BERGMANN
ARCHITECTS ENGINEERS PLANNERS

# Energy Efficient Indoor Air Quality
# Preliminary Report
# August 24, 2020

## Progress to Date:

A. General

Bi-Weekly team meetings 7/27, 8/17

B. St. John Fisher

1. Processed information collected during site visits, researching nameplate information and comparing information to as built equipment schedules in available drawing sets 7/22 – 8/11
2. Populated equipment summary tables with nameplate and nominal values 8/11 - 8-14
3. Completed existing conditions portion of draft report including, architectural analysis, HVAC, and general Indoor Air Quality deficiencies found among HVAC systems. 8/11 - 8/20
4. Used VPN to start Building Management System analysis 8/19 – 8/21

C. The Harley School

1. Field work 8/17 and 8/18 to document floor areas and room volume. Generating code ventilation rates per room and air changes per hour.
2. Provided initial guidance document based on preliminary findings to Harley to assist with their reopening plans, including:
    i. Open classroom windows when outside air conditions allow.
    ii. Replace existing filters with MERV 13 or the highest allowable MERV rating for the equipment to still maintain proper airflow.
    iii. Extend AHU runtime by 2 hours pre and post occupancy.
    iv. Increase outside air and confirm functionality of energy recovery wheels, adjust space setpoint temperatures.
    v. Suggestions for HVAC upgrades to Nurses Room as a potential isolation zone.
3. Received vendor quotes for 100% replacement to MERV 13 filters and provided to The Harley School.
4. Received vendor quotes for retrofit UV in AHUs and purchase Upper Air UV units. However, recent NYSED guidance does not support the installation of UV. The Harley School intends on following NYSED recommendations.

## Study Findings to Date

A. Resources and Guidance Documents

1. ASHRAE Guidance
2. NYS Department of Health
3. NYS Education Department
4. Manufacturer's literature (UV, filters)

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B. Findings/Recommendations

1. Harley
    i. DX condenser coils may have decreased cooling capacity due to the as-found condition. They have since been cleaned and do not have obstructed airflow.
    ii. Ventilation air ranges between 25% and 100%, depending on the AHU. Continued coordination with site to determine minimum recommended OA % (based on floor area, air changes per hour, and served zone) ongoing.
    iii. 2 of 5 energy recovery wheels not operating in summer, identified to The Harley School for further investigation.
    iv. Increasing AHU fan speed may require each downstream VAV box to have their settings modified to provide more airflow to zones.

2. Saint John Fisher
    i. Most AHUs/RTU filters have been upgraded to MERV 13 already, while several continue to use MERV 8 filters. The airflow performance across the MERV 13 filters is currently being evaluated.
    ii. Over pressurization issues in old Trane RTUs have caused filters to be dislodged.
    iii. Over pressurization issues exist within several other units derating the performance and capacity of the units
    iv. Due to the condition of the cooling coils, the cooling capacity and airflow are likely reduced.
    v. Currently investigating OA damper positions and ventilation rates provided by each unit using BMS data
    vi. Currently investigating equipment scheduling to ensure proper ventilation is provided to the building
    vii. Have list of filters for all AHU, beginning to evaluate

C. Lessons Learned
1. Education facilities are under pressure to respond to parents and faculty.
2. SED guidance on UV-C conflicts with program requirements.
3. Facility staff information on system operations may be anecdotal until verified.
4. There is a demand for IAQ testing, info on available technology would be useful.

D. Work Plan Adjustments

None

E. Next Steps
1. Equipment and operations well understood. Begin analytical evaluation
2. Beta case analysis of potential measures
3. Screening
4. Initiate RC plans

Attachments:

St John Fisher Equipment Table
Harley School Memo 8/5/2020

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**NYSERDA IAQ Audit – The Harley School**

August 5, 2020

The Harley School
1981 Clover Street
Rochester, NY 14618

Per your request, we are providing these initial recommendations related to HVAC upgrades to help with the return of students to school. Our evaluation is continuing, and more detailed recommendations will be provided upon completion of the project. The initial recommendations for The Harley School's Indoor Air Quality Audit are noted below.

