Indoor Air Quality Assessment

Somerset Public Schools

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The Trane Indoor Air Quality Assessment is intended to provide guidance as it relates to the operation and potential updates to your HVAC system(s) and equipment to provide for the best possible indoor air quality (IAQ) in support of infection control and prevention during the pandemic that we are currently facing.

The transmission of Covid-19 may occur in a variety of ways and circumstances, many of the aspects of which are currently not known. HVAC systems, products, services and other offerings are still in the early stages of testing to evaluate their effectiveness in reducing the spread of Covid-19, including through the air in closed environments. With that being said, we are making recommendations in this report based upon our systems knowledge and the most up to date guidance we have received.

Assessment Overview

The U.S. Centers of Disease Control and Prevention (CDC) and World Health Organization (WHO) both published recommendations for occupying workplaces in areas with a COVID-19 outbreak[1][2]. In addition, two leading industry trade associations, ASHRAE and REHVA, published guidance for operating building HVAC systems under these circumstances.[3][4]

	ASHRAE Guideline
DILUTE	Proper ventilation ensures that plenty of fresh, outdoor air comes into the building to dilute the buildup of indoor contaminants. Adjusting building ventilation is one tool that can influence indoor air quality.
EXHAUST	Getting exhaust air out efficiently is equally important – including recirculated air from kitchens, restrooms and combustion systems.
CONTAIN	Maintaining indoor humidity levels within the ASHRAE recommended range maximizes the comfort of building occupants while avoiding the likelihood of harmful microbial growth in the building.
CLEAN	Of increasing concern is the HVAC system's ability to reduce micro-organisms, such as mold, bacteria and viruses.

[1] Interim Guidance for Businesses and Employers to Plan and Respond to COVID-19, CDC
[2] Getting your workplace ready for COVID-19, WHO, dated 3 March 2020
[3] ASHRAE Position Document on Infectious Aerosols, dated 14 April 2020
[4] REHVA COVID-19 guidance document, dated 3 April 2020

Summary of Findings

Somerset Public Schools has contracted with Trane to assess, design and then provide solutions to repair and/or replace HVAC systems, building envelope and other related energy conservation measures and IAQ measures at Somerset Middle school, and North, South and Chase Elementary Schools.

This progress report provides initial findings and a summary of initial recommendations for consideration by SPS. Trane will provide additional information addressing long-term solutions and systems replacement information in the coming weeks.

	Middle School	North Elementary	South Elementary	Chace Elementary
Age of the system (Years)	55	47	68	59
Condition of HVAC System	Poor	Poor	Poor	Poor
Type of Controls	Pneumatic	Pneumatic	Pneumatic	Pneumatic
Type of System	Unit Ventilators and Heating Ventilation Units	Unit Ventilators and Heating Ventilation Units	Unit Ventilators and Heating Ventilation Units	Unit Ventilators and Heating Ventilation Units
Exhaust Fan	Normal	Normal	Normal	Normal
Brings Minimum Amount Outside Air	No	No	No	No
Automatic Capabilities to Bring 100% Outside Air	No	No	No	No
Meet ASHRAE ?	No	No	No	No
Current Filter Type	MERV 8	MERV 8	MERV 8	MERV 8
System Can Be Repaired	Yes, but not recommended	Yes, but not recommended	Yes, but not recommended	Yes, but not recommended
Must Be Replaced	Yes	Yes	Yes	Yes

Chace Elementary School

Chace Elementary School is a 128,400 square foot facility built in 1961, last renovated in 1967 with an addition. The mainly single story building houses a variety of classrooms, gymnasium, auditorium, cafeteria and administrative offices with current enrollment of 465 students. Windows in this building are the original single-pane windows with metal frames. The existing Sarnafil PVC roof was installed in 2007 and is in fair condition.

General Description of Mechanical System:

Heating hot water is provided by one (1) Benchmark 2.0 condensing boiler with input capacity of 2,000 MBH and one (1) HB Smith cast iron sectional boiler. The HB Smith serves as the backup and standby boiler. Heating hot water is circulated by four (4) constant speed 3 HP pumps, with two pumps dedicated to each boiler.

The ventilation systems include unit ventilators and air handling units. The Classrooms, Library and White corridor area are heated and ventilated with unit ventilators. Two air-handling units provide heating and ventilation to the gymnasium. The corridors also have ceiling mounted Nesbitt unit ventilators.

