# Groton Public Schools
# Covid-19 School Opening Support and Guidance Commissioning Checklists

## Northeast Academy Elementary School
**Groton, CT**

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# Executive Summary

**Disclaimer:** This list of recommendations is intended to help mitigate the potential spread of viruses and/or other biological hazards. Our recommendations reflect current best practices of the HVAC industry. There is no guarantee that any of these recommendations can or will prevent any occurrences of Covid-19 or any other airborne hazards.

## Summary of Observations

Fuss & O'Neill, Inc. (F&O) visited Northeast Academy Elementary School on August 5th, 2020 to review the items contained within these checklists. The following deficiencies were noted during the walk-down and through conversations with facility personnel. This list does not exclude other items in the checklists that follow. All items should be reviewed with school staff and facility personnel for inclusion in potential Covid-19-related renovation efforts.

System Summary for Northeast Academy Elementary School:

- Northeast Academy Elementary and Catherine Kolnaski Elementary are newer buildings based on the same designs set tailored for their sites.
- HVAC systems include the following:
    - A combination of air handling units (AHU) and rooftop units (RTU) serve these schools. Northeast has seven AHUs and three RTUs. These units are equipped with outdoor air dampers to ventilate the spaces served. These units serve the building via hydronic heating and cooling coils. These units utilize outdoor air dampers to ventilate the spaces served.
    - All AHU and RTU units have variable frequency drives (VFD) to control supply and exhaust fans.
    - Some classrooms have operable windows.

General:

- Mold and mildew issues were reported in Northeast Academy. Rooms 1131 and 1223 were reported to be have the worst mold and mildew conditions. These rooms have had all of the carpeting removed and have had humidity sensors installed in each room to more effectively balance the problem areas. Since these changes have been made there have been no more reported issues.

Nurse's Station:

- The isolation room at Northeast Academy will be the room adjacent to the stairwell leading to the exterior doors. This room does not have dedicated exhaust and supply air and is not located near a bathroom. The resting room in the nurse's station could be considered as it is across from a bathroom but would need dedicated exhaust.

Controls:

- The building is monitored and controlled by a campus-wide energy management system (EMS), also known as a building management system (BAS). This system is connected to all units, boilers, chillers and exhaust fans. Points in each room include room relative humidity, temperature, and HVAC system status.

- All equipment, including exhaust fans, are capable of control through the BMS.
- The HVAC system is capable of running 100% outdoor air, but coil freezing concerns in winter may limit outdoor air entry during colder months.

Air Distribution & Filtration:

- AHU and RTU equipment currently incorporate MERV 8 filters which have been regularly changed.
- Maintenance regularly performed filter cleanings and changes and no dirty filters or clogged screens were found.
- No blocked air grilles or diffusers were noted.
- No indoor air quality issues were noted.
- No short-cycling issues were noted.

HVAC Systems:

- HVAC Systems have been in operation on a daily basis.
- If adjusting unit performance in Northeast Academy supply temperatures must be kept above the space dewpoint as moisture may result in additional mold and mildew concerns.

Domestic Water:

- Nothing to Report.

## Summary of Recommendations:

General

- Incorporate policies to support reopening; See Checklist 1.
- Ensure changes to the HVAC system do not cause water, mold, and mildew problems to resume.

Nurse's Station

- The nursing station selection should be re-evaluated per the guidance in Checklist 2. Additional exhaust fans, dampers and controls may be required to comply with recommended alterations.

Controls:

- Run exhaust fans continuously during occupied mode.
- Space conditions should adhere to recommended by ASHRAE in Checklist 3 to limit mold as well as virus transmission and survivability.
- Alter ventilation schedule per Checklist 3.
- Energy recovery wheels are installed in the air handling equipment. Measure pressure to determine if cross-contamination between supply and exhaust air streams is a concern.

Air Distribution & Filtration:

- Replace all MERV 8 filters with high-capacity MERV 13 filters.

HVAC Systems:

- Retain water treatment testing services to maintain optimal glycol concentrations while reducing corrosion and microbial growth in each hydronic loop.

Domestic Water Systems:

- Ensure plumbing traps are full of water to prevent sewer gases and viruses from entering inhabited spaces.
- Ensure all domestic water heaters are installed and maintained properly and have proper flues that limit corrosive flue gas from entering the interstitial space.