**1) Open Classroom Windows**

The best way to maximize the volume of fresh air entering a classroom is to open all operable windows. To the greatest extent possible, and as weather conditions allow, this should be encouraged for all areas of the building. This policy should be paired with an increase in the cooling season space setpoint temperature in the Building Management System (BMS) such that cool, conditioned air is only provided on days where air conditioning is a necessity. The air handlers should continue to remain in operation during all occupied hours.

**2) Replace the Existing Air Handler Filters with MERV 13 Filters on All Air Handling Units**

Based on our investigation, the existing MERV 8 filters can be directly replaced with MERV 13 filters. MERV 13 filters will provide greater removal of virus particles than the existing MERV 8 installed across the site. Based on our preliminary findings and the original design drawings of the AAON air handling units, the MERV 13 filters should operate within little to no impact on the air handling equipment. The remaining air handlers should also have a limited impact on airflow and performance. Our investigation is ongoing with regard to any potential performance changes from all units.

We are in contact with your current filter vendor to confirm the pressure drop impact of MERV 13 filters versus the existing MERV 8 filters. In air handling equipment installed with 1" filters (unit ventilators), the search for a suitable replacement is in process. Replacing the filters will have the following impacts:

- All existing BMS differential pressure sensors on the air handling units should be checked for proper operation and recalibrated as necessary. This will ensure that filter replacements occur based on the actual loading of the filter.
- Air handlers that are not installed with a differential pressure sensor through the BMS should be installed with an on-unit differential pressure gauge. These gauges will visually inform maintenance staff the loading on the filters.
- With all air handlers providing an accurate differential pressure reading (digitally through the BMS or manually at the air handler), filters should only be replaced as required. BMS notifications and manual differential pressure sensors must be checked on a regular basis.

- MERV 13 filters are a higher first cost item and may require more frequent replacements than MERV 8 filters.

3) **Retrofit Air Handling Units with UV-C Lamps**

Installing UV-C lamps in air handlers can be used to damage virus and bacteria cells, reducing their ability to replicate by damaging the internal structures of the cell. The focus of this item is on the eight (8) AAON units installed throughout the site. The local sales representative of AAON products offers retrofit UV-C assemblies for the units. The AAON units serve:

- The Arts Addition on the southeast of the building (ground, first, and second floors)
- The northeast corner of the building (ground, first, and second floors)
- The southwest corner classrooms (first and second floors)

These air handlers serve approximately 40% of the ground floor, 55% of the first floor, and 100% of the second floor in the main building. The auditorium is considered part of the first floor for the percentages noted above.

It may also be feasible to retrofit UV-C in the air handlers serving the Field House, Pool, Locker Room, Fitness Center, Auditorium, Front Office Area, and the Upper School Science Wing. Discussions with the local rep regarding the best approach with these served areas and the existing air handling units are ongoing.

UV lamps typically have an effective operable lifespan of 9,000 runtime hours. Depending on the scheduling of the air handler, this can equate to annual or bi-annual bulb replacements. While the bulbs will still produce light in the UV-C spectrum beyond 9,000 hours, they become less and less effective for the purpose of killing viruses. Special procedures to ensure that site staff and/or contractors are not exposed to UV-C light during regular maintenance activities should be implemented.

One item of potential concern is the age of these AAON units. They have between 16 and 18 years of in-service life. Through continued preventative and scheduled maintenance, these units could have an additional 5 to 10 years of use.

**4) Install Upper Air UV-C Lamps**

The local AAON sales representative is in the process of putting together a package of Upper Air UV-C fixtures from UV Resources. Information is still pending.

Areas of the building that have limited capabilities to be retrofit with UV-C lamps in the air handlers include:

- Rooms provided ventilation air through 100% outside air units (The Commons, the Kitchen, and the first floor science wing)
- Rooms installed with unit ventilators (primarily on the ground floor)

These building areas, as well as hallways and other common entrance/gathering areas, are good candidates for Upper Air UV-C installations. Upper Air UV-C consists of wall-mounted lighting fixtures that provide light in the UV-C spectrum to damage the internal components of the virus, reducing its ability to replicate. These fixtures provide direct in-space disinfection of particulates in the air.

