NEW BEDFORD PROBATE & FAMILY COURT
HVAC SYSTEM EVALUATION SUMMARY

Visited November 5, 2020. While on site, 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 New Bedford Probate & Family Courthouse is a two-story building constructed in 1909, with significant HVAC improvements in 1987. The courthouse is approximately 16,200 square feet in size. Fourteen air handling units (AHU) provide ventilation air to the building.

1.0 Airflow Rate per Person (Reduced Occupancy)

		Total Air		*Outdoor Air*	
Courtroom	*Total People*	*Supply Airflow (CFM)*	*Airflow Rate (CFM/Person)*	*Outside Airflow (CFM)*	*Airflow Rate (CFM/Person)*
Courtroom 1	37	2,500	68	750	20
Courtroom 3	16	1,600	100	300	19

2.0 Recommendations

Section	Recommendation/Finding	Action
2.1	**Filtration Efficiency**	
RF-1	Replace filters with MERV 13	In-progress
RF-3	Install a differential pressure sensor across the filter banks	In-progress
RF-3a	Connect the pressure sensor to a local alarm	In-progress
2.2	**Testing and Balancing**	
RTB-1	Test and rebalance air handling unit supply air and minimum outside air flow rates	In-progress
2.3	**Equipment Maintenance and Upgrades**	
RE-1	Test existing air handling system dampers and actuators for proper operation	In-progress
RE-2	Clean air handler coils and drain pans	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	Complete
2.5	**Additional Filtration and Air Cleaning**	
RFC-1	Install portable HEPA filters in high traffic areas – *if courthouse is to operate at a high occupancy (i.e. 50% occupancy or greater)*	In-progress
2.6	**Humidity Control**	
	No actionable items listed	

2.7	Other Recommendations	
2.7.1	Run ventilation fans continuously during occupied hours	Complete
2.7.2	Add ventilation to all occupied areas	In-progress
2.7.3	Add heat to AHU's	In-progress

New Bedford Probate & Family Court
New Bedford, MA

HVAC SYSTEM EVALUATIONS COVID-19

Office of Court Management

February 3, 2021

Tighe&Bond

100% Recyclable

Section 1
Existing Conditions & Site Observations

Tighe & Bond visited the New Bedford Probate and Family Courthouse on November 5, 2020. While on site we inspected the air handling equipment located in ceilings and the attic and toured the facility to determine if the spaces generally matched usages noted on the architectural plans.

Site Visit Attendees:

- *Office of Court Management:*
  - Doug Firth, Courthouse Facilities Staff
- *Tighe & Bond*
  - Sean Pringle, PE, Mechanical Engineer
  - Caitlin DeWolfe, Staff Engineer

1.1 Existing Ventilation System

The New Bedford Probate and Family Courthouse is a two story building constructed in 1909, with significant HVAC improvements in 1987. The courthouse is approximately 16,200 square feet in size. Fourteen air handling units (AHU) provide ventilation air to the building.

The AHU's are light commercial / residential style constant volume air handlers. Each unit has a DX cooling coil, and supply fan. AC's 1-10 have an outdoor air (O.A.) duct and outdoor air. Several of the attic AHUS also have standalone economizer controllers and return air dampers. The AHU's do not provide heat. The AHU serving Courtroom 1 has a duct-mounted hot water coil to temper the supply air in the winter. Heating in the areas served by each AHU is provided by hot water perimeter baseboard. The AHU's have historically been configured to cycle the fan with calls for cooling and did not operate in the heating season. However, staff have indicated that they have been encouraging occupants to leave the systems in "fan on" at the thermostat and plan to continue to do so through the heating season. Due to the locations of the AHU's in the ceiling and attic and difficulty of access, not all units were observed. The units that were observed all appeared similar in age and were generally in fair condition.

AC's 11-14 do not have any outdoor air ductwork, and as a result the basement areas served by these units do not have any ventilation. This includes the following occupied areas:

- Room 005 (Library / Conference)
- Room 019 (Staff Lounge)
- Room 020 (Conference)
- Rooms 014 & 015 (Office)
- Room 013 (Reception)

In addition to the areas served by these AHU's, Rooms 007 and 008, which are being used by facilities staff, do not have any mechanical ventilation. Heat in this area is provided by a ceiling mounted unit heater.

