ALLEGHANY HIGHLANDS
Public Schools

Covington Middle School

Mechanical Systems Assessment Report

Prepared by:

Facility Dynamics

Facility Dynamics Engineering

March 03, 2025

TABLE OF CONTENTS

Title **Page**

Executive Summary 1
- Overview 1
- Process 1

System Observations and Recommendations.....2
- Kitchen Area/ Exhaust 2
- Other Potential sources of Carbon Monoxide 3
- Minimum Outside Air Ventilation 4
- Noxious smells 5

Appendices

Title **Appendix**

Photos ..... A

SECTION I - EXECUTIVE SUMMARY

Overview

Facility Dynamics Engineering (FDE) was contracted to survey and evaluate the building's mechanical systems with a focus on performance, safety, and efficiency. The safety and efficiency aspect focused mainly on the air side of the mechanical systems. The main intent was to investigate any potential issues that may be associated with the previously reported issues including alleged carbon monoxide leaks and/or noxious smells in one or more of the classrooms.

FDE was provided with mechanical system drawings from an upfit project that took place in 1989. These were reviewed and compared to the actual systems currently installed and operating in the building. FDE was onsite on Monday, February 24th, 2025 to perform the onsite investigation described above. This report contains the high-level overview of the assessment of the mechanical systems with specific emphasis on how these systems may relate to the alleged issues previously identified.

Process

FDE walked the building with school personnel. The mechanical systems were identified and physically inspected, where feasible. This included air handling units (AHU) and exhaust systems (ES) serving the building located in classroom spaces, mechanical rooms, and on the roof.

SECTION II – SYSTEM OBSERVATIONS AND RECOMMENDATIONS

Kitchen Area/ Exhaust

The kitchen area was a potential source of carbon monoxide from the gas burning equipment being utilized in the kitchen. The following was reported:

- The kitchen exhaust fan was not fully operational at the time of the incident. The belts on the fan were loose causing the fan to rotate slower than designed and produced less airflow.
- Carbon monoxide was measured in kitchen hood exhaust while the gas-fired food warmer was operating.
- While the kitchen hood exhaust fan was not fully operational (not exhausting its designed amount of air), it was confirmed that there was still some exhaust air flow (qualitative analysis by physically "feeling" the air flow). i.e., the exhaust air flow was greater than 0 cfm even when not operating properly.
- The belts on the kitchen hood exhaust fan have now been replaced and have been properly tensioned.
- Based on a qualitative assessment only (visual inspection of the fan & a general sense of flow consistent with this type of fan), the fan appears to be operating within an acceptable flow range.

The following was noted during our investigation.

- There is no longer any gas burning equipment in the kitchen. All such equipment has been removed, and only electrically powered equipment remains. All future equipment will also be electrically powered as there is no intention of reverting back to any gas fired kitchen appliances. As such, there should not be any source of carbon monoxide from the kitchen area.
- It is typical for a gas fired appliance to produce at least small amounts of carbon monoxide when operating (active flame on the appliance). Thus, detecting carbon monoxide in the exhaust duct while the appliance is operating would be normal. However, the concentration level detected previously was not information that was available.
- FDE confirmed that the exhaust fan was operating and exhausting significant air flow (again, a qualitative analysis only) when the fan was turned on.
- The fan operation is not automatic and must be manually turned on or off.
- There is no make-up air being provided to the kitchen when the exhaust system is enabled. Typical kitchen exhaust systems also provide sufficient make-up air that is conditioned. This will prevent the building from becoming overly negatively pressurized while the fan is on.
- FDE noted that the building pressure was -0.015"w.c. while the fan was operating (as measured across the door to the outside from the kitchen). This pressure reduced to approximately -0.01 to -0.005"w.c. when the fan was turned off. A typical building should be operating at a pressure of approximately +0.005 to +0.01"w.c. This issue does not pose any immediate health risk to the occupants. However, it is an inefficient

means of operation as this leads to significant amounts of unconditioned air being introduced through doorways, windows and other building leakage. This leakage could potentially lead to undesirable humidity levels in the building (both too high and too low depending on the outside air conditions).

Summary and conclusions

- FDE is not aware of there being any reports of any symptoms related to carbon monoxide overexposure by any of the kitchen personnel.
- If operating at design air flow rates, the exhaust system should likely be able to handle the carbon monoxide output of more than the single cabinet warmer that was previously installed (and now removed). Thus, even operating at a reduced capacity, it is likely that sufficient exhaust would have been provided. However, it is unknown what the reduced capacity was nor what the extent of the inefficient gas combustion was of the cabinet warmer. No detailed analysis has been carried out in this regard.
- Currently, there is no gas fired equipment remaining in the kitchen. As such, there are no known sources of carbon monoxide remining in the kitchen.
- FDE would still recommend confirming that the kitchen hood exhaust is providing the proper air flow when enabled. If necessary, adjustments to the system should be made to make sure sufficient air flow to ensure proper exhaust air flow when the kitchen hood exhaust fan is enabled.
- The main reason for continuing to utilize the exhaust system would be to remove excess heat from the electrically powered warmers and to prevent kitchen smells from migrating to other parts of the building. Neither of these conditions would pose any health risks to the occupants.
- Consider providing a make-up air unit or other means of providing sufficient conditioned make-up air to the kitchen space. Not implementing this recommendation will not pose a specific health risk to the occupants. However, it would improve occupant comfort and energy efficiency.

