NORTHERN BERKSHIRE DISTRICT COURT
HVAC SYSTEM EVALUATION SUMMARY

Visited February 22, 2021. While on site we inspected the air handling equipment located in the mechanical rooms and toured the facility to determine if the spaces generally matched usages noted on the architectural plans. The North Adams Juvenile and District Courthouse building was constructed in 1961. In 2002, much of the building was substantially renovated for use by the courts. In 2020, the remaining portions of the building were renovated for additional space for the courts. The courthouse is approximately 27,000 square feet in size.

1.0 Airflow Rate Per Person (Reduced Occupancy)

	Total People (reduced occupancy)	*Total Air*		*Outdoor Air*	
Courtroom		*Supply Airflow (CFM)*	*Airflow Rate (CFM/Person)*	*Outside Airflow (CFM)*	*Airflow Rate (CFM/Person)*
Jury Pool Room	9	400	45	350	39
Courtroom #1	15	2,100	140	820	55
Courtroom #2	23	3,500	150	920	40

2.0 Recommendations

Section	Recommendation/Finding	Action
2.1	**Filtration Efficiency**	
RF-1	Replace fan coil filters with 1" MERV-13 filters	Complete
RF-3	Install a differential pressure sensor with a display across the filter bank	N/A
RF-3a	Connect the pressure sensor to the BMS system	N/A
2.2	**Testing and Balancing**	
RTB-1	Test and balance air handling unit supply air and minimum outdoor air flow rates	Complete
RTB-6	Test and balance all air handler chilled water, hot water, and DX coils	Deferred
2.3	**Equipment Maintenance and Upgrades**	
RE-1	Test existing air handling system dampers and actuators or proper operation	Complete
RE-2	Clean fan coil air handler coils and drain pans	Complete
RE-5	Confirm the existing freeze stat is working correctly on each air handling unit	Complete
RE-7	Test the existing air handler control valves and actuators for proper operation	Complete
2.4	**Control System**	
RC-1	Implement a pre and post-occupancy flush sequence	Complete

RC-4	Confirm the economizer control sequence is operational	N/A
2.5	Additional Filtration and Air Cleaning	
RFC-1	Install portable HEPA filters	Complete
2.6	Humidity Control	
	No actionable item	
2.7	Other Recommendations	
2.7.1	Repair or Replace Holding Cell and Toilet Exhaust Fans	Complete
2.7.2	Replace RTU's	Deferred
2.7.3	Connect Outdoor Air Ductwork to Fan Coils	Complete

Northern Berkshire District Court
North Adams, MA

HVAC SYSTEM EVALUATIONS COVID-19

Office of Court Management

May 24, 2021

Tighe&Bond

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Section 1
Existing Conditions & Site Observations

Tighe & Bond visited the North Adams Juvenile and District Courthouse on February 22, 2021. While on site we inspected the air handling equipment located in the mechanical rooms and on the roof and toured the facility to determine if the spaces generally matched usages noted on the architectural plans.

Site Visit Attendees:

- *Office of Court Management:*
  - Michael Briggs, Facilities
- *Mass MoCA (Owner):*
  - Greg Eastman, Facilities Engineer
  - Zack Moulton, Facilities Staff
- *Tighe & Bond*
  - Sean Pringle, PE, Mechanical Engineer

1.1 Existing Ventilation System

The North Adams Juvenile and District Courthouse building was constructed in 1961. In 2002, much of the building was substantially renovated for use by the courts. In 2020, the remaining portions of the building were renovated for additional space for the courts. The courthouse is approximately 27,000 square feet in size.

AHU-1 is a constant volume dedicated outdoor air system (DOAS) air handling unit (AHU), which provides all ventilation air to the building. AHU-1 contains outdoor air dampers, 2" MERV 13 filters, a dual temperature coil with a face and bypass damper, and a supply fan. The unit is in good condition.

