



ENE Systems, Inc./Energy Efficient Investments, Inc. Ventilation Review

FOR:

SAU 70

Dresden School District

Hanover School District

Norwich School District

Date: August 24, 2020



Executive Summary

EI performed site inspections at all of the SAU 70 schools to help the district operate their ventilation systems per the State of New Hampshire and Vermont Back to School Guidelines for Reopening that was issued in July of 2020.

The State of NH Guidance states that:

As we learn more about the spread of COVID-19, the role of poor air circulation has become a concern. Schools should ensure that HVAC systems are working properly and are configured to increase the circulation of exterior air as much as possible. Schools should also consider other opportunities to circulate exterior air into buildings, through the use of open windows and doors (with appropriate safety protocols) and moving instructional opportunities outdoors when the weather is conducive. Facilities should evaluate their buildings' ventilation systems to increase auditorium and overall building ventilation, increase the number of air exchanges, increase outdoor air ventilation, limit internal air circulation, and improve central air filtration. Ventilation systems' filters must be routinely replaced and other necessary maintenance should be performed as needed. CDC guidance should be reviewed and used in evaluating building ventilation.

State of Vermont issued similar Guidelines:

- 1. That ventilation systems are cleaned, operating, and working as required.*
- 2. That pre-occupancy building flushes are performed prior to the start of school.*
- 3. Windows and doors are opened when this can be done safely.*
- 4. Increase Outdoor air flow.*
- 5. Consider Natural Ventilation.*
- 6. Consider Extended Runtime on HVAC System.*
- 7. Consider Filters improvements to best level possible*
- 8. Consider portable air filters*
- 9. Maintain temperatures between 68 and 78 with humidity at 40-60%*
- 10. Isolation room: Where feasible have a dedicated HVAC system with negative pressure.*

This was as summary of the HVAC portions in the Strong Health Start guidance updated 8-11-20

In areas where possible the district will operate all ventilation systems 24/7 1 week prior to students return to create a full building flush. During the school year the controls system will be modified to have ventilation systems run. A minimum of 2 hours prior to occupancy and 2 hours post occupancy to perform a daily ventilation flush. Air filters will be upgraded where possible to best filter the unit can handle and changed every 3 months. All ventilation units have been inspected for operation prior to start of school and all classroom spaces had operating outdoor air controls during inspection. Plug in HEPA filtration units will be provided to isolation rooms, classrooms and office spaces as necessary.

Executive Summary

EI worked with SAU staff with the goal to review each building and provide recommendations that could be implemented in the near term to improve ventilation in accordance with the best practices recommended in the state of New Hampshire and Vermont guidance. In general, the schools in Norwich and Hanover have functioning mechanical ventilation systems that are actively maintained. The buildings have a wide range of design concepts and eras of construction but there are 3 main types of HVAC systems that will be discussed in the report.

System 1 Classroom Unit Ventilators (UV)



Most of the classrooms at Marion Cross, Hanover High and Richmond Middle Schools are served by unit Ventilators. These systems are common in Northern New England Schools because they were economical to install and provide direct ventilation and heating controls to each classroom. Due to their small size they are not capable of installing Merv-13 filters. The ventilation in these units can be increased through the existing controls system to allow for a pre and post school flush. The Districts maintenance crews are working on switching over to MERV-8 or highest possible without significantly diminishing design airflow.

System 2 Large Roof Top Units and Energy Recovery Ventilators

The school auditoriums (all schools) and most of the classrooms at the Ray School have large units which can handle the pressure drop from 2" Merv-13 Filters. These units should have their air filters upgraded prior to the heating season. In the auditoriums, gyms and cafeterias, CO2 based energy controls will be disabled and ventilation increased to maximum possible while maintaining comfort settings.



System 3 Small Packaged Roof Tops

The Hanover High school has several small packed roof top units in building area 3 that may not be capable of Merv-13 air filters and they lack digital controls on damper position for outdoor air. Rooms served by these units should consider Plug In - HEPA filters and increased natural ventilation.



Objective: Verify mechanical systems operation and classroom ventilation for outside air and relief air. Review performed on August 10,14 & 21, 2020.

The systems at the schools do not have humidity control through dehumidification (DX cooling) or humidification through duct/unit mounted humidifiers. To implement humidity control in all the spaces would have a huge cost impact.

Storage, mechanical and support spaces were not included in the site observations. This review was to observe existing conditions and not alter the system set points or modify mechanical equipment.

The general pandemic guidelines that would apply to mechanical equipment at these facilities would be to provide enhanced ventilation, increase air filtration as much as possible, modify control sequences for building air flush outs and to consider Ultra Violet-C light sterilization in ductwork/units if applicable.

The recommendations discussed below fall in-line with existing maintenance schedules and control sequences such as filter change outs and controls sequencing. They do not create additional maintenance requirements through the addition of new mechanical systems or devices.

Richmond Middle School

The majority of the classrooms at the middle school are ventilated and heated by UV's (unit ventilators) or central RTU's (roof top units). Each UV has an air intake and a relief either through the roof or side wall which ensures the proper ventilation through the space.

The auditorium, media center, and central offices are each conditioned by a roof mounted air handler. Units provide heating and ventilation for each space and are large enough to be fitted with MERV-13 filters. Other offices will be outfitted with plug-in, movable HEPA filtration units.

The gym area is ventilated by 3 unit ventilators with outside air connections and relief dampers on the roof. The space has demand control ventilation for the outside air controls. Units can be used to flush the space with outside air but care should be considered during the winter to prevent freezing the heating coils.