The control system in the building is exclusively pneumatic controls. The centrally located pneumatics provide compressed air to individual pneumatic control devices in the building to control space temperature, unit operation and outside air intake. The existing controls are outdated and have very limited functionality.

Following provides detail information about the individual system and recommendation related to indoor air quality improvements.

Unit Ventilators:

The existing unit ventilators are original to the age of the building. The main components of the unit ventilator are fan, hot water coil, and air damper to control outside and return air. During the walk-through, we noticed that the air damper was closed for outside air, so the unit was recirculating 100% room air in the space. According to facility personnel, the outside air is controlled by a pneumatic thermostat inside the space. Whenever the room gets over heated, the control system opens the damper to allow more outside air inside the space. Current Classroom unit ventilators are capable of providing ventilation (with manual changes) with proper adjustment of pneumatic control inside each unit. This may cause nuisance freezestat trips depending on the minimum position of the outside air damper during cold weather conditions.

Air Handling Units:

Two air-handling units serve the gymnasium area. Both units are operated by pneumatic controls. During the walkthrough, we noticed that return air for the AHU is open to the mechanical room, and it is not connected to the return air duct. This arrangement is not ideal for proper control of outside air intake to the space. The outdoor air damper for the second AHU was closed, so the unit was not bringing in any outside air. The unit also needs cleaning.

Exhaust Fans:

All the classroom and bathroom exhaust fans are in good condition and operating normal.

The kitchen hood exhaust fan was removed during the roof project so there is currently no exhaust fan for the kitchen hoods. The kitchen is not used for cooking; only heating and preparing.

IAQ Recommendation:

- Upgrading Unit Ventilators:
    - Option 1: Replace the aging equipment new unit ventilators with factory mounted DDC controls. Convert the existing steam system to new hot water system or new heat pump system
    - Option 2: Retrofit existing unit ventilators with new DDC controls
- Provide the adjustment to existing pneumatic controls to bring minimum of 30% outside air inside the space (customer to make adjustment)
- Purge the room with 100% outside air on daily basis before and/or after the school hours
- Upgrade the filters to MERV 13 or maximum MERV recommended by manufacturer
- Upgrade to advanced air filtration and disinfection technologies where applicable, for example:
    - Synexis DHP air and surface cleaning technology in spaces
        - Recommended for large spaces (gym/cafeteria/library)
    - Bipolar ionization technology in unit ventilators
        - Recommended for classrooms
- Install humidifiers in ducts where possible to improve space humidity and maintain recommended humidity levels
- Run the exhaust fan for longer hours

North Elementary School

North Elementary School is a 137,000 square foot facility, built in 1973 and last renovated in 1988. The mainly single story building houses a variety of classrooms, gymnasium, auditorium, cafeteria and administrative offices with current enrollment of 465 students. Windows in this building are the original single-pane windows with metal frames. The existing Sarnafil PVC roof was installed in 2007 and it is in fair condition. There is a roof mounted solar PV system, which provides clean energy to the building.

General Description of Mechanical System:

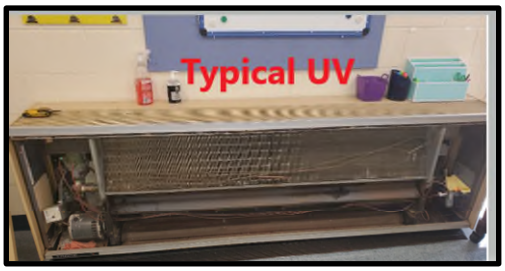
Lochinvar condensing boilers, installed recently, provide hot water for the heating requirement of the school. The locker rooms and showers are not used in this school, so the domestic hot water load is minimal. Heating hot water is circulated to the building by two 10 HP pumps equipped with AC Tech variable frequency drives.

The ventilation systems include unit ventilators and air handling units. The majority of the building consists of open floor plan areas with ventilation provided by constant volume heating ventilation units. Five or six air-handling units are clustered in a penthouse mechanical room. There are 8 or 9 closed classrooms served by unit ventilators.

The control system in the building is a pneumatic control system. The centrally located system provides the compressed air to individual pneumatic control devices in the building to control space temperature, unit operation and outside air intake in the building. The existing controls are functional but also outdated and have very limited functionality.

Following provides detail information about the individual system and recommendation related to indoor air quality improvements.