# Checklist 1: General District Recommendations

## Determining Building Readiness

- ☐ Create a District or Campus Health and Safety Committee that includes all stakeholders (environmental health and safety, administration, education staff, operations staff, local healthcare providers, etc.)
- ☐ Develop policies for staff and contractor PPE requirements for completing work at facilities that follow local authority, CDC, and OSHA guidelines for the proper use of Personal Protective Equipment (PPE).
- ☒ Where semi-annual / annual scheduled maintenance on the equipment can be performed safely, do not defer this maintenance cycle.
- ☐ Where worker safety could be at risk, defer semi-annual/ annual maintenance on the equipment up to 60 days until worker safety can be accomplished.
- ☐ During the summer period before occupancy, perform Checklist No. 1: Tasks to Be Completed Prior to Start of Classes
- ☐ Operate all HVAC in occupied mode for a minimum of one week prior to occupancy.
- ☒ During the week prior to occupancy, perform Checklist No. 2: HVAC Systems Startup Checklist.
- ☐ Discuss with the entire facilities team and school administrators the general principles about what changes are planned to the usual ventilation system operation for the coming year.
- ☒ Develop a system for building users to notify the facilities department if the building needs to be open longer than usual so that the fan schedule can be altered for that day.
- ☒ Develop standards for frequency of filter replacement and type of filters to be utilized. When feasible, filters may be cleaned by lightly spraying with a 10% bleach solution or other appropriate disinfectant, approved for use against SARS-CoV-2, before removal. Filters may be disposed of in regular trash after disinfecting.
- ☐ Do not allow teachers or other staff to make changes to ventilation system controls in their respective rooms. Explain to them the importance of keeping fans running all day. If temperature, noise, or other issues exist in certain areas, encourage staff to discuss the problem with the facilities department to try to identify a suitable fix that does not negatively impact ventilation.

# Checklist 2: Facility Checks Prior to Start of Classes

## General

☒ Review existing Indoor Air Quality issues, if any, records of documents and investigate current status of complaint and address any deficiencies identified, if possible.
☒ General inspection of spaces to identify any potential concerns for water leaks or mold growth that could negatively impact occupant health.
☒ Check all lavatories and sinks for correct operation and ensure soap dispensers are functional and adequate supply of soap is available to allow for proper handwashing.

## Nurse's Station

The State of Connecticut Department of Education requires isolation rooms at all schools, but the choice of which rooms to use are up to each individual school. Fuss & O'Neill recommends the following steps to develop new isolation rooms based on industry best practices, the recommendations of the CDC and ASHRAE, and the Connecticut reopening guidelines from the Department of Public Health and the Department of Education.

**Minimum Provisions**

The nurse's station should include, at minimum, the following:

☐ Dedicated bathrooms.
☒ Normal non-isolation nursing office.
☐ Provisions for Biohazard waste.
☐ The HVAC serving the nurse's station should have two modes of operation:
(1) "Isolation Mode"
(2) "Normal Mode"

**Isolation Rooms**

☐ Evaluate the addition of an isolation room to the Nurse's Station. This room will contain 1 bed per room.
☐ If a retrofit is not possible, temporary nurse's station trailers are recommended.
☐ For isolation rooms to be used for holding sick students prior to dismissal, consider adding supplemental filtration, such as a portable air cleaner. This is particularly important if the ventilation serving those rooms cannot be run at 100% exhaust at all times. If a portable air cleaner is used, it should:
  ☐ Contain HEPA filters only without ionizers, ozone generators, UV light, or other add-ons.
  ☐ Be correctly sized for the space, with an appropriate CADR (clean air delivery rate).
  ☐ Be located for greatest efficiency within the space.
  ☐ Be turned on at all times that the space is occupied.
☐ Passive isolation may be maintained by isolating patient in a room with a closed door.

**HVAC Operation and Scheduling Guideline**

☐ Isolation Mode (Dedicated 100 % OA systems)
  ☐ Cooling, Heating, Humidification, Dehumidification, Ventilation - 24/7
  ☐ Exhaust fans- 24/7

☐ Normal Mode (Supplementary HVAC systems)
- ☐ Cooling, Heating, Ventilation - per normal school schedule (occupied/unoccupied)
- ☐ Exhaust fans - per normal school schedule (occupied/unoccupied), might be OFF during unoccupied hours

Normal Mode

☐ For the "Normal Mode," the HVAC system can be a (supplementary) standard HVAC system (Fan coils, etc.) per typical current design practices.

