occupants that would be 370 CFM). Units are provided with a hot water heating coils interconnected to the hot water distribution piping system. Each UV heating coil is controlled by a wall mounted thermostat connected to the coil control valve. Each classroom is provided with a ceiling exhaust grille ducted to a roof mounted EF. Science labs are provided with ducted UV's located above the ceilings with dedicated outdoor air intake louvers. (Classroom Ventilation = 10 CFM x Occupant + 0.12 CFM x SF or for a typical 1,000 classroom with 25 occupants that would be 370 CFM).

Computer Lab 1& 2

The 3rd FL Computer Labs 1 & 2 are heated, air conditioned and ventilated by dedicated split dx air handling units (AHU's)with hydronic heat coils. AHU-1 & AHU-2 each have an airflow capacity of 2,000 CFM and a minimum outdoor air rate of 450 CFM. Classroom ventilation exceeds current code required ventilation (Classroom Ventilation = 10 CFM x Occupant + 0.12 CFM x SF or for a typical 1,000 classroom with 25 occupants that would be 370 CFM). Dedicated condensor units are located at the roof and are connected to the respective door AHU systems via RS & RL refrigerant piping.

Locker Rooms

The 2nd FL Locker rooms are heated and ventilated by dedicated split dx air handling units (AHU) with a dedicated hydronic heating coil. AHU-3 has an airflow capacity of 5,200 CFM and a minimum outdoor air rate of 5,200 CFM. The Boys and Girls locker rooms are each equipped with a dedicated Exhaust Fan (EF) that is located at the roof and have a design capacity of 1,150 CFM.

Miscellaneous

Bathrooms, Janitor's Closets, Storage, etc. are provided by exhaust registers, exhaust duct distribution system and roof exhaust fans. Bathrooms are provided with hot water heating terminal equipment.

Specialty exhaust systems have been provided for the Science Rooms, Kiln, Dark Room, Art Room, Art Storage and Science Storage.

Electric rooms have been provided with heat dissipation systems including an exhaust fan, a gravity intake with motor operated damper and a temperature sensor to maintain a maximum space temperature.

Miscellaneous spaces have been provided with hot water terminal equipment interconnected with the hot water distribution piping system.

The building is controlled by electric controls.

ROOFTOP UNIT (RTU) SCHEDULE				
UNIT NO.	SERVICE	LOCATION	TOTAL CFM	MIN. O.A. CFM
RTU-1	LIBRARY	ROOF	6000	1500
RTU-2	CAFETERIA	ROOF	6000	4500
RTU-3	GYM	ROOF	21,000	10,500
RTU-4	ADMIN (PART A)	ROOF	9000	1800
RTU-5	ADMIN (PART C)	ROOF	4300	1300
RTU-6	AUDITORIUM	ROOF	10,000	7500

AIR HANDLING UNIT (AHU) SCHEDULE				
UNIT NO.	SERVICE	LOCATION	TOTAL CFM	MIN O.A. CFM
AHU-1	COMP. ROOM	MECH ROOM	2000	450
AHU-2	COMP. ROOM	MECH ROOM	2000	450
AHU-3	LOCKER ROOM	MECH ROOM	5200	5200

UNIT VENTILATOR (UV) SCHEDULE			
UNIT NO.	LOCATION	TOTAL CFM	MIN. O.A. (CFM)
UV-1	CLASSROOMS	1250	450
UV-2	MUSICAL INSTR	1500	600
UV-3	SCIENCE	1000	500
UV-4	ART ROOMS	1250	750
UV-5	CHORAL	1500	750
UV-6	SPECIAL NEEDS	750	225
UV-7	TECHNO. EDUCATION	1500	450
UV-8	SPEECH	750	225

EXHAUST, SUPPLY FAN (EF, SF, RF) SCHEDULE			
UNIT NO.	SERVICE	LOCATION	CFM
EF-1	GENERAL EXHAUST	ROOF	10600
EF-2	GENERAL EXHAUST	ROOF	6650
EF-3	GENERAL EXHAUST	ROOF	10000
EF-4	TOILET EXHAUST	ROOF	500
EF-5	GIRLS' TOILET EXHAUST	ROOF	2500
EF-6	BOY'S TOILET EXHAUST	ROOF	2500
EF-7	KILN EXHAUST	ROOF	500
EF-8	KITCHEN EXHAUST	ROOF	7800
EF-9	GENERAL EXHAUST	LOW ROOF	800
EF-10	MECH. RM. VENTILATION	MECH ROOM	1200
EF-11	DRESSING ROOM EXHAUST	LOW ROOF	200
EF-12	ELECTRIC ROOM VENTILATION	ROOF	1100
EF-13	TOILET EXHAUST	LOW ROOF	450
EF-14	ATRIUM EXHUST (SMOKE)	ROOF	21,000
EF-15	GIRL'S LOCKER ROOM	ROOF	1150
EF-16	BOY'S LOCKER ROOM	ROOF	1150
EF-17	SCIENCE PURGE FAN	SCIENCE STORAGE ROOMS	500
EF-18	VENTED CABINET	ROOF	500
EF-19	TRASH AREA EXH.	ROOF	1340
SF-1	KITCH. MAKE-UP	ROOF	7000
RF-1	COMPUTER ROOM	MECH ROOM	2000
RF-2	COMPUTER ROOM	MECH ROOM	2000