Building areas without ventilation significantly increase the risk of spreading viruses like COVID-19, especially areas with high occupant density and where people occupy the same space for relatively long periods of time. Consider significantly reducing occupancy or relocating occupants to other areas with adequate ventilation.

The basement rooms noted above generally have windows with operable sashes.

At the time of the visit, all toilet exhaust fans appeared to be operational. The fans generally serve one or two restrooms each and are interlocked with the light switch in each restroom.

Two 690 MBtu/Hr hot water boilers provide hot water to the perimeter baseboard heating and duct mounted coil. Cooling for each AC unit is provided by separate condenser on the roof.

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

TABLE 1
Existing Air Handling Units

Unit	Original Design Airflow (CFM)	Original Design Min. O.A. (CFM)	Filters	Condition
AC-1	1,600	Unknown	1" MERV 10	Fair
AC-2	1,400	Unknown	1" MERV 10	Fair
AC-3	1,400	Unknown	1" MERV 10	Fair
AC-4	1,200	Unknown	1" MERV 10	Fair
AC-5	2,500	Unknown	1" MERV 10	Fair
AC-6	1,400	Unknown	1" MERV 10	Fair
AC-7	1,600	Unknown	1" MERV 10	Fair
AC-8	1,400	Unknown	1" MERV 10	Fair
AC-9	800	Unknown	1" MERV 10	Fair
AC-10	800	Unknown	1" MERV 10	Fair
AC-11*	500	0	1" MERV 10	Fair
AC-12*	800	0	1" MERV 10	Fair
AC-13*	600	0	1" MERV 10	Fair
AC-14*	600	0	1" MERV 10	Fair

*AHU has no outdoor air ductwork.

Photo 1 – Representative Air Handler

1.2 Existing Control System

The Courthouse does not have a building-wide control system. Each AHU has local thermostatic controls in the space. Some are 7 day programmable thermostats, while the others are non-programmable. Next to each thermostat is a switch to enable outdoor air for that AHU, and also a speed selector switch. Standalone economizer controllers were observed on several of the AHU's in the attic. It is unclear if these are present on all of the AHU's with outdoor air provisions, or only some units, as we were not able to observe every unit.

The perimeter baseboard heating units are controlled via thermostatic valves and return temperature sensor bulbs located within the heaters.

Section 2
Recommendations

Below is a list of recommendations that we propose for the New Bedford Probate and Family Courthouse. Please refer to the "Master Recommendation List" for further explanation and requirements of the stated recommendations.

2.1 Filtration Efficiency Recommendations

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

RF-1: *Replace 1" MERV-10 filters with MERV-13 filters.*

The existing MERV filters have relatively high removal efficiency. However, we recommend replacing the MERV 10 filters with MERV 13 filters if supply airflows can be maintained. The TAB contractor and/or Engineer shall verify that the air handlers can accommodate a MERV 13 filter per Appendix A in the overview of recommendations report. Note that the increased pressure drop associated with upgrading to MERV 13 filters is generally higher with 1" filters than with 2" filters. The filters will also require more frequent replacement.

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

RF-3a: *Connect the pressure sensor to a local alarm.*

Provide a local alarm. As many AHU's are in difficult to reach areas, provide a local alarm in an area that will be noticed by staff.

2.2 Testing & Balancing Recommendations

The air handling units are approximately 34 years old and it is unknown to Tighe & Bond when the last time the units were tested and balanced. Also, the code requirements to determine the outside air flow rates that were used to design the original system were different than the 2015 International Mechanical Code (IMC) and current ASHRAE Standard 62.1 requirements.

The original design drawings do not indicate the intended outdoor air percentage for the AHU's, only the cooling capacities and total airflow. Based on the design cooling capacities of the equipment, we verified that the recommended outdoor air percentage would allow a supply air of 54-57°F in cooling to be maintained.

We recommend the following testing and balancing measures be implemented:

RTB-1: *Test and rebalance air handling unit supply air and minimum outside 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)
AC-1	1,600	Unknown	110	150
AC-2	1,400	Unknown	40	150
AC-3	1,400	Unknown	60	150
AC-4	1,200	Unknown	90	150
AC-5	2,500	Unknown	720	750
AC-6	1,400	Unknown	60	100
AC-7	1,600	Unknown	300	300
AC-8	1,400	Unknown	40	150
AC-9	800	Unknown	140	150
AC-10	800	Unknown	60	150
AC-11*	500	0	150	0
AC-12*	800	0	100	0
AC-13*	600	0	190	0
AC-14*	600	0	160	0

*AHU has no outdoor air ductwork.