AHU's 2 and 3 serve the open lobby areas on the first and second floors and receive outdoor air from AHU-1. Each unit contains return and outdoor air dampers, 2" MERV 13 filters, a dual temperature coil, and a supply fan. The units are in good condition.

The packaged RTU's that serve the courtrooms appear to be from the original 2002 renovation and are in fair condition overall. Each unit contains a mixing section, 2" MERV 13 filters, a DX cooling coil, a supply fan, and a gas furnace. Outdoor air is delivered from AHU-1 into the return air ducts for each RTU. While present, the outdoor dampers are fully closed since the outdoor air is provided by AHU-1.

All other areas in the courthouse are conditioned with concealed fan coil units serving each zone. The fan coils have 1" MERV 8 filters, a dual temperature coil, and a supply fan. The outdoor air supply from AHU-1 is distributed to the spaces through different approaches in various areas. In some areas, outdoor air is provided directly into the return ductwork serving the fan coils. In other areas, the outdoor air discharges into the open ceiling return plenum near the fan coils. In the remaining areas (generally corridors and storage areas), the supply air discharges directly into the occupied spaces via supply grilles.

According to the plans, there are eight roof mounted exhaust fans, which are in fair condition. REF's 1-6 serve cells and toilet rooms, and REF 7 and 8 provide relief exhaust for the courtrooms. At the time of our site visit, REF-2 and REF-6 were not operational.

The lockup areas are served by fan coil units which provide 100% outdoor air from AHU-1. Supply air is delivered to the corridors and into each cell. Air is exhausted from each cell at greater rate than the supply (to maintain a slightly negative pressurize) via REF-5.

Hot and chilled water is provided from the Mass MoCA central heating and cooling plant.

During the walkthrough, we noted that the corridor near storage room 222 appears to be dramatically overventilated. This is a small corridor, but the drawings show it receiving 740 CFM of outdoor air. This excess air was preventing doors from automatically closing.

Table 1 summarizes the air handling units' designed airflow rates, the MERV rating of the installed filters, and the condition of the units.

TABLE 1
Existing Air Handling Units

Unit	Original Design Airflow (CFM)	Original Design Min. O.A. (CFM)	Pre/Final Filters	Condition
AHU-1	8,100	8,100	2" MERV 13	Good
AHU-2	1,550	300*	2" MERV 13	Good
AHU-3	2,040	400*	2" MERV 13	Good
RTU-1	2,100	640**	2" MERV 13	Fair
RTU-2	3,500	400**	2" MERV 13	Fair

*OA for AHU-2 and AHU-3 is provided by AHU-1.
**The OA shown is provided by AHU-1. No OA is provided from the RTU-1 and RTU-2 outdoor air openings.

Photo 1 – AHU-1 Air Handler

1.2 Existing Control System

The HVAC equipment is controlled by a Schneider Building Management System (BMS). The AHU's, RTU's, exhaust fans, zone fan coil units, and room temperature controllers are all tied into the system. There are no demand controlled ventilation (DCV) sequences for this building. The ventilation airflow is constant during occupied periods.

The BMS sends commands for heating, cooling, and fan operation to the packaged RTU's. All other controls are self-contained within the RTU's.

According to staff, the building is currently set to a 24/7 occupancy schedule in response to the COVID-19 pandemic to provide as many air changes as possible overnight.

Section 2
Recommendations

Below is a list of recommendations for the North Adams Juvenile and District Courthouse. Please refer to the "Master Recommendation List" for further explanation and requirements of the stated recommendations.

2.1 Filtration Efficiency Recommendations

The filters in the air handlers and rooftop units were recently upgraded to use 2" MERV 13 filters. The use of 2" MERV 13 meets the minimum ASHRAE recommendations for filtration during the pandemic. We recommend that a testing and balancing contractor test and document the airflow and static pressure profile of all AHU's and RTU's, as outlined in recommendation RF-1 in the Overview of Recommendations document. This will help determine if the equipment can accommodate the increase in system static pressure associated with the addition of the MERV 13 filters.