☐ Follow CDC guidelines for supply air return air paths, do not mix isolation room air with any other spaces. Directly exhaust isolation rooms. Follow design guidelines for location of OA intakes and exhaust air from exhaust fans.

☐ Locate nurse's office HVAC on an exterior wall.

☐ Maintain pressure relationship for room and corridor:
- ☐ Isolation Room and Nurse's office will be Negative Pressure (- 0.015" to – 0.5" W.C)

☐ HEPA filter to return is acceptable for a small surge in cases

Isolation Mode

Utilize a dedicated HVAC system with the following characteristics:

☐ Winter Conditions: 72 F/50-55% RH

☐ Summer Conditions: 72 F/50%-60% RH

☐ No energy recovery for airborne infectious isolation rooms.

☐ 100 % OA system – no air circulation, exhausted directly to outdoors

☐ 10 Air Changes per Hour (ACH)

☐ Filtration: Two filter banks, MERV 7 and HEPA (MERV 14 for existing HVAC that is unable to support HEPA)

☐ Isolation Room and Nurse's office will be Negative Pressure (- 0.015" to – 0.5" W.C)

☐ Given the small size of the systems serving the Nurse Station in Isolation Mode, it is suggested considering Constant Volume, hard balanced air system.

☐ Air shall be exhausted directly outdoors

## HVAC System Startup

**Commissioning**

☐ Commission building mechanical systems for full occupancy.

☒ Operate HVAC to maintain human comfort while reducing potential spread of pathogens and mold growth. Maintain temperatures between 68-78 degrees F dry bulb and 40-60% relative humidity per ASHRAE guidelines. Installation of portable humidifiers and/or electric heaters is acceptable to maintain these conditions while maximizing outdoor air.

☐ Trend and monitor temperature and humidity levels in each space to the extent possible and within the capability of BAS, portable data loggers and handheld instruments.

☒ Verify proper separation between outdoor air intakes and exhaust discharge outlets to prevent/limit re-entrainment of potentially contaminated exhaust air (generally minimum of 10-foot separation - comply with local code requirements).

☐ Have airflows and building pressurization measured/balanced by a qualified Testing, Adjusting and Balancing (TAB) service provider, as recommended by ASHRAE.
  - ☐ Have airflows and system capacities reviewed by design professionals to determine if additional ventilation can be provided without adversely impacting equipment performance and building Indoor Environmental Quality (IEQ).
  - ☐ Measure building pressure relative to the outdoors. Adjust building air flows to prevent negative pressure differential.
  - ☐ Verify coil velocities and coil and unit discharge air temperatures required to maintain desired indoor conditions and to avoid moisture carry over from cooling coils. (500 fpm)
  - ☐ Review outdoor airflow rates compared to the most current version of ASHRAE Standard 62.1 or current state-adopted code requirements. (TAB or drawing review)

**Ventilation**

☐ Review air distribution conditions of existing spaces (look for covered diffusers, blocked return grilles, overly closed supply diffusers/registers and return/exhaust grilles creating short cycling, possible measurements of airflows by commissioning or balancing professionals, possible review of overall system configuration by design professional, etc.)

☐ Reduce recirculation to the extent possible allowed by the air handling system to avoid contamination in supply air.

☐ If Demand-Controlled Ventilation (DCV) systems using Carbon Dioxide (CO2) sensors are installed, operate systems to maintain maximum CO2 concentrations of 800-1,000 Parts Per Million (ppm) in occupied spaces:
  - ☐ Trend and monitor levels continuously if controls system is capable of doing so.
  - ☐ Determine if DCV can be temporarily disabled. If so, maximize outdoor air while operating under infectious disease crisis.

☐ Verify how ventilation is controlled by the BAS. Confirm if the BAS currently supports occupancy overrides. If possible, override CO2 sensors to maximize outdoor air.

☐ Modulate outdoor air damper to maintain ASHRAE recommended indoor conditions.

☐ Perform Initial Air Flush of All Spaces Prior To Occupants Re-Entering Building
  - ☐ Mechanical systems should operate in occupied mode for minimum period of one week prior to students returning (may be completed at same time as teachers start returning to building) while assuring the outside air dampers are open.
  - ☐ Operate all ventilation systems at full capacity for one week prior to occupancy per DPH Guidance.

**Filtration**

☐ Verify filters are installed correctly.

☐ Evaluate if existing can accept MERV 13 filters. If so, install high-capacity MERV 13 filters.