<u>Other Potential sources of Carbon Monoxide</u>

The only other known possible sources for Carbon Monoxide are the building heating water boilers. In further discussion with school personnel, it was reported that routine combustion stack analysis has recently been performed on the boilers to confirm safe, efficient, and code compliant operation. This, combined with the fact that the boiler stacks are more than the code required 10 feet away from any outside air intakes, should ensure that combustion gases (CO_2, CO, NO_x, etc.) do not re-enter the building. Based on this information, there are no further recommendations regarding the need for elimination of Carbon Monoxide (or other combustion gases).

<u>Minimum Outside Air Ventilation</u>

Minimum Outside Air requirements always need to be met in any large building to ensure that it is being properly ventilated. Ensuring these requirements are met helps maintain proper

building pressurization which will also help with moisture and humidity control. It will also reduce contaminants by diluting Carbon Dioxide (CO_2), volatile organic compounds (VOCs) and any potential odors produced from within the building. Maintaining the required ventilation rates can often be difficult in new buildings but may be even more difficult in existing (especially) older buildings. While investigating the existing conditions regarding how ventilation was being maintained in this building, the following was noted:

- There is no outside air being delivered via the HVAC systems to the kitchen or cafeteria areas.
- There is no outside air being delivered to the music room located next to the cafeteria.
- There is only a minimal amount of outside air being delivered to the gymnasium and stage area. 1 of the 2 units has an outside air intake that is always open to the unit. The other unit only utilizes return air and does not have an outside air intake.
- Most of the classrooms are intended to receive outside air from RTU-4. This unit serves all 3 floors, but it is not operational. It was in the process of being renovated to get it functioning properly at the time of our site visit (but it was still off). The exact amount of time that this unit had been down (turned off) is unknown. However, it is believed that it has been down for a significant amount of time.
- RTU-4 has capacity to heat the air, only. There is no cooling source for this unit and thus does not have the capability to dehumidify during warm and/or humid conditions.
- The office areas also did not appear to have any outside air connected to the AHUs serving this area. However, the duct connections could not be verified to definitively confirm this statement (although it is highly doubtful that there is an outside air duct connection tied to any of them). There were renovations to the school that added split system units and Variable Refrigerant Flow (VRF) type heating and cooling units. All other units throughout the school were configured as return air only type units. So, it is believed that these units serving the office area were of a similar configuration.
- There are operable windows in all spaces which could provide ventilation to the spaces on an as needed basis. However, it is believed that the windows were open rarely, if ever. Also, to meet code requirements, the open windows must meet specific minimum air flow requirements based on floor area and occupancy. No analysis was carried out to verify whether either of these requirements are met.

Summary and conclusions

- It is highly recommended that RTU-4 be repaired and made operational before reopening the school to students
- It is recommended that, at some point soon, the airflow be verified and flow rates confirmed to make sure the proper amount of air is being delivered at each classroom (or other space) per the latest design drawings (from 1989).
- Consider replacing RTU with a new Dedicated Outside Air Supply (DOAS) unit. The unit should provide both heating and cooling and may want to utilize heat recovery from the building exhaust (mostly bathroom exhaust). This would allow for proper conditioning of the air prior to being supplied to the space. The new unit would likely also be more energy efficient.

- A detailed analysis of the entire school and its current ventilation rates should be performed by reputable Engineering firm. They should provide recommendations for adjustments, modifications and or additions to the mechanical systems to ensure that:
    - The correct amount of outside air is being provided to the building to meet building codes and ASHRAE standard 62.1 which dictate ventilation for acceptable indoor air quality.
    - The correct amount of exhaust is also being pulled from the building including proper exhaust from all restrooms.
    - Proper building pressurization is being maintained by delivering slightly more Outside Air than is being exhausted from the building.

Noxious smells

Finally, there were reports of noxious smells coming from 2 different classrooms. However, none of those smells were noticeable on the day of my site visit. As it can be difficult to troubleshoot an issue that no longer persists, there are only a few recommendations that may or may not have been related to the issue.

1. It was noted that a couple of the classrooms had large amounts of trash (mostly candy wrappers) jammed into the radiators. Since the temperature of the radiator lines can reach temperatures of ~180°F, it is possible that the plastic on these wrappers or the food residue could be melting. This may result in undesirable smells. In theory, these should not be dangerous if they are not combusting. Dirt or other items could also produce undesirable smells. As such, it is recommended that the radiators all be cleaned. This should take 15-30 minutes per radiator.
2. Many of the radiator control valve actuators were missing. When removed, the valves always remain fully open. This results in an unregulated flow of hot water through the radiator anytime the boilers are operating. This could result in the classroom overheating. In turn, this may cause the VRF unit(s) in the room to start cooling. This simultaneous heating and cooling is inefficient and results in energy waste. Although not directly related to any possible smell issue, it is recommended that the actuators be replaced as part of the cleaning process.
3. Room 306 is where one of the unidentified smells was reported. Again, we did not detect any smells in this space but also noticed that there was a refrigerator, microwave, coffeemaker & toaster located in the exact corner of the room where the smell was reportedly the strongest. While we have no idea if these appliances were the cause of the smells, items of this type are often related to noxious smells. It is recommended that the owner make sure there are no leaks from any of the appliances and that all are kept satisfactorily clean.

Appendix A

Photos

Figure 1 – Kitchen Roof Top Unit – No Outside Air Intake

Figure 2 – Gym Roof Top Unit – with fixed, minimum Outside Air Intake Hood to the right of the unit

Figure 3 – Classroom RTU-4 (Dedicated Outside Air Unit). Note OA intake (at left of the unit) is approximately 40-50 feet away from the boiler stack discharge located at the far corner of the building (chimney) which is a more than sufficient distance away.