Unit Ventilators:



The existing unit ventilators are original to the age of the building. There are 13 unit ventilators in the building. The main components of a unit ventilator are a fan, steam coil, and air damper to control outside and return air. During the walk-through, we noticed that air damper was closed for outside air, so the unit was recirculating 100% room air in the space. According to facility personnel, the outside air is controlled by a pneumatic thermostat inside the space. Whenever room gets over heated, the control system opens the damper to allow more outside air inside the space. Current Classroom unit ventilators are capable of providing ventilation (with manual changes) with proper adjustment of pneumatic control inside each unit; however this may cause nuisance freezestat trips depending on the minimum position of the outside air damper during cold weather conditions.

Air Handling Units:

There are a total of thirteen indoor air-handling units, two roof top air-handling units and two roof top air conditioning units serving the majority of the space in the building. The air-handling unit for the office area is equipped with a DX coil for air conditioning. All of the units were installed in 1973 and appear to be in poor physical condition. Some of the units were bringing minimum amount of fresh air, while the majority of them had OA damper cloased. The existing controls for the units are not capable of proving precise control for the outside air intake in the building.

Exhaust Fans:

All of the classroom and bathroom exhaust fans are in good condition and operating normally. The kitchen hood exhaust fan appears to be working normally.

IAQ Recommendation:

- Upgrading Unit Ventilators:
  - Option 1: Replace the aging equipment new unit ventilators with factory mounted DDC controls. Convert the existing steam system to new hot water system or new heat pump system

- Option 2: Retrofit existing unit ventilators with new DDC controls
  - Provide the adjustment to existing pneumatic controls to bring minimum of 30% outside air inside the space (customer to make adjustment)
  - Purge the room with 100% outside air on daily basis before and/or after the school hours
  - Upgrade the filters to MERV 13 or maximum MERV recommended by manufacturer
  - Upgrade to advanced air filtration and disinfection technologies where applicable, for example:
    - Synexis DHP air and surface cleaning technology in spaces
      - Recommended for large spaces (gym/cafeteria/library)
    - Bipolar ionization technology in unit ventilators
      - Recommended for classrooms
  - Install humidifiers in ducts where possible to improve space humidity and maintain recommended humidity levels
- Run the exhaust fans for longer hours

South Elementary School

South Elementary School is a 28,000 square foot facility, built in 1928 and last renovated in 1967. The mainly single story building houses a variety of classrooms, cafeteria and administrative offices with current enrollment of 229 students. Windows in this building are the original single-pane windows with glass blocks on top. The existing Steven's PVC roof was installed in 2004 and it is in fair condition.

General Description of Mechanical System:

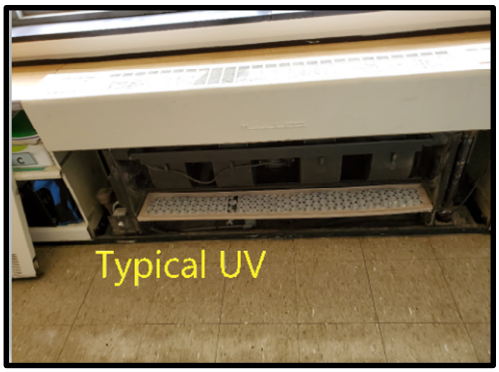
One Weil McLain and one HB Smith boiler generates steam to provide heating in the space.

The ventilation systems include unit ventilators and air handling units. Classrooms are heated and ventilated with unit ventilators. Two air-handling units provide heating and ventilation to the cafeteria. The corridors also have ceiling mounted Nesbitt unit ventilators.

The control system in the building is pneumatic. The centrally located system provides the compressed air to individual pneumatic control devices in the building to control space temperature, unit operation and outside air intake in the building. The existing controls are functional but are also outdated with very limited functionality.

Following provides detailed information about the individual systems and recommendations related to indoor air quality improvements.

Unit Ventilators:



The existing unit ventilators are original to the building. During the walk-through, we noticed that the air damper was closed for outside air, so the unit was recirculating 100% room air in the space. According to facility personnel, the outside air is controlled by a pneumatic thermostat inside the space. Whenever the room gets over heated, the control system opens the damper to allow more outside air inside the space. Current Classroom unit ventilators are capable of providing ventilation (with manual changes) with proper adjustment of pneumatic control inside each unit; however this may cause nuisance freezestat trips depending on the minimum position of the outside air damper during cold weather conditions.