We recommend the following measures be implemented for the existing air handling units:

RF-1: *Replace fan coil filters with 1" MERV 13 filters.*

The TAB Contractor and/or Engineer shall verify that the existing fan coils can accommodate a 1" MERV-13 filter while maintaining the design supply airflow. per Appendix A in the overview of recommendations report. Filter racks should be inspected and adjusted to ensure that filters fit tightly and that end spacers are in place to minimize filter bypass.

Note that because 1" MERV 13 filters have a higher pressure drop than 2" MERV 13 filters, the fan coils may not be able to maintain supply airflows with the added restriction of a MERV-13 filter. If airflow cannot be maintained, install a filter with the highest possible MERV rating while maintaining airflow.

RF-3: *Install a differential pressure sensor with a display across the filter bank.*

This measure applies to the AHU's, and if possible, the RTU's. This is likely not practical for the fan coils.

RF-3a: *Connect the pressure sensor to the BMS system.*

Maximum differential pressure should be set per manufacturer's recommendation based on air velocity to ensure filters are within their service lives. Typically, this is not more than 1.0" w.g.

Alarm setpoints for each bank of filters should be reviewed, to ensure they are consistent with the filter manufacturer's recommendation.

2.2 Testing & Balancing Recommendations

The air handling units are approximately 20 years old. The whole building was balanced in 2015, and the renovated areas were balanced in March 2021. The code requirements to determine the outdoor air flow rates that were used to design the original system may be different than the 2015 International Mechanical Code (IMC) and current ASHRAE Standard 62.1 requirements.

We recommend the following testing and balancing measures be implemented:

RTB-1: *Test and balance air handling unit supply air and minimum outdoor air flow rates.*

We recommend testing and balancing the outdoor air flow rates for all air handling units to the recommended minimum O.A. rates listed in Table 2.

TABLE 2
Recommended Air Handler O.A. Flow Rates

Unit	Original Supply Airflow (CFM)	Original Design Min. O.A. (CFM)	Current Code Min. O.A. Requirements (CFM)	Recommended Minimum O.A. (CFM)
AHU-1	8,100	8,100	5,000	8,100
AHU-2	1,550	300	150	300*
AHU-3	2,040	400	220	400*
RTU-1	2,100	640	820	820*
RTU-2	3,500	400	920	920*

Note: Although the ASHRAE Position Document on Infectious Aerosols recommends using the latest published standards and codes as a baseline for minimum ventilation, the mechanical code in effect at the time the HVAC systems were designed and constructed is what governs the required outdoor air flowrate for the HVAC equipment, if there have been no additions, renovations, alterations, or changes in occupancy to the building. The 2015 International Mechanical Code does not prevent the continued use of existing systems.

*Outdoor provided through AHU-1.

During the pandemic, we recommend maintaining the outdoor airflows at the original designed values where they exceed the code minimums calculated by Tighe & Bond. Supplying more outdoor than required by code will provide better indoor air quality. For AHU-1, the recommended outdoor air quantity the scheduled capacity. This is slightly higher than the apparent connected load after implementing the recommended changes in this section of 7,700 CFM. During the Covid pandemic, we recommend balancing all supplies to the values shown on the drawings and in this section, and then increasing the fan speed of AHU-1 to obtain approximately 8,100 CFM if possible. After the pandemic has passed, the AHU-1 airflow can be reduced to connected airflow.

Our ventilation air analysis discovered that the design outdoor airflow for the Jury pool room is not adequate based on current code requirements at full occupancy. We recommend increasing the outdoor air delivered to the space to 350 CFM, from the current 200 CFM indicated on the design drawings. This may require an additional duct branch from the AHU-1 supply ductwork which runs above the space. Also, as noted above, it appears that the corridor near room 222 is dramatically overventilated. The airflow to this corridor should be reduced to approximately 100 CFM. We recommend coordinating the response to these issues with the engineer of record for the 2020 project.

