Barnstable Public Schools
Barnstable High School
Barnstable, MA

2020

HVAC System Evaluation

Prepared For:

Barnstable Public Schools
230 South Street
Hyannis, MA 02601

Prepared By:

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

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EXECUTIVE SUMMARY

General

Barnstable Public Schools engaged BLW Engineers to evaluate the building HVAC system relative to its current operating conditions, re-opening to the building to the public and potential considerations relative to Covid-19. Kenneth R. Beck, PE, Principal-In-Charge, visited each site, reviewed building documentation and prepared the following evaluation.

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 Barnstable High School is located at 744 Main Street, originally constructed in 1957 and last renovated in 1999; the school comprises approximately 440,000 square feet of educational space.

Barnstable High School Planned Reopening

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

- Classrooms seating will be reorganized to provide recommended social distancing; typically, classrooms sizes will be reduced to 15 people (students and a teacher).
- Cafeterias will not be used in normal fashion; students will eat lunches at their desk.
- Gym will not be used in normal fashion.
- Auditorium will not be used in normal fashion.
- Library room will not be used in normal fashion; it will be used primarily as classroom space.

Recommendations

Based on applicable guidelines (ASHRAE, State of Massachusetts Re-opening Guidelines, Massachusetts Teachers Association, etc.), the Barnstable High 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" 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; rooftop units, unit ventilators, air handling units and heating/ventilating units 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 (24 hours a day, 7 days a week) 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 (CO2) levels in occupied areas of the building by building personal on an intermittent basis.
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 two hours 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 rooftop units at maximum outdoor air for ventilation. Based on reduced classroom sizes, the classroom current system can provide more than 30 CFM/occupant for 12 people (10 CFM per occupant plus 0.12 CFM/SF), MTA Guidelines and can be supplemented by operable windows.
11. Operate Cafeteria rooftop units (RTU-1, 2, 3) at maximum design air flow; the units have the capability of providing 20/CFM per occupant for 300 occupants.
12. Operate PE Room rooftop units (RTU-4) at maximum design air flow; the units have the capability of providing 20/CFM per occupant for 80 occupants.
13. Operate new Food Lab rooftop unit at maximum design air flow.
14. Operate new Health rooftop unit at maximum design air flow.
15. Operate new Library rooftop units at maximum design air flow.
16. Operate Field House rooftop units (RTU-11, 12) at maximum design air flow; the units have the capability of providing 20/CFM per occupant for 625 occupants.
17. Operate Lecture Hall air handling unit (AHU-1F) at maximum design air flow; the units have the capability of providing 20/CFM per occupant for 247 occupants.
18. Operate Lecture Hall Stage air handling unit (AHU-2F) at maximum design air flow; the units have the capability of providing 20/CFM per occupant for 45 occupants.
19. Operate Auditorium air handling units (AHU-1k, 2K) at maximum design air flow; the units have the capability of providing 20/CFM per occupant for 1,125 occupants.
20. Operate Stage air handling unit (AHU-3K) at maximum design air flow; the units have the capability of providing 20/CFM per occupant for 18 occupants.
21. Operate Band Room air handling unit (AHU-2L) at maximum design air flow; the units have the capability of providing 20/CFM per occupant for 48 occupants.
22. Operate Choral air handling unit (AHU-3L) at maximum design air flow; the units have the capability of providing 20/CFM per occupant for 64 occupants.
23. Operate L-Wing air handling unit (AHU-4L) at maximum design air flow; the units have the capability of providing 20/CFM per occupant for 63 occupants.
24. E-Wing and F-Wing offices with fan coil units shall utilize operable windows, supplemental electric heat and portable HEPA filters as required for occupation
25. Operate Television Studio air handling unit (AHU-1F) at maximum design air flow; the units have the capability of providing 20/CFM per occupant for 18 occupants.
26. Operate Gymnasium heating/ventilating units (HV-1B, 2B) at maximum design air flow; the units have the capability of providing 20/CFM per occupant for 882 occupants.
27. Operate Locker Room units and associated exhaust fans continuously.