☐ If MERV 13 filters cannot be installed, evaluate the feasibility of ultraviolet germicidal irradiation (UVGI) as a supplement to supply air systems within air handling units or supply ductwork.

**Space Air Flow Patterns**

☒ Ensure airflow patterns in classrooms are adjusted to minimize occupant exposure to particles.

## Domestic Water System

- ☒ Systems should be flushed to remove potential contaminants from stagnant equipment, piping, fixtures, etc.
  - ☒ Domestic cold-water systems should be flushed with all fixtures on a branch of piping opened simultaneously for a minimum period of five minutes – preferred approach is to have all building fixtures open at same time if possible – if not, care should be taken to ensure flow rate is adequate to flush piping mains and branch lines.
  - ☒ Domestic hot water systems should be flushed with all fixtures on a branch of piping opened simultaneously for a minimum period of 15 minutes – preferred approach is to have all building fixtures open at same time if possible – if not, care should be taken to ensure flow rate is adequate to flush piping mains and branch lines.
- ☒ All plumbing traps should contain water to avoid transmission through dry traps.

# Checklist 3: HVAC System Operation during the Academic Year

## Scheduling

- ☐ Change the start of operation hours (e.g. change 6 am start to 4 am). The goal is to create a thermal lag and minimize HVAC operations when occupied

## Air Handling Units and Packaged Rooftop Units

- ☐ Increase Filtration to that recommended in the Filtration Upgrade section below. For existing units, an increase in filtration efficiency may reduce airflow capacity.
- ☐ Compensate for loss of capacity in winter with portable plug in electric heaters or higher discharge temps.
- ☐ Compensate for loss of capacity in summer with lower discharge temps off of AHU – recommend 52 F (this is mainly for VAV units where supply air temperature is controlled and due to additional pressure drop associated with higher efficiency filters).
- ☐ Check and fix economizer dampers and controls and maximize the economizer operation when possible (favorable outdoor conditions and outdoor air pollution).
- ☐ Minimize the unit air recirculation to minimize zones cross contamination thru the return air system.
- ☐ Install Humidifiers in AHUs and Packaged rooftop units if possible to maintain minimum recommended humidity.
- ☐ Install duct mounted humidifiers at classrooms as an alternate.

## Dedicated Outdoor Air Systems (DOAS)

- ☐ Create "Minimum Transmission Sequence of Operation"
  - ☐ Run DOAS units 24/7 as part of new DOAS sequence of Operation
  - ☐ Based on the recommendation from your ASHRAE professional, turning off Energy Recovery Wheels for systems with rotary energy recovery wheels should be considered as an option to limit cross contamination at the wheel (Enthalpy and Sensible wheels). See ERV Section.
  - ☐ Energy Recovery Systems with purge and or potential for air leak from the exhaust side to the supply should be checked to eliminate air leaks. See ERV Section.

## Ventilation

- ☐ Perform a daily air flush prior to occupancy: Mechanical Systems should be operated in occupied mode (including normal or peak outside air rate introduced to each space) for minimum period of 2 hours prior to occupants re-entering building and 1 hour after occupancy with the dampers fully open to maximize fresh air intake. Where possible, this controls sequence should be programmed into the building occupancy schedule.
- ☐ Keep the ventilation system running during all hours that the building is occupied.
- ☒ Keep bathroom exhaust systems running all day, every day (24 hours a day/7 days a week).
- ☒ Where temperature allows and no other means of ventilation is available, windows should be opened to allow for some minimum level of fresh air exchange into occupied spaces.
- ☐ For nursing station ventilation, see Nursing Station Section

☒ Separate, free-standing air cleaner or HEPA filter units are not recommended for individual classrooms. These units are highly variable in their effectiveness in larger open spaces such as classrooms and in general, any effect on indoor air quality is likely insignificant and greatly outweighed by the additional costs to school systems.

## Exhaust Fans

☒ Turn on 24/7, use DOAU as makeup air.
- ☒ Only applies to school days, not weekend operations. The goal is to flush the building with OA and positively pressurize the building.

## Energy Recovery Ventilation (ERV) Systems

☐ ERV's may be within AHU's, DOAS or as standalone systems. Determine location and type of each ERV, as well as manufacturer Exhaust Air Transfer Rate, which predicts leakage between supply and exhaust streams.