We believe the outdoor air for RTU's 1 and 2 can be increased to the recommended values with the current building operation, as the connected load of AHU-1 is currently less than the scheduled capacity. This may require minor changes in

ductwork to accommodate the higher airflow. (see Section 2.7.1 for additional recommendations.)

The average airflow rate per person is shown below in Table 3. These values are based on the original full design supply airflow rate and the recommended outdoor airflow rates shown in Table 2. The airflow rate per person assumes a diversity factor of 70%, meaning the maximum number of occupants assumed to be in all zones at all times equates to 70% of the code required occupancy.

TABLE 3
Average Airflow Rate per Person

	All spaces	***Courtrooms***	***Non-Courtroom Spaces***
Total Occupancy (People)	338	166	172
Total Supply Air (CFM/Person)	68	34	100
Outdoor Air (CFM/Person)	24	11	37

The airflow rate per person for each Courtroom and the Jury Pool Room is shown below in Table 4. These values are based on full occupancy without taking diversity into account, the original full design supply airflow rate, and the recommended outdoor airflow rate. The airflow rate per person assumes the full supply airflow is being delivered to the room.

TABLE 4
Airflow Rate per Person (Full Occupancy)

		Total Air		***Outdoor Air***	
Courtroom	***Total People***	***Supply Airflow (CFM)***	***Airflow Rate (CFM/Person)***	***Outdoor Airflow (CFM)***	***Airflow Rate (CFM/Person)***
Jury Pool Room	40	400	10	350	9
Courtroom #1	112	2,100	19	820	7
Courtroom #2	125	3,500	28	920	7

Note: Courtroom occupant density is based on 70 people/1,000 square feet, per the 2015 International Mechanical Code

The airflow rate per person for each Courtroom and the Jury Pool Room, based on a reduced occupancy schedule determined by the Office of Court Management, is shown below in Table 4a. The airflow rate per person assumes the full supply airflow is being delivered to the room.

TABLE 4a
Airflow Rate per Person (Reduced Occupancy)

		Total Air		Outdoor Air	
Courtroom	Total People	Supply Airflow (CFM)	Airflow Rate (CFM/Person)	Outdoor Airflow (CFM)	Airflow Rate (CFM/Person)
Jury Pool Room	9	400	45	350	39
Courtroom #1	15	2,100	140	820	55
Courtroom #2	23	3,500	150	920	40

Note: If occupancy is further reduced, the airflow rate per person will increase, assuming full airflow is being delivered to the space.

RTB-6: *Test and balance all air handler chilled water, hot water, and DX coils.*

Testing and balancing the air handler hot and chilled water coils will help ensure the coils are receiving the proper water flow rates. Due to the age of the coils, the coils may not perform as required to properly temper the supply air. Coils become fouled over time, which degrades the performance.

Confirm each condenser is operating correctly to ensure the DX coil is receiving the correct refrigerant temperature.

2.3 Equipment Maintenance & Upgrades

We recommend the following equipment maintenance and upgrades:

RE-1: *Test existing air handling system dampers and actuators for proper operation*.

Replace dampers and actuators that are not functioning properly.

RE-2: *Clean fan coil and air handler coils and drain pans.*

RE-5: *Confirm the existing freeze stat is working correctly on each air handling unit.*

RE-7: *Test the existing air handler control valves and actuators for proper operation.*

2.4 Control System Recommendations

We recommend the following for the control system:

RC-1: *Implement a pre and post-occupancy flush sequence.*

It is our understanding based on conversations with staff that the building is currently being operated in an occupied mode 24/7, possibly including using daytime occupied temperature setpoints. This exceeds the three air change flush sequence recommended by ASHRAE. This likely results in more air changes and energy cost than necessary. If the current strategy is continued, it is recommended that the nighttime temperature setpoints be used instead of the daytime setpoints to reduce energy use.

RC-4: *Confirm the economizer control sequence is operational.*

This applies to AHU 2 and 3, and RTU 1 and 2.