28. Close Coffee Shop.
29. At the commencement of school and until the heating season, the rooftop units, air handling units and heating/ventilating units can be run in the "economizer mode" with 100% outdoor air and no recirculation.
30. During the heating season, operate rooftop units, air handling units and heating/ventilating to the level above the ventilation design capacity based on outdoor air temperature and the acceptable indoor air temperature acceptable to the occupant comfort.
31. Eliminate zones that are not occupied to better use outdoor air in occupied areas.
32. Relocate occupants from areas that do not have mechanical ventilation or operable windows.
33. Use operable windows when outdoor air conditions allow.
34. Keep conference room doors open as much as possible or open windows when feasible.
35. Increase regular maintenance of all mechanical heating, ventilating and air conditioning equipment.
36. Monitor the heating, ventilating and air conditioning operation of the building on a continual basis.
37. Follow recommendations of holistic view of building recommendations in General Recommendations noted hereinafter.

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 (100 cfm/250 SF) or UV filtration units for rooftop units, air handling units and heating/ventilating units with large percentages of recirculation air.
2. Install portable humidifiers or retrofit existing equipment with humidifiers for local humidity control should humidity become an issue.
3. Add plug-in type supplemental electric heat as required for increased ventilation requirements through equipment or operable windows.
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 UV decontamination lights on highly touched surfaces.

Notes:

1. 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.
2. These recommendations will have a significant impact on the operating and maintenance related costs of the HVAC systems.

HVAC SYSTEM EVALUATION

The existing building is provided with heating hot water by hot water boilers, a water cooled chiller, cooling tower, a two-pipe hot water water distribution piping system, a two-pipe dual water distribution piping system, a two-pipe condenser water distribution piping system, rooftop units, unit ventilators, air

handling units, heating/ventilating units, fan coil units, exhaust fans and miscellaneous heating terminal equipment.

The three standard efficiency Cleaver Brooks boilers are located in the mechanical room. The boilers are piped to hot water pumps (2 lead/ 1standby) with variable speed drives which provides heating hot water to the hot water terminal equipment/coils throughout the building through a heating hot water piping distribution system and to the dual water pumps (lead/standby) with variable speed drives which provides heating hot water to the dual water terminal equipment/coils throughout the building through a dual water piping distribution system. Heating/Ventilating unit HV-1K provides heating and combustion air (9,000 CFM tempered outdoor air).

The 625 ton water cooled chiller is located in the mechanical room. The chiller condenser is water cooled by the condenser water pumps (` lead/1 standby) and the piping to the two cooling towes; the chiller evaporator provides chilled water through the chilled water pumps (2 lead/1 standby) to the dual water terminal equipment/coils throughout the building through a dual water piping distribution system.

The Cafeteria is provided with multizone packaged (DX cooling) rooftop units (RTU-1, 2, 3) that provide heating and ventilation air through an insulated duct system to ceiling supply diffusers. Air is returned to the unit though ceiling register into a low pressure return/exhaust air is duct distribution system. The original design provides 26,780 CFM of total air supply and approximately 6,000 CFM of outdoor air for ventilation which exceeds current code requirements (Classroom Ventilation = 7.5 CFM x Occupant + 0.18 CFM x SF). Heating is provided through the rooftop unit coil interconnected to the hot water distribution piping system and a wall mounted space temperature sensor. The Cafeteria could accommodate up to 300 students at 20 cfm/student ventilation rate.

The PE rooms are provided with multizone rooftop units (RTU-4) that provides heating and ventilating through an insulated duct system to ceiling supply diffusers. Air is returned to the unit though ceiling register into a low pressure return/exhaust air is duct distribution system. The original design provides 8,000 CFM of total air supply and approximately 1,600 CFM of outdoor air for ventilation which exceeds current code requirements (Classroom Ventilation = 7.5 CFM x Occupant + 0.06 CFM x SF). Heating is provided through the rooftop unit coil interconnected to the hot water distribution piping system and a wall mounted space temperature sensor. The PE Rooms could accommodate up to 80 students at 20 cfm/student ventilation rate.