The installation of Upper Air UV-C fixtures may require an extension of existing electrical service. The installation location is dependent on the room layout and available wall space. These wall-mounted units are generally installed at 8 feet high.

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**5) Extended Air Handler Runtime**

It is recommended to operate air handlers for a minimum of 2 hours prior to occupancy to flush out the building. Units should continue to operate for 2 hours post-occupancy.

Currently, air handlers serving The Harley School are scheduled to run for varied lengths of time. Most units are scheduled to operate from 4:00 AM to 7:00 PM on weekdays. Due to the current summer usage schedules, these appear to be effective schedules for the building. They should be reevaluated upon the start of school to provide 2 hours of pre- and post-occupancy runtime.

**6) Increase Outside Air**

At a minimum, it is recommended to continue compliance with the NYS Mechanical Code for ventilation in each space. Air handlers should be evaluated to provide the maximum volume of outside air capable to be properly conditioned by the air handlers, without compromising indoor thermal comfort for a learning environment. Demand control ventilation, a control scheme that monitors the carbon dioxide levels in a room and adjusts the volume of outside air accordingly, should be disabled.

There are five (5) air handlers with energy recovery wheels installed. Most wheels were not in operation at the time of the initial site visit. If the energy recovery wheels are regularly maintained, cleaned, and tested for proper operation, they can continue to be safely operated. The advantage of an energy recovery wheel is it allows for an increased percentage of outside air to enter the building, while also reducing the heating or cooling load required to condition the supply air. The increase in outside air further dilutes any potential virus particles that may be present in the served zone.

Per current BMS screenshots, most air handlers are operating with their outside air damper locked at 25% open. Further calculations and measurements are required to determine the exact volume of outside air required by code for each classroom zone in the building. This work is scheduled for August in order to provide further guidance prior to the start of school.

An actionable step that can be performed today is to slightly raise the temperature setpoint of zones with cooling. Space temperatures should be increased to a minimum setpoint of 75°F in cooling mode. This will allow the air handling equipment to increase the supply of outside air without overtaxing the cooling equipment. In heating mode, a maximum setpoint temperature of 68°F is recommended.

It is also recommended to immediately remove the lock of “25% open” on the outside air dampers. Implementing the damper lock will eliminate the ability for the building to operate in economizer mode. During economizer mode, the building will automatically increase the volume of outside air brought into the building to provide “free

cooling". This functionality is most available during the fall and spring seasons. Each air handler should be programmed to operate at a minimum 25% outside air percentage, with the ability to increase the volume of outside air volume (economizer mode) as conditions allow.

**7) Nurses Room and/or Isolation Room**

One additional recommendation is to provide an "isolation room" for potential students or staff if they are showing symptoms of being sick while still in the building. Currently, the Nurses Room is provided ventilation air from a central system air handler that draws return and supply air from common headers. This could present an avenue for the virus to become airborne and spread to multiple locations throughout the building very quickly.

The Nurses Room, or other identified "patient isolation" areas, should be capable of operating in "isolation mode" via a dedicated HVAC system. Return air from this zone cannot mix with common return air and should be exhausted directly outside (away from walking paths or people). This zone should be operated at a negative pressure to connecting rooms.

Based on the current location and general operation of the Nurses Room, it is not believed to meet the recommended criteria above. It may be necessary to convert a classroom or office space that has a separate HVAC system, such as the 100% outside air unit zones or a classroom with a unit ventilator, to meet this criteria. Any converted zone should have direct access to an exhaust fan that does not recirculate air through the building.

We are available to discuss these preliminary results at your earliest convenience.