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.

The average airflow rate per person is shown below in Table 3. These values are based on the original design supply airflow rate and the recommended outdoor air flow 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. Note this includes the supply air for AHU systems that do not provide outdoor air. The outdoor air CFM/person only includes areas that are mechanically ventilated.

TABLE 3
Average Airflow Rate per Person

	Spaces Mechanically Ventilated	*Courtrooms*	*Non-Courtroom Spaces*
Total Occupancy (People)	209	122	88
Total Supply Air (CFM/Person)	80	34	144
Outdoor Air (CFM/Person)	11	9	13

The airflow rate per person for each Courtroom is shown below in Table 4. These values are based on full occupancy without taking diversity into account, the original design supply airflow rate, and the recommended outdoor airflow rate. The airflow rate per person assumes the fan operates continuously.

TABLE 4
Airflow Rate per Person (Full Occupancy)

		Total Air		*Outdoor Air*	
Courtroom	*Total People*	*Supply Airflow (CFM)*	*Airflow Rate (CFM/Person)*	*Outside Airflow (CFM)*	*Airflow Rate (CFM/Person)*
Courtroom 1	123	2,500	20	750	6
Courtroom 3	51	1,600	31	300	6

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, 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 fan operates continuously.

TABLE 4a
Airflow Rate per Person (Reduced Occupancy)

		Total Air		*Outdoor Air*	
Courtroom	*Total People*	*Supply Airflow (CFM)*	*Airflow Rate (CFM/Person)*	*Outside Airflow (CFM)*	*Airflow Rate (CFM/Person)*
Courtroom 1	37	2,500	68	750	20
Courtroom 3	16	1,600	100	300	19

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

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 air handler coils and drain pans.*

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.*

Adjust schedules in thermostats and local controls where possible. For manually operated equipment, turn on three hours prior to occupancy, and off three hours after occupancy. This includes AHU ventilation and exhaust fans.

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

Verify the operation of any standalone economizers on present AC's 1-10. Replace or adjust any economizers that are not functioning properly.

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.

Because several basement rooms do not provide outdoor air, we recommend the use of portable HEPA filters in these areas if they will be occupied.

2.6 Humidity Control

Installing duct mounted or portable humidifiers can help maintain the relative humidity levels recommended by ASHRAE. The feasibility of using duct mounted humidification or portable humidifiers 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. We are not aware if this building was constructed to accommodate a humidification system.

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 Run Ventilation Fans Continuously During Occupied Hours

We strongly recommend running the supply fans continuously during occupied hours, to provide mechanical ventilation at all times, as code requires. According to staff, this measure is already being implemented.

Implementing this strategy may cause comfort issues. When the fan continuously runs, the cooling coils will turn on and off based on the space temperature. Comfort issues may arise if the existing units do not have multiple stages of cooling that would otherwise handle load fluctuations better. During the winter, AHU's without heating coils in the ductwork will supply air below room temperature. Further system analysis and improvements are required to address these issues.

Consider adding a single electronic time clock to control AHU fans and exhaust fans from a single location in the Courthouse to simplify scheduling and operation. Alternately, the existing individual thermostats serving the AHU's could be replaced with new thermostats that include a programmable fan or an occupancy schedule function. Depending on the current wiring, new control wiring may be required between the thermostats and AHU's.

2.7.2 Add Ventilation to All Occupied Areas

Several occupied areas in the basement do not have any mechanical ventilation. Consider adding outdoor air to serve these areas. At minimum, this would include installing outdoor air ductwork to the AHU from either the existing shafts providing outdoor air, a wall opening, or a window opening. Consider the use of an energy recovery ventilator (ERV) to temper the outdoor air. Further system analysis and improvements are required to execute this recommendation.

2.7.3 Add Heat to AHU's

The only system that provides heat via a duct mounted heating coil is AC-5. As mentioned in section 2.7.1, occupants may feel cold with the low supply air temperature in the winter without heat to temper supply air. Consider providing duct mounted hot water heating coils or replace the AC unit and condenser with a split air source heat pump system to provide heating and cooling with the refrigerant coil.

This recommendation is a comfort and energy saving measure and does not affect the indoor air quality of the building.

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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