The Food Labs are provided with a new packaged (DX cooling) variable air volume rooftop unit (replacing RTU-5) that provides conditioned air through a medium pressure duct distribution system to variable air volume terminal unit with hot water reheat coils to a insulated duct system to ceiling supply diffusers. Air is returned to the unit though ceiling register into a low pressure return/exhaust air is duct distribution system. The original design provides 11,700 CFM of total air supply and approximately 2,400 CFM of outdoor air for ventilation (300 CFM per zone) which exceeds current code requirements (Classroom Ventilation = 10 CFM x Occupant + 0.12 CFM x SF). Heating and Air Conditioning is provided through the air handling unit coil interconnected to the dual water distribution piping system and a wall mounted space temperature sensor. Heating for the variable air volume terminal unit hot water reheat coil interconnected to the hot water distribution piping system and a wall mounted space temperature sensor.

The Health Classrooms are provided with a new packaged (DX cooling) variable air volume rooftop unit (replacing RTU-6) that provides conditioned air through a medium pressure duct distribution system to variable air volume terminal unit with hot water reheat coils to an insulated duct system to ceiling supply diffusers. Air is returned to the unit though ceiling register into a low pressure return/exhaust air is duct distribution system. The original design provides 6,100 CFM of total air supply and approximately 1,200 CFM of outdoor air for ventilation (300 CFM per zone) which exceeds current code requirements (Classroom Ventilation = 10 CFM x Occupant + 0.12 CFM x SF). Heating and Air Conditioning is provided through the air handling unit coil interconnected to the dual water distribution piping system and a wall mounted space temperature sensor. Heating for the variable air volume terminal unit hot water reheat coil interconnected to the hot water distribution piping system and a wall mounted space temperature sensor.

Classrooms are provided with provided with unit ventilators to provide heating and ventilation; the units were designed to provide varying (1,000 CFM to 2,000 CFM) total air supply and 375 CFM of outdoor air; the original ventilation air design exceeds current code requirements (Classroom Ventilation = 10 CFM x Occupant + 0.12 CFM x SF or for a typical 750 SF classroom with 25 occupants that would be 340 CFM). Heating and Air Conditioning is provided through the air handling unit coil interconnected to the dual water distribution piping system and a wall mounted space temperature sensor.

Classrooms in the H-wing are provided with multizone packaged (DX cooling) rooftop units (RTU-7, 8) that provide conditioned air through a medium pressure insulated duct system to variable air volume terminal units with hot water reheat coils; from variable air volume terminal units to ceiling supply diffusers. Air is returned to the unit though ceiling register into a low pressure return/exhaust air is duct distribution system. The original ventilation design provides 375 CFM of outdoor air for ventilation which exceeds current code requirements (Classroom Ventilation = 10 CFM x Occupant + 0.12 CFM x SF or for a typical 750 SF classroom with 25 occupants that would be 340 CFM). Heating and Air Conditioning is provided through the air handling unit coil interconnected to the dual water distribution piping system and a wall mounted space temperature sensor.

The Library and surrounding spaces are provided with new packaged (DX cooling) variable air volume rooftop units (replacing RTU-9) that provides conditioned air through a medium pressure duct distribution system to variable air volume terminal unit with hot water reheat coils to an insulated duct system to ceiling supply diffusers. Air is returned to the unit though ceiling register into a low pressure return/exhaust air is duct distribution system. Heating and Air Conditioning is provided through the air handling unit coils interconnected to the dual water distribution piping system and a wall mounted space temperature sensor. Heating for the variable air volume terminal unit hot water reheat coil interconnected to the hot water distribution piping system and a wall mounted space temperature sensor.

The Kitchen is provided with packaged (DX cooling) rooftop units (RTU-10), Kitchen Hood Exhaust Fans (EF-1D, 2D) and Dishwasher (EF-3D) and a gravity vent that provide conditioned air through an insulated duct system to ceiling supply diffusers. Heating is provided through the rooftop unit coil interconnected to the hot water distribution piping system and a wall mounted space temperature sensor.