2.5 Additional Filtration and Air Cleaning

We recommend the installation of the following air cleaning devices:

RFC-1: *Install portable HEPA filters.*

If the Courthouse is to operate at a high capacity (i.e. 50% occupancy or greater), we recommend installing portable HEPA filters in high traffic areas, such as entrance lobbies. They should also be considered for Courtrooms, depending on the occupancy of the room and how much noise is generated from the filters. The noise levels will vary depending on the manufacturer.

2.6 Humidity Control

Installing duct mounted or portable humidifiers can help maintain the relative humidity levels recommended by ASHRAE. The feasibility of adding active humidification is determined by the building envelope. Buildings that were not designed to operate with active humidification can potentially be damaged due to a lack of a vapor barrier, adequate insulation, and air tightness.

Duct mounted humidifiers must be engineered, integrated into the building control system, tested, and commissioned. They are available in many configurations but require substantial maintenance and additional controls. They also run the risk of adversely affecting IAQ from growing microorganisms, or leaking water through poorly sealed ductwork damaging insulation and ceilings. Portable humidifiers are easier to install and require less maintenance, but still have the potential to damage the building envelope.

While active humidification is not recommended as a whole building solution due to high installation costs, operational costs, potential to damage the building envelope and adversely affect poor IAQ, it may be warranted as a temporary solution in some areas.

2.7 Other Recommendations

2.7.1 Repair or Replace Holding Cell and Toilet Exhaust Fans

We recommend repairing or replacing the exhaust fans REF-2 and REF-6 that were not working at the time of the visit.

2.7.2 Replace RTU's

While generally in fair condition and well maintained, the RTU's are nearing the end of their expected service life of 20-25 years. Plan to replace the RTU's over the next five years.

Consider selecting RTU's that can provide outdoor air through the RTU, rather than through AHU-1. This would provide some additional capacity margin in AHU-1 and would allow for economizer operation and demand controlled ventilation in the courtrooms (after the pandemic has passed). To allow for this, the replacement units should have modulating or multi-stage heating and preferably modulating or multi-stage cooling as well. This will improve thermal comfort when operating the fans continuously. With a single stage furnace, occupants may feel cold in the winter as the supply air temperature would be very low (approximately 50°F) if the furnace cycles on cold days. Note that the RTU

heating and cooling capacities will also have to be reviewed in order to allow the unit to adequately heat and cool the space with the code-required outdoor air.

Note that there is an exhaust fan within a few feet of the current outdoor air intake for RTU-1. If the outdoor air on the replacement unit is in the same area, the exhaust discharge will need to be relocated to comply with the mechanical code.

This recommendation is a primarily an energy saving measure and does not impact indoor air quality.

2.7.3 Connect Outdoor Air Ductwork to Fan Coils

In many locations, the outdoor air ductwork discharges into ceiling return plenums near the fan coils serving the spaces. This practice is not acceptable, as it does not guarantee that the OA being provided to the plenum will be drawn into the intended unit, especially where several FCU's exist within the same plenum. We recommend connecting the outdoor air ductwork to the return air ductwork. Once completed, the OA to the fan coils should be rebalanced.

Disclaimer

Tighe and Bond cannot in anyway guarantee the effectiveness of the proposed recommendations to reduce the presence or transmission of viral infection. Our scope of work is intended to inform the Office of Court Management on recommendations for best practices based on the guidelines published by ASHRAE and the CDC. Please note that these recommendations are measures that may help reduce the risk of airborne exposure to COVID-19 but cannot eliminate the exposure or the threat of the virus. Implementing the proposed recommendations will not guarantee the safety of building occupants. Tighe & Bond will not be held responsible should building occupants contract the virus. The Office of Court Management should refer to other guidelines, published by the CDC and other governing entities, such as social distancing, wearing face masks, cleaning and disinfecting surfaces, etc. to help reduce the risk of exposure of COVID-19 to building occupants.

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