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Hunter College Campus Schools

APPLICABILITY of HVAC SYSTEM REPAIRS to SARS-CoV-2 INFECTION PREVENTION

Report for
Professional Staff Congress
(AFT Local 2334)

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Introduction

This report addresses the following issues:

- *Based on data provided by the involved parties*, does the repair and retrofit work performed on ventilation systems at Hunter College Campus Schools (HCCS) conform to the guidance of ASHRAE Standard 62.1-2019[1] for acceptable indoor air quality, in a non-COVID-19 context?
- Would compliance with ASHRAE Standard 62.1-2019 provide adequate protection for human health and life in the current COVID-19 context?
- What additional HCCS ventilation measures, if any, should HCCS be implementing to protect human health and life in the current COVID-19 context?

[1] American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE). Ventilation for Acceptable Indoor Air Quality: ASHRAE Standard 62.1-2019.

Report Limitations

This report is subject to significant limitations.

Document review is limited to assessment of two very brief (5 pages and 3 pages) Genesys Engineering documents[2,3] provided by HCCS in response to an information request from the Professional Staff Congress (PSC). These documents provide a basic but ultimately circumscribed overview of what appears to constitute a major infrastructure project.

The documents raise multiple questions which warrant additional informational response:

1. The “scope of work for HCCS air-side HVAC repairs” is referenced but not provided.
2. A reference to “air quality that meets or exceeds all standards for a K-12 school” does not specify the standards.
3. A reference to “said spaces [that] are ready for safe occupancy” does not specify the criteria that define safe occupancy.
4. A reference to completion of “Phase 1 of the Air-side HVAC System repairs” does not specify the criteria for Phase 1 or for a presumed Phase 2.
5. A reference to HCCS’s “long-term HVAC refurbishment solution” is not explained.
6. A statement that “work on the waterside of the HVAC systems at HCCS are [sic] the responsibility of the school’s maintenance staff” warrants explanation.
7. An “Indoor Air Quality Assessment” is planned. How will this differ from the work performed by Genesys and Trane and what is the schedule and reason for this IAQ assessment?

[2] Braun RL. President, Genesys Engineering P.C. Letter to Dr. Ali Vedavarz, Director of Engineering Services, CUNY. September 4 2020 (“Letter/summary.report”)

[3] Genesys Engineering. Hu.nter Campus School – Classroom HVAC Unit Ventilator Outside Air Calculations per ASHRAE 62.1-2019 (“Final balancing report”).

8. The specific classrooms served by HVAC units AC-4 and AC-7 are not identified.
9. Unit ventilator configuration (i.e. under-the-window vs. vertical) is not specified.
10. Air exchange data (i.e., calculation of air changes per hour in each occupied space, based on percentage of outside air) are not provided.
11. Provision or lack thereof for natural ventilation in each occupied space is not addressed; interior classrooms (classrooms without a wall to the exterior), if any, are not identified.
12. The presence or absence of a nurse office/suite, a key component of infection control preparedness and response, is not explicitly addressed.

Most significantly, the provided documents contain not a single reference to the ongoing SARS-CoV-2 pandemic. The documents provide no indication of whether the Genesys/Trane work comprises the full range of ventilation modifications that HCCS will be utilizing to minimize virus transmission in the indoor environment or whether additional ventilation changes are planned for this purpose.

This EOHS Associates LLC assessment of the two Genesys documents is limited to basic consideration of HCCS mechanical ventilation options only; it does not consider other necessary COVID-19 preventive measures such as physical distancing, cleaning and disinfection, source control (masks), personal protective equipment, isolation of infectious or presumed infectious individuals, etc. Further, EOHS Associates LLC has not spoken or otherwise communicated with HCCS staff or administration and has not conducted an independent site assessment.

Consequently, observations, comments, and recommendations by EOHS Associates LLC are based solely on the content of the provided Genesys documents and are not intended to be, nor should they be considered, a comprehensive health and safety assessment.

Ventilation work at Hunter College Campus Schools

As of September 4, 2020, Genesys Engineering and Trane Technologies completed “Phase 1” repairs on the ventilation components of the heating, ventilation, and air conditioning (HVAC) system(s) at Hunter College Campus Schools, 71 East 94 Street, New York NY 10128.

According to the documents provided, the Genesys/Trane project prioritized:

- Outside air – investigating existing conditions, modifying to meet original design criteria, validating performance through air balancing, and
- Unit ventilator functionality – retrofitting defunct unit ventilator controllers with new controllers and thermostats, and
- Centralized HVAC systems – assessing sufficiency of outside air supply, balancing systems.