☐ Configurations where the outdoor air supply fan is located downstream of the wheel and the return air fan is located upstream of the wheel should **not** be used, as leakage will return contaminated air to the supply stream. In other configurations, exhaust air transfer can take place between supply and exhaust streams if the supply side static pressure is less than 0.5" wc higher than the exhaust side.

## Local HVAC Units

Includes Fan Coils, VRF, and Radiators/Baseboards

☐ Increase Filtration to the maximum MERV suggested by the manufacturer.

☐ Compensate for loss of capacity in winter with portable plug in electric heaters or higher discharge temps.

☐ Hydronic baseboard can remain operational.

☐ Install Portable humidifiers in each classroom for local humidity control.

## Domestic Systems

☒ Keep plumbing traps full of water to avoid transmission through dry traps.

# Appendix A: Routine HVAC Preventative Maintenance Items

## Daily Maintenance

Cleaning

- ☐ All areas that have been occupied after previous cleaning efforts should be re-cleaned.
- ☐ All restrooms should be thoroughly cleaned.
- ☐ All food preparation areas should be thoroughly cleaned.
- ☐ Any spaces not previously cleaned should have all accessible surfaces properly cleaned.

## Monthly Maintenance

Boilers

- ☐ For systems with Steam Boilers, develop a schedule that provides minimum supervision on-site.
- ☐ Perform chemical testing of system water. Verify water treatment target levels are being maintained.
- ☐ For systems using fuel oil:
  - ☐ Check fuel pump for proper operation.
  - ☐ Inspect fuel filter; clean and verify proper operation.
- ☐ For systems using natural gas:
  - ☐ Check gas pressure, gas valve operation, and combustion fan operation.
  - ☐ Check for evidence of leakage of fuel supply, heat transfer fluid, and flue gas.
- ☐ Verify proper operation of safety devices per manufacturer's recommendations.

Chilled Water, Hot Water and Condenser Water Systems

- ☐ Perform chemical testing of system water. Verify water treatment target levels are being maintained.
- ☐ Check for proper fluid flow and for fluid leaks. If necessary, vent air from system high points and verify backflow preventers and pressure regulating valves on makeup water lines are functioning properly.
- ☐ Check the control system and devices for evidence of improper operation.
- ☐ Verify control valves operate properly.
- ☐ Check variable-frequency drives for proper operation.
- ☐ Check expansion tanks and bladder type compression tanks have not become waterlogged.

Air Cooled Chillers

- ☐ Check the refrigerant system for evidence of leaks.
- ☐ Check and clean fan blades and fan housing.
- ☐ Check coil fins and check for damage.
- ☐ Check for proper evaporator fluid flow and for fluid leaks.

Air Handling Units

- ☐ Check for particulate accumulation on filters, replace filter as needed.
- ☐ Check P-trap on drain pan.
- ☐ Check the control system and devices for evidence of improper operation.
- ☐ Check variable-frequency drive for proper operation.
- ☐ Check drain pans for cleanliness and proper slope.

- ☐ Verify control dampers operate properly.
- ☐ Confirm AHU is bringing in outdoor air and removing exhaust air as intended.
- ☐ Verify filters are installed correctly.
- ☐ Follow filter replacement policy.
- ☐ Review condition of cooling coils in air handling equipment – if issues with condensate drainage are identified or biological growth is identified, corrective action should be taken to clean or repair.

Energy Recovery Ventilation Units

- ☐ Clean the unit with a vacuum to facilitate inspection.
- ☐ Clean the exchanger surface as recommended by the manufacturer, or simply clean the exchanger with a vacuum and soft brush (use a HEPA vacuum if possible, and always if the unit is inside a building).
- ☐ Check for gross leak paths between compartments that might result from age or deterioration. Check inside cabinet to see if light is coming in thru fastener holes or seams.
- ☐ Check that the bypass and other damper are operating properly, not jammed, and that the damper seals are in good condition.
- ☐ Also identify any bypasses between compartments.
- ☐ Check filters: dirty filters affect airflows and pressure differentials.

Unitary and Single Zone Equipment: Fan Coil Units

- ☐ Check for particulate accumulation on filters, replace filter as needed.
- ☐ Check the control system and devices for evidence of improper operation.
- ☐ Verify control dampers operate properly.

## Annual Maintenance

Pumps

- ☐ Inspect pumps and associated electrical components for proper operation.
- ☐ Check variable-frequency drive for proper operation.
- ☐ Check the control system and devices for evidence of improper operation.