Wilmington Public Schools
West Intermediate School
Wilmington, MA

2020

HVAC System Evaluation

Prepared For:

Town of Wilmington
30 Church Street
Wilmington, MA 01887

Prepared By:

BLW Engineers, Inc.
311 Great Road
Post Office Box 1551
Littleton, MA 01460

September 4, 2020

GENERAL

Wilmington Public Schools engaged BLW Engineers to evaluate the West Intermediate 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. The building was the actively going under an asbestos abatement.

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 West Intermediate School is located at 22 Carter Lane, Wilmington, MA and was originally constructed circa 1962; the building comprises approximately 62,060 square feet of educational space.

HVAC SYSTEM EVALUATION

Existing Conditions

General

The space heat throughout the building is provided by the central boiler plant within the lower level Mechanical room. The central boiler plant has a gross output of approximately 5,400 MBH. Boiler system includes water specialties, insulated hot water distribution piping system, boiler breeching system and local electronic controls with a dedicated outdoor air temp sensor to modulate HWS distribution temperature. Insulated hot water distribution system from the boilers provides heating hot water into the insulated hot water distribution piping system throughout the building. P-1 & P-2 main circulators operate in lead/lag sequences and have a nominal capacity of 675 GPM at 60 Ft HD, 5 HP.

Classrooms

Typical Classrooms are provided with unit ventilators to provide classroom heating and ventilating. Typical classroom unit ventilators were designed to each have a total airflow capacity of 1,000 CFM and 500 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, typical classroom unit ventilators (UV-A) are equipped with a 97.1 MBH heating coil. Each UV heating coil is controlled by a wall mounted thermostat connected to the coil control valve. Each classroom is provided with on sidewall exhaust grilles located within a recessed alcove in each classroom that exhaust 360 CFM/ea. Roof mounted Exhaust Fans (EF's) are located at common central points of the classroom corridor to provide pressure relief and exhaust interior spaces. Roof Mounted Exhaust Fans exhaust approximately 6,760 from the First and Second Floor Classroom and Common Spaces. Various classroom areas have been provided with Window AC units.

Cafeteria

HV-1 serves the Cafeteria and is designed to provide heating and ventilation air. HV-1 has an airflow capacity of 5,880 CFM and is designed to provide 50% outdoor air via 60"X36" sidewall air intake louver. HV-1 includes a 350.0 MBH hot water heat coil with 2" HWS/HWR piping connections. The unit was

designed with eight (8) ceiling diffusers providing 735 CFM/ea into the space. There is a single 36"X24" sidewall exhaust grille located below adjacent to the stage platform ducted to a dedicated exhaust fan that exhausts 2,650 CFM to the outdoors. The HV-1 blower motor is rated at 3 HP and was designed with an ESP of 0.5" w.c. The Cafeteria exterior wall assembly also has Two-Tier Finned Tube Radiation, which as Stage-1 heat source during unoccupied periods.

Kitchen

HV-2 serves the Kitchen area and was designed to provide heating and ventilation air. KV-1 has an airflow capacity of 5,500 CFM and was designed to provide 100% outdoor air with a 60"X24" sidewall air intake louver. The system includes a 480 MBH hot water heat coil with 2" HWS/HWR piping connections. The units blower motor is rated at 1.5 HP and was designed with an ESP of 0.625" w.c. Air is distributed to the kitchen areas via supply sidewall supply grille. The Kitchen hood exhaust fan (RF-7) is designed with an exhaust airflow rate of 5,500 CFM and is a dedicated Type-1 Hood and Fan assembly to serve the Kitchen hood.

Administration Office Areas

HV-3 serves the First Floor Administrative areas and was designed to provide heating and ventilation air to the interior office areas. HV-3 has an airflow capacity of 2,265 CFM and was designed to provide 100% outdoor air with a 48"X18" sidewall air intake louver. The system includes a 220 MBH hot water heat coil with 1-1/4" HWS/HWR piping connections. The unit's blower motor is rated at 1.5 HP and was designed with an ESP of 0.5" w.c. Air is distributed to the office areas via ceiling sidewall supply diffusers. Bathrooms and storage rooms have been provided with ceiling and sidewall exhaust grilles to serve the administrative and public bathroom areas.