A stated goal of the project was to “prepare Hunter College Campus Schools to safely reopen for the 2020-2021 academic year.” The Genesys letter states that repairs and retrofits included 40 of 87 unit ventilators. However, the air balancing report indicates the presence of 97 unit ventilators, three of which, in rooms 313, 425, and 438, will require additional work before they will be able to supply adequate outside air. HCCS is also equipped with seven separate centralized mechanical ventilation systems, also known as heating, ventilation, and air-conditioning (HVAC) systems. These HVAC systems serve the gym and locker rooms, the cafeteria, administrative offices, the lobby and (unspecified) associated classrooms, the kitchen, the corridors and (unspecified) associated classrooms, and the auditorium. Three of these seven HVAC systems are identified as providing insufficient outside air, even with dampers manually set to the fully open position. Six of the seven HVAC systems are identified as providing insufficient supply air.

In apparent contradiction to these findings, the Genesys letter states that virtually all spaces “are being supplied with adequate outside air” and that “the system is expected to yield air quality that meets or exceeds all standards for a K-12 school.

With regard to fresh air flow to the spaces addressed and repaired by this project, said spaces are ready for safe occupancy." In addition, "in accordance with ASHRAE standards, the fresh air flow to the spaces indicated in the final report generally meet or exceed… the standards for a K-12 school."

Genesys also calculated post-repair revised recommended room occupancy limits based on correlation of room size with measured supplied air flow rates. These potential revisions include both reductions and increases in maximum room occupancy and vary from room to room.

Revised room occupancy limits calculated by Genesys are based on ventilation rates only. Prior to implementing any increase in occupancy density in an indoor space, HCCS should confirm that the increase does not exceed legally applicable maximum occupancy limits such as those of local fire, building, or education departments.

Although not explicitly stated in the Genesis letter, it is reasonable to conclude that Genesys/Trane work at HCCS was predicated on the guidance of ASHRAE Standard 62.1-2019, which is the basis for the Genesys air balance report. Based on the data in that report, *current provision for outside air satisfies ASHRAE 62.1 guidance in almost but not quite all rooms served by unit ventilators. Current provision for outside air satisfies ASHRAE 62.1 guidance in only four of seven HVAC systems. Current provision for supply air is sufficient in only one of seven HVAC units*. *(Classrooms served by centralized HVAC systems are not identified in the provided Genesys documents.)*

The Genesys documents are silent regarding the ongoing SARS-CoV-2 pandemic. However, multiple references to "safely reopening for the 2020-2021 academic year" may reflect tacit acknowledgement of this health concern and of the critical role that mechanical ventilation can play in minimizing exposure to infectious agents. Unfortunately, Genesis, and by implication HCCS, do not explicitly address these potentially life-threatening issues in the documents provided.

Does conformance with ASHRAE 62.1 provide adequate protection for human health in the COVID-19 context?

ASHRAE Standard 62.1: Ventilation for Acceptable Indoor Air Quality is the most commonly referenced standard addressing achievement of sufficient indoor environmental quality and appropriate HVAC system design and operation *under typical conditions*. It forms the basis for most mechanical codes and is often directly referenced in those codes.

Ventilation standards were initially formulated to address occupant dissatisfaction with perceptible odors or irritants This approach had serious limitations in that it did not take into account the possible presence of harmful contaminants that could have health impacts at concentrations below their odor and irritation thresholds.[4] As standards evolved, ASHRAE divided indoor air into four categories ("classes") that describe the level of contamination within the air in a given zone and inform the application of mechanical ventilation.[5]

Table 6-1 (Minimum Ventilation Rates in Breathing Zones) of ASHRAE Standard 62.1-2019 assigns classrooms to Air Class 1: "Air with low contaminant concentration, low sensory-irritation intensity, and inoffensive odor." Class 1 air can be recirculated within the space of origin or to other spaces. In contrast, rooms containing or potentially containing infectious SARS-CoV-2 virions would likely have been categorized as Air Class 4, had the current pandemic been anticipated. Class 4 is characterized as "Air with highly objectionable fumes or gases or with potentially dangerous particles, bioaerosols, or gases, at concentrations high enough to be considered harmful". Class 4 air is usually exhausted by default.

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[4] Persily A. Challenges in Developing Ventilation and Indoor Air Quality Standards: The Story of ASHRAE Standard 62. *Build Environ*. 2015; 91: 10.1016/j.buildenv.2015.02.026. doi: 10.1016/j.buildenv.2015.02.026

[5] Alspach P. ASHRAE 62.1: A Review of Key Requirements and Concepts. *Consulting-Specifying Engineer*. July 15, 2013. https://www.csemag.com/articles/ashrae-62-1-a-review-of-key-requirements-and-concepts/

Per the Genesys air balance report, ventilation goals for HCCS classrooms were based on the assumption of the presence of “clean” Class 1 air. This would have been technically correct in normal circumstances.