Air Handling Units:

Two air handling unit serves the cafe area. Both units are operated by pneumatic controls. One of the units is not operational.

Exhaust Fans:

All the classroom and bathroom exhaust fans are in good condition and operating normally.

IAQ Recommendation:

- Upgrading Unit Ventilators:
  - Option 1: Replace the aging equipment new unit ventilators with factory mounted DDC controls. Convert the existing steam system to new hot water system or new heat pump system
  - Option 2: Retrofit existing unit ventilators with new DDC controls
- Provide the adjustment to existing pneumatic controls to bring minimum of 30% outside air inside the space (customer to make adjustment)
- Purge the room with 100% outside air on daily basis before and/or after the school hours
- Upgrade the filters to MERV 13 or maximum MERV recommended by manufacturer
- Upgrade to advanced air filtration and disinfection technologies where applicable, for example:
    - Synexis DHP air and surface cleaning technology in spaces
      - Recommended for large spaces (gym/cafeteria/library)
    - Bipolar ionization technology in unit ventilators
      - Recommended for classrooms
- Install humidifiers in ducts where possible to improve space humidity and maintain recommended humidity levels
- Run the exhaust fan for longer hours

Somerset Middle School

Somerset Middle School is a 128,400 square foot facility, built in 1965 and last renovated in 1969. The mainly single story building houses a variety of classrooms, gymnasium, auditorium, cafeteria and administrative offices with current enrollment of 607 students.

Windows in this building are the original single-pane windows with metal frames. Two connecting corridors have single-pane glass curtain walls with metal frame and deteriorated gaskets. The existing Douglas PVC roof was installed in 2007 and it is in poor condition. There is a roof mounted solar PV system, which provides clean energy to the building.

General Description of Mechanical System:

Heating hot water is provided by one Aerco (1) Benchmark 2.0 boiler with input capacity of 2,000 MBH and three (3) HB Smith Model 640 cast iron sectional boilers installed circa 1964 with 18 sections each and input capacity of 7,250 MBH each. One of the HB Smith boilers is disconnected and no longer in service. Currently the Aerco boiler is out of service due to a failed heat exchanger.

An AO Smith water heater provides domestic hot water. Natural gas is currently utilized as the primary fuel at the school. We noticed asbestos insulation in the boiler room.

Heating hot water is circulated by two 15 HP pumps equipped with Danfoss variable frequency drives.

Following provides detailed information about the individual systems and recommendations related to indoor air quality improvements.

Unit Ventilators:

The existing unit ventilators are original to the building. Similar to the other schools, the outside air damper was closed for outside air, so the unit was recirculating 100% room air in the space. Current Classroom unit ventilators are capable of providing ventilation (with manual changes) with proper adjustment of pneumatic control inside

each unit; however, this may cause nuisance freezestat trips depending on the minimum position of the outside air damper during cold weather conditions.

Air Handling Units:

There eleven indoor air-handling units, and one rooftop air conditioning unit serving the majority of the space other than classrooms in the building. The air-handling unit for the office area is equipped with a DX coil for air conditioning. All the units were installed in 1965 and appear to be in poor physical condition. Most of the units have had their OA damper closed. The existing controls for the units are not capable for proving precise controls for the outside air intake in the building.

Exhaust Fans:

All the classroom and bathroom exhaust fans are in good condition and operating normal. Kitchen hood exhaust fan appears to be working normal.

IAQ Recommendation:

- Upgrading Unit Ventilators:
  - Option 1: Replace the aging equipment new unit ventilators with factory mounted DDC controls. Convert the existing steam system to new hot water system or new heat pump system
  - Option 2: Retrofit existing unit ventilators with new DDC controls
- Provide the adjustment to existing pneumatic controls to bring minimum of 30% outside air inside the space (customer to make adjustment)
- Purge the room with 100% outside air on daily basis before and/or after the school hours
- Upgrade the filters to MERV 13 or maximum MERV recommended by manufacturer
- Upgrade to advanced air filtration and disinfection technologies where applicable, for example:
    - Synexis DHP air and surface cleaning technology in spaces
      - Recommended for large spaces (gym/cafeteria/library)
    - Bipolar ionization technology in unit ventilators
      - Recommended for classrooms
- Install humidifiers in ducts where possible to improve space humidity and maintain recommended humidity levels
- Run the exhaust fan for longer hours