Classrooms with UV's

The classrooms at the middle school are ventilated and heated through unit ventilators. Each unit either mounted on the floor or suspended from the ceiling have an outside air intake and a relief to achieve balanced airflow through the spaces. These are sized to bring in the required ventilation and heat the space. Units can be used to run 100% outside air

through the unit to flush out the class rooms. Care should be taken in consideration during the winter so heating coils are not frozen or damaged.

The standard unit ventilator filters are MERV-6 or less with a 1" thickness. These could potentially be upgrade to a MERV-13 filter on new units that have an ECM motors, but the units at the school are older and do not have the capacity for MERV-13 filters. The existing motors are not rated for the high static pressure drop through a MERV-13 filter bank. The Districts maintenance crews are working on switching over to MERV-8 or highest possible without significantly diminishing design airflow.

Marion Cross School

The Marion Cross school is ventilated by a combination of floor mounted unit ventilators and heat recovery units on the roof. This hybrid design brings in outside air through the UV's and exhaust the air to the HRU which brings air into other spaces in different areas of the building.

During the site study all the HRU's were operational (turned on) and the damper controls on the units were verified to work properly through the DDC system.

The design shows 120 CFM of outside air entering the UV intake and 120 CFM being exhausted (RM's #118 through #121 for examples). A classroom area of approximately 760 SF would require a minimum of 280 CFM of outside air. This design is energy efficient and brings mechanical ventilation to all classrooms, however, when the windows are closed the system brings in less outdoor air than recommended.

During the site review the exhaust and relief airflows were measured to compare to the design documents and guidelines. Our findings were that the majority of the classrooms had less airflow than indicated on the design documents due to the shared exhausting type system. Increasing the required airflow through the HRU's would not be possible because the ductwork and distribution system is sized for the lower airflow rates. The Districts maintenance crews are working on switching over to MERV-8 or highest possible without significantly diminishing design airflow.

Recommendation: Maximize outside airflow through the UV with revised controls sequence, utilize outside air flow and provide plug in HEPA air filtration units (especially for colder months when windows can't be opened) in the classrooms.

The gym, auditorium, and office spaces have central air handlers or HRU's that provide better ventilation through a larger unit. These units can be modified to bring in outside air to flush out the spaces and MERV-13 filters can be installed in the units for enhanced air filtration.

Hanover High School

Most of the classrooms at the high school are ventilated and heated through unit ventilators. Each unit has an outside air intake and a relief to achieve balanced airflow through the spaces. These are sized to bring the required ventilation and heat the space.

During our site visit in classroom R40 (which was modified) was ventilated by a UV, but did not have a relief vent or exhaust system serving the room. A vent can be installed in the roof to provide adequate relief for outside airflow intake.

Units can be used to run 100% outside air through the unit to flush out the classrooms. Care should be taken in consideration during the winter so heating coils are not frozen or damaged.

The standard unit ventilator filters are MERV-6 or less with a 1" thickness. These could potentially be upgraded to a MERV-13 filter on new units that have an ECM motor, but the units at the school are older and do not have the capacity for MERV-13 filters. The existing motors are not rated for the high static pressure drop through a MERV-13 filter bank. The Districts maintenance crews are working on switching over to MERV-8 or highest possible without significantly diminishing design airflow.

The gym, cafeteria, media center and auditorium have large roof mounted air handlers with a ducted air distribution system. These units have the ability to install MERV-13 filters for enhanced air filtration.

The DDC system should be modified to bring in 100% outside air to flush out the areas, but should have control sequences to accommodate winter conditions not to freeze out the spaces or damage equipment.

The office areas in building 3 have small DX RTU's to cool, heat and ventilate the front office areas. These units are small and the interior of the unit is cramped. The filters in these units do not have adequate space for installing MERV-13 filters. The Districts maintenance crews are working on switching over to MERV-8 or highest possible without significantly diminishing design airflow. A solution for these spaces would be to install plug in type HEPA filtration units, as well as other offices in the building.

Ray Elementary School

The primary ventilation systems for the classrooms at Ray Elementary is provided by RTU's with a ducted distribution system. Each class room has a high supply air grille and a low return air grille providing adequate airflow as required by system design and guidelines. The spaces are heated by fin tube radiation and the building has a DDC system for mechanical systems operations. Each RTU has the ability to have MERV-13 filters installed in them for the recommended enhanced filtration. Airflows should be tested after the filter upgrade to ensure for the correct motor speeds to maintain airflow.

The gym, art room and the music room each have central RTU's that have the ability to install MERV-13 filters. These units can also function to flush out the air in the spaces.

The classrooms built in 1994 2014 have UV's. Each space is equipped with independent roof mounted relief hoods sized in proportion for the required outside air intake. The Districts maintenance crews are working on switching over to MERV-8 or highest possible without significantly diminishing design airflow.

Summary

The priority of SAU 70 and its school Districts should focus primarily on increasing ventilation to the largest extent possible through adjusted control measures, opening of windows and regular equipment maintenance. Air filtration should be improved through installing larger filter ratings in the ventilation units where the ability exists and plug in, portable HEPA units where filters have smaller ratings.

Other longer term measures that should be reviewed and discussed

1. Upgrade of older mechanical equipment and ductwork
2. Review benefits of larger central systems with controls for dehumidification
3. U.V. Lights could be added in some of larger roof top units for increased disease mitigation
4. Installing CO2 monitoring controls in all classrooms