The Field House is provided with rooftop units (RTU-11, 12) and a gravity vent that provide heating and ventilation air through an insulated duct system to ceiling supply diffusers. Air is returned to the unit though ceiling register into a low pressure return/exhaust air is duct distribution system. The original

design provides 25,000 CFM of total air supply and approximately 7,500 CFM of outdoor air for ventilation which exceeds current code requirements (Classroom Ventilation = 7.5 CFM x Occupant + 0.06 CFM x SF). Heating is provided through the air handling unit coil interconnected to the hot water distribution piping system and a wall mounted space temperature sensor. The Field House could accommodate up to 625 students at 20 cfm/student ventilation rate.

The Field House boys and girls locker rooms are each provided with two horizontal unit ventilators and exhaust fans for heating and ventilating.

The Gymnasium is provided heating/ventilating units (HV-1B, 2B) to provide heating and ventilation; the units were designed to provide 17,650 CFM total air supply and 17,650 CFM of outdoor air for ventilation; the original ventilation air design exceeds current code requirements (Ventilation = 7.5 CFM x Occupant + 0.06 CFM x SF). Heating is provided through the unit's hot water coil interconnected to the Gymnasium hot water piping distribution system. The Gymnasium could accommodate up to 882 students at 20 cfm/student ventilation rate.

Two new rooftop units are being installed for the new Environmental Science Classrooms.

The Lecture Hall is provided with an air handling unit (AHU-1F) that provides conditioned air through an insulated duct system to ceiling supply diffusers. Air is returned to the unit though register into a low pressure return/exhaust air is duct distribution system by return/exhaust fans (RAF-6) back to the unit or to the outdoors. The original design provides 11,550 CFM of total air supply and 4,950 CFM of outdoor air for ventilation which exceeds current code requirements (Ventilation = 7.5 CFM x Occupant + 0.06 CFM x SF). Heating and Air Conditioning is provided through the air handling unit coil interconnected to the dual water distribution piping system and a wall mounted space temperature sensor. The Lecture Hall could accommodate up to 247 students at 20 cfm/student ventilation rate.

The Lecture Hall Stage is provided with an air handling unit (AHU-2F) that provides conditioned air through an insulated duct system to ceiling supply diffusers. Air is returned to the unit though register into a low pressure return/exhaust air is duct distribution system by return/exhaust fans (RAF-7) back to the unit or to the outdoors. The original design provides 6,000 CFM of total air supply and 900 CFM of outdoor air for ventilation which exceeds current code requirements (Ventilation = 7.5 CFM x Occupant + 0.06 CFM x SF). Heating and Air Conditioning is provided through the air handling unit coil interconnected to the dual water distribution piping system and a wall mounted space temperature sensor. The Lecture Hall Stage could accommodate up to 45 students at 20 cfm/student ventilation rate.

The Auditorium is provided with two air handling units (AHU-1K, 2K) that provide conditioned air through an insulated duct system to ceiling supply diffusers. Air is returned to the unit though register into a low pressure return/exhaust air is duct distribution system by return/exhaust fans (REF-1K, 2K) back to the unit or to the outdoors. The original design provides 52,500 CFM of total air supply and 22,500 CFM of outdoor air for ventilation which exceeds current code requirements (Ventilation = 5 CFM x Occupant + 0.06 CFM x SF). Heating and Air Conditioning is provided through the air handling unit coils interconnected to the dual water distribution piping system and a wall mounted space temperature sensor. The Auditorium could accommodate up to 1,125 students at 20 cfm/student ventilation rate.

Construction Technology is provided with an air handling unit (AHU-3K) that provides heating and ventilation air through an insulated duct system to ceiling supply diffusers. Air is returned to the unit

though register into a low pressure return air back to the unit. The original design provides 2,700 CFM of total air supply and 375 CFM of outdoor air for ventilation Heating is provided through the rooftop unit coil interconnected to the hot water distribution piping system and a wall mounted space temperature sensor. Construction Technology could accommodate up to 18 students at 20 cfm/student ventilation rate.

Custodial Storage is provided with an air handling unit (AHU-4K) that provides heating and ventilation air through an insulated duct system to ceiling supply diffusers. Air is returned to the unit though register into a low pressure return air back to the unit. The original design provides 2,800 CFM of total air supply and 400 CFM of outdoor air for ventilation. Heating is provided through the rooftop unit coil interconnected to the hot water distribution piping system and a wall mounted space temperature sensor.