GENERAL PUBLICATION RECOMMENDATIONS
Publications referenced include ASHRAE and State of Massachusetts Re-opening Guidelines for schools.

Operating school buildings under epidemic conditions requires a holistic framework during the crisis and the restoration to potentially a new "normal" after the public health emergency has ended. Considerations include:

- Review of current operational practices
- Holistic view for owner/operator

Review of current operational practices

- Modes of operation of HVAC systems
    - sequences of operations
    - set points
    - schedules
- Verification that equipment and systems are properly functioning and have the enhanced capabilities to address public health considerations, with a focus building air circulating systems.
- Understanding that infected people who are asymptomatic may enter buildings, increasing the likelihood of the spread of virus through air systems to other occupants.

Holistic view for owner/operator

Owners and operators should take a holistic view of their buildings and:

1. Develop a pandemic preparedness plan
2. Review indoor and outdoor environment
3. Review the space types
4. Operate and maintain HVAC
    - Air-Conditioning and Ventilation systems
    - Exhaust systems
5. Check Elevator Control
6. Check BAS and Access Control Systems

Develop a Pandemic Preparedness Plan

Consider these possible goals:

- Reduce the spread of infection among building occupants,
- Maintain HVAC and Building Service Systems in safe and healthy conditions,
- Minimize impact on building occupants and visitors,
- Communicate risks and precautions being taken with occupants transparently
- Implement measures that help make occupants feel secure:
    - Require occupants, visitors and maintenance personnel to wear appropriate PPE per CDC,
    - Screen, monitor and control the circulation of occupants and guests to help avoid transmission of disease,

  - Increase frequency for surface disinfection on frequently touched surfaces, such as door handles, handrails, door bells and elevator buttons.

Ensure continuity of supply chains and have backup plans.

- Identify your critical suppliers, e.g. filters, cleaners, disinfectants, parts, PPE, etc.,
- Identify vendors who could negatively affect your operation if they fail to deliver,
- Review current service provider agreements to see if alternate suppliers can be engaged in the event of a supply disruption, for example, equipment service providers, and understand contract limitations and restrictions on using alternative providers,
- Ask critical suppliers to share their pandemic plans:
  - What does their plan include?
  - Have they tested their plan? When was it updated?
  - Set boundaries with suppliers – ask that they do not send staff who may be showing signs of illness to your property.

Review contract agreements:

- Review contract agreements: Review contracts with service providers, utilities, and suppliers to determine what rights and remedies they have because of disruptions due to unforeseeable circumstances that prevent fulfillment of a contract.

Establish a communication protocol and continuity of operations plan:

- Identify key contacts and publish normal and emergency contact information,
- Document the chain of command and communication requirements, and provide instructions and outline expectations for how all responses are to be documented and what records shall be maintained and distributed.

Provide staff with:

- PPE per CDC and OSHA requirements,
- Training on the proper use and disposal of PPE and waste,
- Training on infection prevention and control measures,
- Cross training to ensure critical building functions are maintained in an emergency, and
- Instruction to staff to stay at home if they are feeling sick.

Check with insurance providers to determine whether there are special measures that can be taken to preserve coverage or lower premiums.

Next Steps:

1. Notify staff, tenants and visitors about the plan
2. Follow all local, state and federal executive orders, statutes, regulations, guidelines, restrictions and limitations on use, occupancy and separation
3. Follow OSHA Guidelines, especially the portion in the guide regarding filter and outside air.