Thank you,

Evan DeCotis, PE
Project Engineer - Mechanical
Bergmann

| Building | Equipment | Tag | Quantity | Serves | Make | Model | Heating Source | Cooling Source | Supply Fan HP | Return Fan HP | Nominal Airflow (CFM) | Heating Capacity (MBH) | Cooling Capacity (Tons) | Filter MERV Rating | Installation Year | General Condition Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Skalny Welcome Center | Rooftop Unit | RTU | 1 | Full Building | AAON | RN-050-9-0-EAD9-000 | NA | Dx | (2) 15 | (2) 5 | 20,000 | | 50 | 13 | 2009 | Damanged Filters |
| | | | | | | | | | | | | | | | | |
| Integrated Science and Health Sciences | Rooftop Unit | RTU-1 | 1 | Offices, Classrooms 1st and 2nd Fl | Daiken | RFS062DSWS50 | HHW | Dx | 20 | 10 | | | 62 | 13 | 2014 | |
| Integrated Science and Health Sciences | Rooftop Unit | RTU-2 | 1 | Lecture Halls 117 and 118 1st Fl. | Daiken | DPS015AHMW4DV | HHW | Dx | 8 | 4 | | | 15 | 13 | 2014 | Dx Condenser Coiler 100% coated with dirt/dust |
| Integrated Science and Health Sciences | Make up Air Unit | RTU-3 | 1 | Science Labs | Daiken | RFS090DSWS53 | HHW | Dx | 25 | NA | | | 90 | 13 | 2014 | OA intake screen was 75% clogged limiting airflow |
| Integrated Science and Health Sciences | Makeup Air Unit | MAU-1 | 1 | Note on BMS | AAON | RQ-006-3-V-0W0M-EJN | HHW | CHW | 2 | NA | 2,000 | | 6 | 8 | 2015 | |
| | | | | | | | | | | | | | | | | |
| Ralph C. Wilson Jr. School of Education | Rooftop Unit | RTU | 1 | Full Building | Trane | NA | HHW | NA | | | | | | 13 | | Overpressurized, Filter blown through and damaged, Potential damper issues |
| | | | | | | | | | | | | | | | | |
| Skalny Science Center | Basement AHU | AHU-1 | 1 | East Side B, 1st | NA | NA | HHW | CHW | 40 | 7.5 | | | | 13 | | Old Units Lmited Information |
| Skalny Science Center | Basement AHU | AHU-2 | 1 | West Side B, 1st | NA | NA | HHW | CHW | 40 | 7.5 | | | | 13 | | Old Units Lmited Information |
| Skalny Science Center | 1st floor AHU? | AHU-3 | 1 | Lecture Hall | | | HHW | CHW | 7.5 | | | | | | | |
| Skalny Science Center | Basement AHU | AC-4 | 1 | | Trane | MCCB003N0F | HHW | CHW | 1.5 | NA | | | | 13 | | Coil dirty, covered in leaves and dirt. Supply fan belt broken fan not spinning |
| | | | | | | | | | | | | | | | | |
| Wegmans School of Pharmacy | Rooftop Unit | RTU-1 | 1 | Full Building | AAON | RL-125-3-0-VE26-EAJ | HHW | WC | (2) 40 | (2) 15 | 30,000 est. | | 125 | 13 | 2006 | |
| | | | | | | | | | | | | | | | | |
| Center for American Enterprise | Rooftop Unit | RTU-1 | 1 | Full Building | AAON | RN-120-3-0JA09-EHJ | HHW | Dx | (2) 15 | (2) 7.5 | 29,500 | 663 | 120 | 8 | 2,013 | |
| | | | | | | | | | | | | | | | | |
| Basil Hall | AHU | AHU-1 | 1 | Located in Mech Room? | | | HHW | CHW | | | | | | 13 | | |
| Basil Hall | AHU | AHU-2 | 1 | Auditorium 1st floor? | | | HHW | CHW | 5 | NA | | | | 13 | | |
| Basil Hall | AHU | AHU-3 | 1 | Second Floor? | | | HHW | CHW | | | | | | | | |