Gymnasium

The Gymnasium is heating and ventilated via two (2) Heating & Ventilating Units (HV-4 & HV-5) located at the interior of space and supported from the roof structure above. HV-4 & HV-5 each have a design airflow capacity of 3,600 CFM with 1,800 CFM of outdoor air to provide hydronic heating and ventilation of the Gym. HV-4 & HV-5 are each equipped with a 42"X 18" return air register recirculating 1,800 CFM from the space. The two units are served by a common intake air plenum located at the adjacent roof plane. The outdoor intake louver is 24"X36" and designed to provide 1,800 CFM to each unit. HV-4 & HV-5 were designed to operate as a separate zones, each unit as a constant volume system with a dedicated local space temperature sensor. Each unit includes a 200 MBH hot water heat coil with 1-1/4" HWS/HWR piping connections. Both units are heat only with a 1.5 HP blower motor at 0.5" w.c. Supply air is distributed via exposed ductwork with high velocity sidewall diffusers. The unit dates to the Addition construction circa 1963, and appears to have had belt and blower periodic service performed as needed. HV-4 & HV-5 have identical system capacities and ductwork layouts, each located at the East and West portions of the Gym. There are (2) exhaust fans that allow pressure relief and exhaust contaminated air from within the space; RF-4 & RF-5 each with a capacity of 1,800 CFM. Gym units are controlled by pneumatic actuators. There is also finned tube radiation located at the exterior wall to provide space heating.

Girls & Boys Locker Rooms

H-6 air handling unit serves the Boys and Girls Locker room and is designed to provide heating and ventilation air. H-6 has an airflow capacity of 3,590 CFM and is designed to provide 100% outdoor air. The unit has a dedicated 36"X36" outdoor air intake louver for fresh air and includes a 350.0 MBH hot water heat coil with 1-1/2" HWS/HWR piping connections. The Boys locker room is exhausted by a

deidcated roof mounted exhaust fan (RF-3) at a capacity of 1,800 CFM at 0.5” w.c. The Girls locker locker room is exhausted by a deidcated roof mounted exhaust fan (RF-6) at a capacity of 1,925 CFM at 0.5” w.c.

Library

Library room has been provided with a single unit ventilator to provide classroom heating and ventilating. The Library unit ventilators were designed to each have a total airflow capacity of 1,500 CFM and 750 CFM of outdoor air (OA). The unit ventilator is provided with a hot water heating coil interconnected to the hot water distribution piping system, and is equipped with a 146.0 MBH heating coil and is controlled by a wall mounted thermostat connected to the coil control valve. The Library is exhausted by a roof mounted exhaust fan that exhausts 450 CFM from the space.

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 in the form of finned tube radiation within baseboard enclosures. Miscellaneous spaces have been provided with hot water terminal equipment interconnected with the hot water distribution piping system.

Art activity classroom includes a kiln and sidewall prop fan for local exhaust.

The building HVAC systems are controlled by stand-alone pneumatic and electrical controls dedicated to the respective systems that they serve.

CLASS ROOM UNIT VENTILATOR SCHEDULE

TYPE	ST'D CFM	TOTAL CAP MBH	AVE. WATER TEMP.	FINAL TEMP.	GPM	%OA	HP	REMARKS
A	1000	97.1	200°	131	11.31	50%	1/6	FL. STANDING
B	500	72.2	↓	119	7.42	↓	↓	FL. STANDING
C	1250	121.2	↓	119	12.47	↓	↓	CL'G TYPE ARR #1
D	750	72.2	↓	119	7.42	↓	↓	CL'G TYPE ARR #1
E	1500	146.0	↓	120	15.02	↓	↓	FL. STANDING
* I	–	21.7	↓	–	4.0	–	–	FL STANDING

BASED ON TRANE CO.
* I AUXILIARY CONVECTORS SIZE 72 (28")