4. Ensure that custodial staff and service providers job descriptions includes performing proper cleaning procedures based EPA and CDC guidance using approved products and methods:
    - Disinfect high touch areas of HVAC and other Building Service systems such as on/off switches, and thermostats;
    - Consider UV light disinfection devices of high touch counters in public spaces.
    - Disinfect interiors of refrigerated devices, such as refrigerators, coolers and vending machines where the virus can survive for potentially long periods of time.
5. Consider installing a thermal camera at building entrances to help screen visitors for elevated body temperatures. Note that that infected individuals may show no signs of being ill, including having no fever, and can be responsible for much of the transmission. In such cases, thermal imaging may not be effective.
6. Provide MERV13 or higher filters for air handling equipment that recirculate air when equipment has the capacity; however, most existing air handling equipment will not be able to accommodate MERV13 filters without significantly impacting system operation, outdoor air delivery to the space and equipment component failures.
7. The HVAC systems that are physical or capacity limited for better filtration and UV decontamination systems in the return airstream, consider installing portable filtration and air cleaning devices such as UVGI (Ultraviolet Germicidal Irradiation), especially if seniors or anyone with other health issues or compromised immune systems may be located, or, in mission critical areas where required.
8. Provide automatic hand sanitizer dispensers in the high touch areas and other common areas, including spaces where equipment where frequent maintenance is required, and ensure dispensers are serviced often and remain operational.
9. Post signage in prominent locations that contain information and instructions to educate and remind staff about proper procedures to maintain personal protection while cleaning, replacing filters and moving or using other equipment that maybe contaminated
10. Consider providing antimicrobial door mats at high traffic entrances to the building.
11. Institute additional cleaning procedures to ensure proper disinfection of bathrooms, kitchens and common areas. Educate cleaning and maintenance staff on proper personal protection and PPE use including following OSHA worker exposure guidelines.

Review Indoor and Outdoor Environment

- Maintain dry bulb temperatures within the comfort ranges indicated in ANSI/ASHRAE Standard 55-2017
- Maintain relative humidity between 40% and 60% through the use of the air conditioning systems.

In Cold Climates
i. HVAC systems with no humidification may not achieve the minimum humidity indicated, ii. Observe building assemblies and finishes frequently for condensation when indoor dew points rise above the surface temperatures of the assemblies and finishes,

In Cold Climates
iii. Excessive humidity may lead to condensation, indoor mold growth, and degradation of indoor air quality.

Review the space types

Conference Rooms	Keep doors to be opened to promote good ventilation where possible. If doors must be closed, consider local air filtration and cleaning devices and appliances such as portable air filters, or provide local exhaust fans discharging directly to the outside to improve ventilation.
Pantries/Storage Rooms	Provide local exhaust, or portable air filtration and cleaning appliances, especially if refrigerators, or similar appliances, are presented.
Public/Large Assembly Spaces	Where there can be a large assembly of people, consider air treatment, e.g. upper-room UVGI lamps.

Operate and maintain the HVAC system

Building owners and service professionals should follow the requirements of ASHRAE Standard 180-2018, Standard Practice for the Inspection and Maintenance of Commercial HVAC Systems which has tables to show the typical maintenance required for equipment that has been in operation. Consider PPE when maintaining ventilation materials including filters, condensate. Consult additional guidance before duct cleaning. Check specifically:

- Dampers, filter, and economizers seals and frames are intact and clean, are functional and are responding to control signals. MERV13 or higher filters are required for capture of airborne viruses; however, most existing equipment will not be able to support the associated pressure drop of these filters and equipment should be provided with only the highest MERV rating that does not affect the heating and cooling capacity of the units.
- Zone and air temperature are calibrated and accurately reporting environmental conditions to the BAS or local controllers.
- Exhaust fans are functional and venting to the outdoors.
- Check outside air intake regularly for any potential risk such as exhaust nearby and provide proper clearance if assessible by pedestrians, etc.

Operate and maintain the HVAC system – Air conditioning and ventilation systems

- Continued operation of all systems is recommended.
- For offices with fan coil units, open windows 2 hours before and after occupied periods.

Centralized and floor-by-floor Variable Air Volume (VAV) systems: General information

- For central or floor-by-floor VAV systems that have the capacity to operate with 100% outside air, such as an economizer cycle, close return air dampers and open outdoor air dampers to 100% or to the maximum setting that the HVAC system can accommodate and still maintain acceptable indoor conditions.
- If there are heating and cooling coils to temper the air, it can provide comfort and eliminate recirculation (in the mild weather seasons this will have smaller impacts to energy consumption, thermal comfort, or humidity control, however, using 100% outside can be more difficult in extreme weather conditions).
- Considerations also should be given in areas with dry outside air that may lower the relative humidity to below 40%.
- Prioritize increasing outside air over humidity (see concerns about operating at indoor humidity outside the range of 40%-60%).