| Basil Hall | Rooftop Unit | AHU-4 | 1 | | Trane | TSCB050U0D | HHW | CHW | 40 | 25 | | | | 13 | 2007 | Over pressurized, air leaks through body of AHU |
| Basil Hall - Unit Near Cyber Café | Rooftop Unit | RTU | 1 | Golisano Academic Gateway | Trane | TSCA025GAB0CA | HHW | CHW | 25 | 7.5 | | | | 13 | 2000 | Overpressurized, Filter blown through and damaged, Coil Dirty |
| | | | | | | | | | | | | | | | | |
| Pioch Hall | Rooftop Unit | AHU - P1 | 1 | Most of Building | Trane | TSCA040GAA0AA0CA | HHW | CHW | 30 | 15 | | | | | 1999 | Overpressurized, Filter blown through and damaged, Coil 50 covered in dirt |
| Pioch Hall | Rooftop Unit | AHU - P2 | 1 | Lecture Hall | Trane | NA | HHW | CHW | 2 | NA | | | | | 1999 est. | |
| | | | | | | | | | | | | | | | | |
| Wegmans School of Nursing | Make up Air Unit | M.U.A - 1 | 1 | Main Building | AAON | RN-025-3-DA02-374 | Gas | Dx | 5 | | 9,000 | 389 | 25 | | 2007 | |
| Wegmans School of Nursing | Make up Air Unit | M.U.A - 2 | 1 | SON Annex | AAON | RQ-006-3-V-FA09-254 | Gas | Dx | 2 | 1 | 2,000 | 113 | 6.0 | 8 | 2007 | |
| Wegmans School of Nursing | Rooftop Unit | RTU-1 | 1 | SON Annex | York | ZH078N10P4AAA5A | Gas | Dx | 2 | NA | 2,600 | 96 | 6.5 | 13 | 2007 | |
| Wegmans School of Nursing | Rooftop Unit | RTU-2 | 1 | SON Annex | York | ZH078N10P4AAA5A | Gas | Dx | 2 | NA | 2,600 | 96 | 6.5 | 13 | 2007 | |
| | | | | | | | | | | | | | | | | |
| Athletic Center | Heating and Ventilting Unit | HV-1,2,3,4 | 4 | Field House | NA | NA | HHW | None | 10 | NA | 11000 est. | | None | 13 | | |
| Athletic Center | Heating and Ventilting Unit | HV -5,6 | 2 | Locker rooms | NA | NA | HHW | None | 3 | NA | 3500 est. | | None | 13 | | |
| Athletic Center | Heating and Ventilting Unit | HV -7 | 1 | Boiler Room | NA | NA | HHW | None | 2 | NA | 5600 est. | | None | 13 | | |
| Athletic Center | CV Rooftop Unit | RTU-1 | 1 | Main Lobby | York | ZJ090N10P4AAA5A | Gas | Dx | 3 | NA | 2,650 | 96 | 7.5 | 13 | 2014 | |
| Athletic Center | CV Rooftop Unit | RTU-2 | 1 | Meeting Room | York | ZJ078S10H4AAA5A | Gas | Dx | 1.5 | NA | 2,600 | 96 | 6.5 | 13 | 2014 | Dirty OA intake screens |
| Athletic Center | CV Rooftop Unit | RTU-3 | 1 | Video Room | York | ZJ049N07B4AAA6A | Gas | Dx | 1.5 | NA | 1,600 | 64 | 4 | 13 | 2014 | Dirty OA intake screens |
| Athletic Center | CV Rooftop Unit | RTU-4 | 1 | North Office Suites | York | ZJ090N10P4AAA5A | Gas | Dx | 3 | NA | 2,650 | 96 | 7.5 | 13 | 2014 | Dirty OA intake screens |
| Athletic Center | CV Rooftop Unit | RTU-5 | 1 | South Office Suites | York | ZJ090N10P4AAA5A | Gas | Dx | 3 | NA | 2,650 | 96 | 7.5 | 13 | 2014 | Dirty OA intake screens |
| Athletic Center | CV Rooftop Unit | RTU-6 | 1 | North Office Suites | York | ZJ090N10P4AAA5A | Gas | Dx | 3 | NA | 2,650 | 96 | 7.5 | 13 | 2014 | Dirty OA intake screens |
| Athletic Center | CV Rooftop Unit | RTU-7 | 1 | South Office Suites | York | ZJ090N10P4AAA5A | Gas | Dx | 3 | NA | 2,650 | 96 | 7.5 | 13 | 2014 | Dirty OA intake screens |