The Senior Cafeteria is provided with six unit ventilator (CUV-6) that provide heating and ventilation to the space. Air is returned to the unit though register into a low pressure return air back to the unit. The original design provides 6,000 CFM of total air supply and 3,000 CFM of outdoor air for ventilation. Heating is provided through the rooftop unit coil interconnected to the hot water distribution piping system and a wall mounted space temperature sensor.
The Senior Cafeteria could accommodate up to 150 students at 20 cfm/student ventilation rate.

The Stage is provided with an air handling unit (AHU-1L) that provides conditioned air through an insulated duct system to ceiling supply diffusers. Air is returned to the unit though register into a low pressure return/exhaust air is duct distribution system by return/exhaust fans (REF-1L) back to the unit or to the outdoors. The original design provides 15,000 CFM of total air supply and 1,200 CFM of outdoor air for ventilation which exceeds current code requirements (Ventilation = 7.5 CFM x Occupant + 0.06 CFM x SF). Heating and Air Conditioning is provided through the air handling unit coil interconnected to the dual water distribution piping system and a wall mounted space temperature sensor. The Stage could accommodate up to 60 students at 20 cfm/student ventilation rate.

The Band Room is provided with an air handling unit (AHU-2L) that provides heating and ventilation air through an insulated duct system to ceiling supply diffusers. Air is returned to the unit though register into a low pressure return air back to the unit. The original design provides 8,591 CFM of total air supply and 961 CFM of outdoor air for ventilation. Heating is provided through the rooftop unit coil interconnected to the hot water distribution piping system and a wall mounted space temperature sensor. The Band Room could accommodate up to 48 students at 20 cfm/student ventilation rate.

The Choral Room is provided with an air handling unit (AHU-3L) that provides heating and ventilation air through an insulated duct system to ceiling supply diffusers. Air is returned to the unit though register into a low pressure return air back to the unit. The original design provides 5,820 CFM of total air supply and 1,282 CFM of outdoor air for ventilation. Heating is provided through the rooftop unit coil interconnected to the hot water distribution piping system and a wall mounted space temperature sensor. The Choral Room could accommodate up to 64 students at 20 cfm/student ventilation rate.

L-Wing Offices are provided with an air handling unit (AHU-4L) that provides conditioned air through an insulated duct system to ceiling supply diffusers. Air is returned to the unit though register into a low pressure return air back to the unit. The original design provides 2,840 CFM of total air supply and 1,270 CFM of outdoor air for ventilation. Heating and Air Conditioning is provided through the air handling

unit coil interconnected to the dual water distribution piping system and a wall mounted space temperature sensor. The Choral Room could accommodate up to 63 occupants at 20 cfm/student ventilation rate.

E-Wing and F-Wing offices are provided with fan coil units and operable windows for heating, ventilating and air conditioning. Heating and Air Conditioning is provided through the air handling unit coil interconnected to the dual water distribution piping system and a wall mounted space temperature sensor.

The Auditorium Lobby is provided with an air handling unit (AHU-5K) that provides conditioned air through an insulated duct system to ceiling supply diffusers. Air is returned to the unit though register into a low pressure return air back to the unit. The original design provides 7,140 CFM of total air supply and 2,150 CFM of outdoor air for ventilation. Heating and Air Conditioning is provided through the air handling unit coil interconnected to the dual water distribution piping system and a wall mounted space temperature sensor.

The Television is provided with an air handling unit (AHU-6K) that provides conditioned air through an insulated duct system to ceiling supply diffusers. Air is returned to the unit though register into a low pressure return air back to the unit. The original design provides 3,590 CFM of total air supply and 360 CFM of outdoor air for ventilation. Heating and Air Conditioning is provided through the air handling unit coil interconnected to the dual water distribution piping system and a wall mounted space temperature sensor. The Television Studio could accommodate up to 18 students at 20 cfm/student ventilation rate.

The Coffee Shop is only provided with minimal exhaust.

Bathrooms, Janitor's Closets, Storage, etc. are provided by exhaust registers, exhaust duct distribution system and roof exhaust fans.

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

The building is controlled by electronic controls.

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, 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.