Centralized and floor-by-floor Variable Air Volume (VAV) systems: Floor-by-floor

- In floor-by-floor VAV systems that have only minimum outside air damper positions or openings, open outside air damper to its maximum position (the same cautions and concerns stated above apply).
- If outside air is supplied centrally from outside air handling units (typically at mechanical levels) to all floors, and there are unoccupied tenant floors, divert the outside air to the occupied floors.
- Consider changing the floor level VAV air handling units' discharge air temperature setpoint the maximum (typically no higher than 60º F).
- This will cause VAV terminal units (boxes) to open to try and satisfy space cooling loads which will increase the number of air changes in the space being served.

Centralized and floor-by-floor Variable Air Volume (VAV) systems: Cooling coils

- Cooling coils, heating coils and condensate drain pans inside air handling equipment can become contaminated.
- Therefore, consider adding UVGI for coil surface and drain pan disinfection are encouraged as it will reduce the needs and frequency for in-person coil surface disinfection.
- These devices and systems should be monitored often and regular and emergency maintenances should continue.
- Provide PPE protection for building operators, maintenance technicians and anyone else who must inspect or come in contact with the device or equipment.

Centralized and floor-by-floor Variable Air Volume (VAV) systems: Operable windows

- In buildings with operable windows, when outside air thermal and humidity conditions and outdoor air quality are acceptable, open windows where appropriate during occupied hours.

- Disabling the interlock between opening windows and air conditioning system lockout or shut down if this feature is provided for in the Building Automation System.
- Monitor indoor spaces for possible contaminants entering through the windows such as toilets exhaust located nearby or for windows accessible to public and high traffic on adjacent streets and walkways.
- Exposure to seasonal and other outdoor allergens (pollen and mold spores) may occur with windows opened.
- Special ductwork cleaning, or, changing filters more often than normal is not necessary.

Domestic Heating Water systems:

- Keep heating water systems circulating and maintain temperatures above 140°F to avoid microbial incursion. Do not let water temperature to drop below 120°F.

Operate and maintain the HVAC system - Exhaust systems

- Exhaust system for toilets should run 24/7. Do not open operable windows in toilets.
- Other exhaust systems should continue to run as normal. Run exhaust systems 2 hours before and after occupied periods.
- If there are exhaust outlets located in pedestrian areas outside, provide warning signs and consider diverting or rearranging the exhaust air discharge locations so that they would pose no opportunity to cause harm.

Elevator Control

1. Turn on elevator cab (lift) ventilation fans, where possible
2. Encourage occupants to take stairs, where possible, especially when elevator lobbies are crowded.
3. Allow elevators to run at high speed to minimize time in elevator.
4. Close elevator lobby vestibule doors, if available.
5. Consider local air treatment devices in frequently used lifts.

Building Automation System and Access Control System Programming

Building Automation Systems:

- Automate the control sequences in this document as a "Epidemic Mode" operation that can be turned on, shut down or override, if needed, by manual selection of the operator.
- Provide remote access to staff and trusted service providers who are responsible for operating and maintain Building Automation Systems, security, access control, information technology, fire alarm and life safety systems. Have written procedures and test remote access and secure access levels and permissions for all individuals prior to an emergency, if possible.

Access Control Systems:

- Post signage and communicate to tenants, and post visitors' procedures for entering and leaving the building that will minimize the time spent in public spaces.
- Use touchless assess control system if available and where possible.
- Require and enforce social distancing within public and shared spaces using signage.
- Ensure that workspaces are situated to accommodate social distancing recommendations

WILMINGTON MIDDLE SCHOOL PLANNED REOPENING

The Wilmington Public Schools plans on the following school re-opening:

- School is to be occupied by 50% of students on Monday/Tuesday, Wednesday will be a disinfection/cleaning day and then occupied by 50% of students on Thursday/Friday
- Classrooms seating will be reorganized to provide recommended social distancing.
- Cafeteria will not be used in normal fashion; cafeteria will be provided with PPE and be occupied be smaller groups that are socially distanced.
- Gym will not be used in normal fashion.
- Library and Auditorium will not be used in normal fashion.

RECOMMENDATIONS

Based on applicable guidelines (ASHRAE, State of Massachusetts Re-opening Guidelines, etc.), the Wilmington Middle School is safe to occupy and should consider the following best practice operation of the current HVAC system in an effort to provide an environment to best protect the occupants and visitors to the building during the pandemic:

Tier 1 Recommendations: Tier 1 recommendations are immediate revisions to system operation prior to start of classroom and until the start of the heating season.