| Athletic Center | CV Rooftop Unit | RTU-8 | 1 | Locker Room | York | ZJ078S10H4AAA5A | Gas | Dx | 1.5 | NA | 2,600 | 96 | 6.5 | 13 | 2014 | Dirty OA intake screens |
| Athletic Center | CV Rooftop Unit | RTU-9 | 1 | Lower Fitness Center | York | ZJ090N10V4AAA5A | Gas | Dx | 3 | NA | 2,650 | 96 | 7.5 | 13 | 2014 | Dirty OA intake screens |
| Athletic Center | CV Rooftop Unit | RTU-10 | 1 | Upper Fitness Center | Trane | Tag Faded | Gas | Dx | 5 est. | NA | 3200 est. | 200 est. | 10 est. | 13 | 2001 est. | Dirty OA intake screens |
| Athletic Center | CV Rooftop Unit | RTU-11 | 1 | Lower Fitness Center | York | ZJ061N09H4AAA5A | Gas | Dx | 1.5 | NA | 2,000 | 96 | 5.0 | 13 | 2014 | Dirty OA intake screens |
| Athletic Center | Make Up Air Unit | RTU-3 | 1 | Weight Room | Trane | TCD121C40AAA | Gas | Dx | 2 | NA | 3200 est. | None | 10 | 13 | 2000 | Dirty OA intake screen r22 |
| Athletic Center | Make Up Air Unit | RTU-4 | 1 | Training Room Corridor | Trane | YHC120F4RHA0LE0C0A | Gas | Dx | 2.75 | NA | 3200 est. | 200 | 10 | 13 | 2017 | |
| Athletic Center | Make Up Air Unit | RTU-5 | 1 | Varsity Locker Rooms | Trane | TCD121C40AAA | None | Dx | 2 | NA | 3200 est. | None | 10 | 13 | 2000 | Dirty OA intake screen r22 |
| | | | | | | | | | | | | | | | | |
| Kearney Hall | Rooftop Unit | RTU-1 | 1 | Roof? | York | ZF060N10A2AAA2A | Gas | Dx | 1 | NA | 2,000 | | 5 | | N1E2773504 | Dirty OA intake screen |
| Kearney Hall | Rooftop Unit | RTU-2 | 1 | 4th Floor? | York | ZF060N10A2AAA2A | Gas | Dx | 1 | NA | 2,000 | | 5 | | N1E2773501 | |
| Kearney Hall | Rooftop Unit | RTU-3 | 1 | 4th Floor? | York | ZF060N10A2AAA2A | Gas | Dx | 1 | NA | 2,000 | | 5 | | N1E2773505 | |
| Kearney Hall | Rooftop Unit | RTU-2 | 1 | Auditorium | Trane | Tag Faded | Gas | Dx | | | | | | | 2013 | Dirty OA intake screen |
| Kearney Hall | Rooftop Unit | RTU-1 | 1 | Auditorium | Trane | YHH300F3RVA030AC0A1B | Gas | Dx | 7.5 | | | 284 | | | 2013 | |
| Kearney Hall | 4th Floor AHU | AHU-1 | 1 | | Trane | MCCB014UA0A0UA | HHW | CHW | 7.5 | 5 | | | | 10 | 2002 | |
| Kearney Hall | 4th Floor AHU | AHU-2 | 1 | | Trane | MCCB014UA0A0UB | HHW | CHW | 5 | 5 | | | | 10 | 2002 | |
| Kearney Hall | Basement AHU | AHU-3 | 1 | Center Wing 1-3 | Carrier ? | | HHW | CHW | 15 | 10 | | | | | | |
| Kearney Hall | Basement AHU | AHU-4 | 1 | Cleary Catering | Carrier ? | | | CHW | | | | | | | | |
| Kearney Hall | Basement AHU | AHU-5 | 1 | Basement Computing Lab | Carrier | | | Dx | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| Campus Center | Rooftop Unit | RTU | 1 | Building | Mammoth | no visible tag | HHW | WC | (3) 25 | (2) 20 | 40,000 | None | 85 | 13 | 2005 | no information on outside of unit - Dirty OA intake screen |

Note * Some units were not accessible due to broken ladders or physical location. Estimations are made based on physical shape and size comparisons.

Note ** Comparable Vertical unit ventilators found online range from 2 to 5 Tons. Using 3 tons as estimate feel free to change.