HEATING AND VENTILATING UNIT SCHEDULE

NO.	MODEL NO.	TOTAL AIR CFM STD	O.A. CFM	TOTAL MBH	TEMP. ENT. COIL °F	O.V.	EXT. S.P.	HP	REMARKS
1	T-12	5880	2940	350	35°	1450	5/8	3	CAFETERIA
2	T-10	5500	5500	480	0°	1637	1/2	2	KITCHEN MAU
3	T-6	2265	2265	220	0°	1190	5/8	1 1/2	1ST FLOOR ADMIN
4	T-8	3600	1800	200	35	1270	1/2	1 1/2	GYMNASIUM
5	T-8	3600	1800	200	35	1270	1/2	1 1/2	GYMNASIUM
6	T-8	3590	3590	350	0°	1268	5/8	1 1/2	LOCKER ROOMS

BASED ON TRANE CO.
TEMP. DROP THRU. COIL 40°F MAX. DROP 6FT
ALL H&V. UNITS SHALL HAVE INT. FACE & BYPASS

ROOF EXHAUST FAN SCHEDULE

NO	MODEL	CFM	SP	HP	TIP-SPEED	REMARKS
1	143BCR	750	3/8	1/4	3500	BATHROOMS
2	243BCR	1800	3/8	1/2	3300	CLASSROOMS
3	302BCR	2005	1/2	1	3600	BOYS LOCKER RM
4	243BCR	1800	3/8	1/2	3300	GYMNASIUM
5	243BCR	1800	3/8	1/2	3300	GYMNASIUM
6	302BCR	1925	1/2	3/4	3500	GIRLS LOCKER RM
7	483BCR	5500	5/8	2	4000	KITCHEN HOOD
8	142BCR	750	1/8	1/4	3000	ADMIN
9	142BCR	420	1/4	1/4	2650	1ST FL ADMIN
10	9BCR	260	1/4	1/12	–	MEN'S BATHROOM
11	72CR	120	1/8	1/40	–	ADMIN / CAFE

BASED ON JENN-AIR CO.
ALL FANS MUST BE A.M.C.A. APPROVED

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

Operating commercial office 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

WEST INTERMEDIATE 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 West Intermediate 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 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.
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 with ventilation as originally designed. Based on reduced classroom sizes, the classroom current system can provide more than 35 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 Cafeteria heating/venting unit (HV-1) at maximum design air flow; the unit has the capability of providing 20/CFM per occupant for 147 occupants.
12. Operate Administration heating/venting units (HV-3) at 100% outdoor air and associated exhaust fan continuously.
13. Operate Gym heating/venting units (HV-4, 5) at maximum design air flow; the unit has the capability of providing 20/CFM per occupant for 180 occupants.
14. Operate Locker Room heating/venting unit (HV-6) with 100% outdoor air and associated exhaust fan continuously.
15. Operate Library unit ventilator at maximum design air flow; the unit has the capability of providing 20/CFM per occupant for 37 occupants.
16. 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.
17. Operate unit ventilators and heating/ventilating 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.
18. Reset discharge air setpoint as high as possible to encourage variable air volume dampers to maximized outdoor air into the building.
19. Disable any CO2 demand control ventilation sequences of operation; operate units at maximum outdoor air capacity.
20. Eliminate outdoor air to zones that are not occupied to better use in occupied areas.
21. Relocate occupants from areas that do not have mechanical ventilation or operable windows.
22. Use operable windows when outdoor air conditions allow.
23. Keep conference room doors open as much as possible or open windows when feasible.
24. Increase regular maintenance of all mechanical heating, ventilating and air conditioning equipment.
25. Monitor the heating, ventilating and air conditioning operation of the building on a continual basis.
26. 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 and Library.
2. Provide additional filtration with portable HEPA filter units or UV filtration units for Cafeteria and Gymnasium heating/ventilating units.
3. Install portable humidifiers or retrofit existing heating/ventilating equipment with humidifiers for local humidity control.
4. Add plug-in type supplemental electric heat as required for increased ventilation requirements.

5. Apply and use outdoor air quality sensors or reliable web-based data for outdoor pollution information as part of the new ventilation operation.
6. Consider adding UV decontamination in return airstream for air handling equipment.
7. Consider UV decontamination lights on highly touched surfaces.

Notes:

1. While there is ventilation air and return air associated with each classroom unit ventilator and the Library 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 heating/ventilating units for the Gymnasium and Cafeteria, the units only recirculate air within each space and do not recirculate air between other spaces.
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.