1. Create an "Epidemic Mode" Building Management System sequence of operation that can be turned on, shut down or override, if needed, by manual selection of the operator.
2. Replace the unit filters with the best filters available that will not impact the heating capacity of the units and develop a filter replacement plan; the existing rooftop units will be able to utilize MERV13 filters butexisting unit ventilators equipment will not be able to accommodate MERV13 filters without significantly impacting system operation, outdoor air delivery to the space and equipment component failures.
3. Filter upgrades will require more frequent changes due to pressure drop of filter and particulates that “dirty” the filters.
4. Continued operation of heating and cooling systems is recommended.
5. Operate toilet exhaust fans 24 hours a day, 7 days a week.; other fans shall operate two hours prior and two hours post occupied hours.
6. Monitor Carbon Dioxide (CO_2) levels in occupied areas of the building.
7. Should building exhaust exit building through sidewall louvers subject to pedestrian traffic, provide warning signs and consider diverting or rearranging the exhaust air discharge locations so that they would pose no opportunity to cause harm.
8. Operate the building in occupied mode with mechanical ventilation prior and two hours post occupied hours; where mechanical ventilation and exhaust are not currently provided, utilize operable windows.

9. Operate the building in the occupied mode during disinfection and cleaning operations.
10. Operate Classroom unit ventilators and computer room split systems with ventilation as originally designed. Based on reduced classroom sizes, the classroom current system can provide 20 CFM/occupant which exceeds current code requirements (10 CFM per occupant plus 0.12 CFM/SF) and can be supplemented by operable windows.
11. Operate Library rooftop unit RTU-1 at maximum design air flow; the unit has the capability of providing 20/CFM per occupant for 75 occupants.
12. Operate Cafeteria rooftop unit RTU-2 at maximum design air flow; the unit has the capability of providing 20/CFM per occupant for 225 occupants.
13. Operate Gymnasium rooftop unit RTU-3 at maximum design air flow; the unit has the capability of providing 20/CFM per occupant for 525 occupants.
14. Operate Administration unit RTU-4 at maximum design air flow; the unit has the capability of providing 20/CFM per occupant for 90 occupants.
15. Operate Administration rooftop unit RTU-5 at maximum design air flow; the unit has the capability of providing 20/CFM per occupant for 65 occupants.
16. Operate Auditorium rooftop unit RTU-6 at maximum design air flow; the unit has the capability of providing 20/CFM per occupant for 375 occupants.
17. At the commencement of school and until the heating season and when outdoor air temperature conditions allow, the air handling equipment with recirculated air can be run in the "economizer mode" with 100% outdoor air and no recirculation.
18. Operate rooftop units and air handling units with highest percentage of outdoor air possible without adversely affecting the occupied environment; outdoor air percentage will be dependent on outdoor air temperature and allowable indoor air temperatures above/below normal operation.
19. Reset discharge air setpoint as high as possible to encourage variable air volume dampers to maximized outdoor air into the building.
20. Disable any CO2 demand control ventilation sequences of operation; operate units at maximum outdoor air capacity.
21. Eliminate outdoor air to zones that are not occupied to better use in occupied areas.
22. Relocate occupants from areas that do not have mechanical ventilation or operable windows.
23. Use operable windows when outdoor air conditions allow.
24. Keep conference room doors open as much as possible or open windows when feasible.
25. Increase regular maintenance of all mechanical heating, ventilating and air conditioning equipment.
26. Monitor the heating, ventilating and air conditioning operation of the building on a continual basis.
27. Follow recommendations of holistic view of building recommendations in General Recommendations.

Tier 2 Recommendations: Tier 2 recommendations are supplemental revisions/additions to the existing systems that may be required for the heating season when systems will need to utilize recirculated air to maintain space temperature setpoints.

1. Provide additional filtration with portable HEPA filter units or UV filtration units for classrooms with unit ventilators.
2. Install portable humidifiers or retrofit existing heating/ventilating equipment with humidifiers for local humidity control.

3. Add plug-in type supplemental electric heat as required for increased ventilation requirements.
4. Apply and use outdoor air quality sensors or reliable web-based data for outdoor pollution information as part of the new ventilation operation.
5. Consider adding UV decontamination in return airstream for rooftop units.
6. Consider UV decontamination lights on highly touched surfaces.

Notes:

1. While there is ventilation air and return air associated with each classroom unit ventilator, the units only recirculate air within each classroom and do not recirculate air between classrooms. The ventilation and exhaust systems for the typical classroom is continuous and separate.
2. While there is ventilation air and return air associated with rooftop units for the Gymnasium, Auditorium, Cafeteria and Library the units only recirculate air within each space and do not recirculate air between other spaces; and the units were designed for MERV13 filters.
3. These recommendations are based on guidance provided by applicable agencies and publications for best practices for protection of occupants and visitors to the building but do not provide absolute protection from the pandemic.
4. These recommendations will have a significant impact on the operating and maintenance related costs of the HVAC systems.