However, the assumption of clean classroom air is not valid in the context of the current pandemic situation. Compliance with ASHRAE 62.1 guidance for ventilation for classroom air does not provide adequate for protection human health in the COVID-19 context and must be supplemented by additional protective ventilation measures as well as by other measures.

What additional ventilation measures are warranted at HCCS for protection of human health in the current COVID-19 context?

Planning to protect human health by minimizing exposure to potential indoor transmission of airborne COVID-19 infectious particles requires consideration of both natural and mechanical ventilation options, as well as other, non-ventilation-based measures.

In particular, both air quantity and air directional flow should be considered and addressed.

Fundamental protective ventilation principles include:

- maximizing the provision of outside air (dilution ventilation), up to and including 100% outside air where feasible
- maximizing air exchange (6-12 air changes per hour, based on outside air)
- eliminating or minimizing recirculation of air within an occupied space and among occupied spaces
- applying the highest possible level of filtration to air that is unavoidably recirculated
- eliminating or minimizing downstream exposure to human exhalation products
- judicious use of openable windows

- eliminating or minimizing recirculation of room air via: window-mounted AC units, certain unit ventilators or other ductless units that lack capability to provide outside air; and personal, desktop, or pedestal fans
- consideration of deployment of portable HEPA cleaning units
- consideration of deployment of HEPA-filtered negative air devices to negatively pressurize isolation areas.

The Centers for Disease Control and Prevention (CDC) offers the following basic guidance for utilizing ventilation to reduce exposure to SARS-CoV-2. The CDC document should be consulted for additional guidance.

- Increase outside air ventilation.
- Increase total airflow supply to occupied spaces.
- Disable demand-controlled ventilation (DCV) controls that reduce air supply based on occupancy or temperature during occupied hours.
- Further open minimum outdoor air dampers to reduce or eliminate HVAC air recirculation, if practical.
- Increase air filtration to as high as possible.
- Consider running the HVAC system at maximum outside airflow for 2 hours before and after occupancy.
- Consider portable HEPA fan/filtration systems.
- Generate clean to less-clean air movement by re-evaluating the positioning of supply and exhaust air diffusers and/or dampers.[6]

ASHRAE states that "transmission of SARS-CoV-2 through the air is sufficiently likely that airborne exposure to the virus should be controlled." It acknowledges the need to supplement and supersede its existing standards with more robust measures to protect staff and students from the spread of SARS-Cov-2. It offers

[6] CDC. Strategies for Protecting K-12 School Staff from COVID-19. August 20, 2020. https://www.cdc.gov/coronavirus/2019-ncov/community/schools-childcare/k-12-staff.html

guidance for retrofitting and/or altering operation of HVAC systems to interrupt or slow virus transmission.[7]

Following is *excerpted, partial* guidance from the ASHRAE Epidemic Task Force. The ASHRAE document should be consulted for additional guidance.

1. Perform **initial air flush** of all spaces prior to occupants re-entering building:
    a. Mechanical systems should operate in occupied mode for minimum period of one week prior to students returning... while assuring the outside air dampers are open.
2. **Daily flush** prior to occupancy:
    a. Mechanical systems should be operated in occupied mode (including normal or peak outside air rate introduced to each space) for minimum period of 2 hours prior to occupants re-entering building.
3. **Increase outside air** to maximum allowable per air handling unit (AHU) without compromising indoor thermal comfort.
4. Disable any demand control ventilation (DCV) and **introduce the maximum possible outside air flow 24/7** until further notice (including Dedicated Outdoor Air Systems [DOAS]).
5. Filtration target level:
    a. **Apply the highest Minimum Efficiency Reporting Value (MERV)** applicable for the HVAC units. Target level for filtration for schools is MERV 13 or higher. This minimum target will on average remove a minimum of 75% of particle size of 0.3-1.0 µm.
    b. If MERV 13 filters cannot be installed consider the following:
        i. **Increase the filtration in the unit to the maximum available**.
        ii. Provide a recirculation fan filtration unit and duct into the return of units.
        iii. Provide a HEPA filtration unit.

[7] ASHRAE Epidemic Task Force. Schools and Universities. July 17, 2020. https://www.ashrae.org/file%20library/technical%20resources/covid-19/ashrae-reopening-schools-and-universities-c19-guidance.pdf

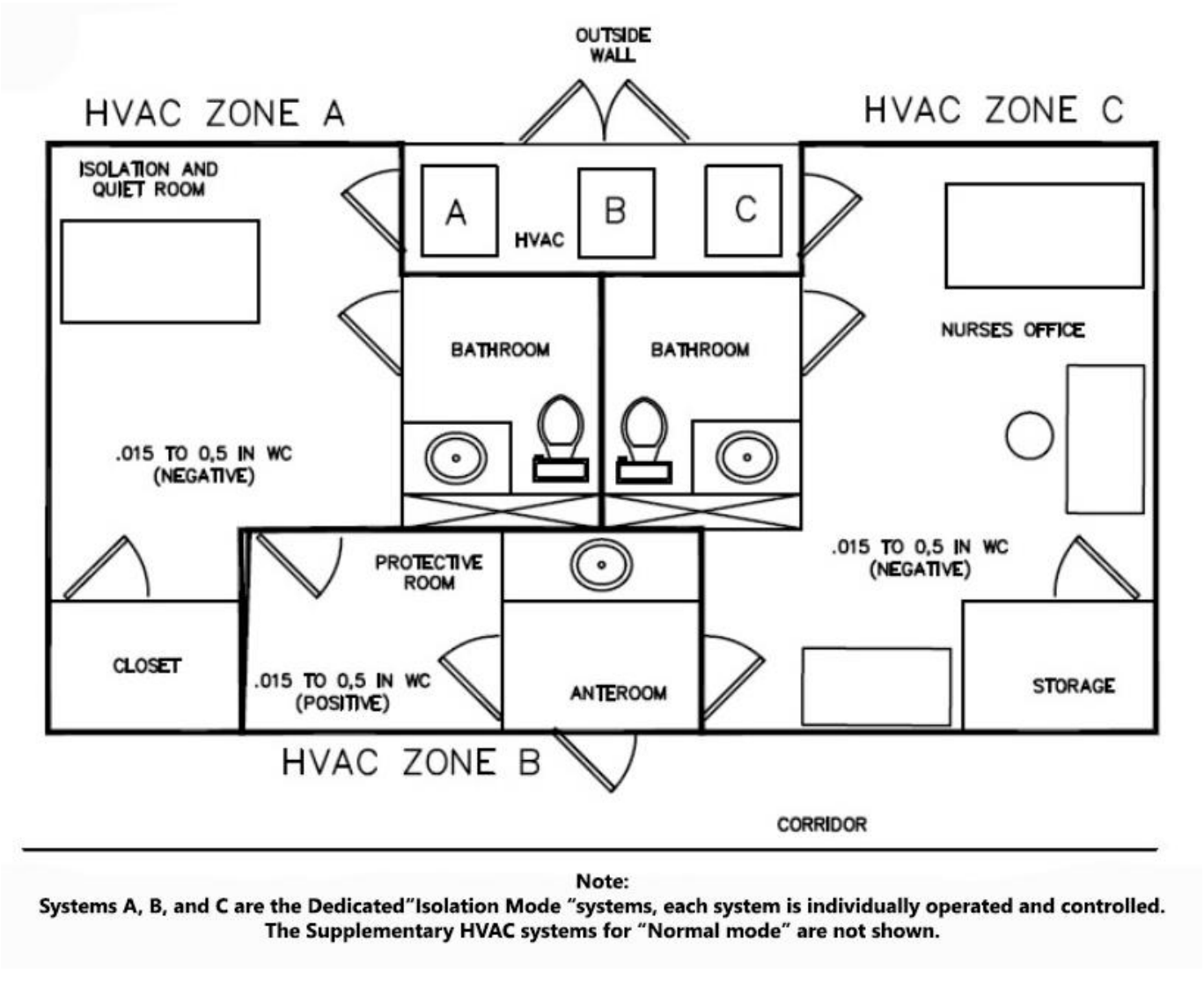
6. Space air flow:
    a. **Ensure airflow patterns in classrooms are adjusted** to minimize occupant exposure to particles.
    b. Recommended guidance is to provide lowest possible particulate concentration anywhere in the space.
7. **Nurse's office/suite**[8,9] - general requirements:
    a. Two modes of operation (isolation and normal):
        i. Isolation mode
            1. Dedicated 100 % OA system
            2. Design for a maximum of 10 Air Changes per Hour (ACH), can operate at 6 ACH
            3. For existing HVAC that is unable to support HEPA, two filter banks, MERV 7 and HEPA (or MERV 14 for HVAC that is unable to support HEPA)
            4. Space pressurization design criteria
                a. Isolation Room and Nurse office will be negative pressure (- 0.015" to – 0.5" W.C)
            5. Protective Room will be positive pressure (+ 0.015" to + 0.5" W.C)

___nurse office/suite schematic diagram on following page___

[8] Re nurse office/suite, see also ASHRAE Standard 170-2017: Ventilation of Health Care Facilities.

[9] Ninety percent of New York City public schools have school nurses. Source: NYC Department of Education - Health Services. https://www.schools.nyc.gov/school-life/health-and-wellness/health-services.

Example of nurse office/suite floorplan and pressure differentials



Note:
Systems A, B, and C are the Dedicated"Isolation Mode "systems, each system is individually operated and controlled. The Supplementary HVAC systems for "Normal mode" are not shown.

Please do not hesitate to call or email with any questions.

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