GOVERNMENT OF THE DISTRICT OF COLUMBIA
DEPARTMENT OF GENERAL SERVICES

PURPOSE

The Department of General Services (DGS), in coordination with District of Columbia Public Schools developed this memo to document and articulate the measures taken surrounding general school preparedness efforts, specifically focusing on Heating, Ventilation, and Air Conditioning (HVAC) augmentations and updates completed to ensure all DCPS facilities are safe for return-to-in-person schooling during COVID-19.

This memo is designed to provide detailed information on overall school preparedness efforts, and technical details of HVAC work completed.

SCHOOL PREPAREDNESS

A safe and healthy environment for in-person learning is the District's top priority. To deliver on DCPS's health and safety commitment and begin to offer in-person learning in Term 2, the District is focused on facility readiness, operational augmentations for health and safety protocols, and building systems for ongoing monitoring.

Specifically, to prepare for offering in-person learning, the District sought the input of a nationally accredited specialist for guidance on ensuring the air quality of our schools meets the highest standards of safety and reflects the health community's latest understanding of COVID-19. The American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE) Epidemic Task Force School Team has done extensive work in developing practices and standards in this area. The licensed professional engineer (PE) brought on to design our program for safe return to school amid COVID-19 is a standing member of the ASHRAE Task Force Team. He is responsible for overseeing respected contractors carrying out all work. Before opening, all work will be inspected by the specialists with the District's Department of General Services and DCPS, and finally the PE who will ensure compliance with the ASHRAE standards.

The District is utilizing a set of building readiness standards to ensure every facility is ready to welcome students back to a safe learning environment. This checklist includes HVAC enhancements to increase fresh air filtration. These standards align with public health guidance issued by DC Health, the Office of the State Superintendent of Education (OSSE), and Centers for Disease Control and Prevention (CDC) to mitigate the spread of COVID-19 when schools reopen.

GENERAL PREPAREDNESS

Schools are receiving detailed guidance and intensive technical assistance to guide the development of individualized operational plans prior to reopening. After these are implemented, school leadership, operations staff, and relevant central office teams will conduct building walk throughs, alongside parent and community leaders, to confirm that each school has received the committed to supplies and improvements. Additionally, the monitoring of new routines and safety protocols will take place on a regular basis after students and staff return to in-person learning.

SCHOOL BUILDING READINESS

DCPS is committed to reopening safely. Each school's principal will organize a site-based walkthrough team to include members from parent and teacher school-based groups. The site- based walkthrough team will verify all items on the building readiness checklist prior to individual school openings.

In addition, DCPS is completing site-specific operational plans for each school in accordance with guidelines from DC Health, the Centers for Disease Control, and the Office of the State Superintendent of Education. Each school's operational plan will be posted online. An overview of key elements of building readiness is provided below:

- **Personal Protective Equipment (PPE) & Hygiene Supplies:** Schools have the necessary general and enhanced PPE and hygiene supplies and are prepared to utilize the standardized inventory monitoring protocol established by central office to ensure timely supply replenishment.
- **Cleaning Supplies & Procedures:** Schools have the necessary cleaning supplies and are prepared to utilize the standardized inventory monitoring protocol established by central office to ensure timely supply replenishment. All cleaning supplies are from the EPA- registered list in the CDC guidance. School custodial staff have been trained to implement enhanced and deep cleaning protocols.
- **Socially Distant Space Arrangement:** Schools are set up to facilitate social distancing among staff and students, using resources provided by central office.
- **Signage:** Schools have COVID-19 health signage (in English and other languages) posted in arrival spaces, hallways, and classrooms. Signage will address key COVID-19 public health and safety practices.
- **Water Access:** Schools have safe and reliable access to water in a manner that prevents risk of virus transmission.
- **HVAC Enhancements:** Schools are equipped with either a Direct Outside Air System (DOAS) with MERV-13/MERV-14 filters or High-Efficiency Particulate Air (HEPA) filters.

- **Plumbing Systems:** School plumbing work orders related to bathrooms, sinks, and water supply systems are prioritized so that schools are ready to welcome students and staff.

HVAC PREPAREDNESS

Part of the DCPS reopening plan is ensuring HVAC and air quality in school facilities is properly suited to welcome back students and staff. DCPS in coordination with the Department of General services has taken on this initiative.

DGS was charged with the design and construction of a stabilization project that would improve HVAC operations for both non-modernized and modernized schools. With the onset of the COVID-19 public health emergency, the decision was made that a more comprehensive assessment and retrofit of the existing systems was mandatory to ensure an optimal HVAC/air quality environment conducive for students, faculty, and visitors to all 117 active public-school buildings. The work is being carried out by numerous HVAC contractors under the guidance and direction of a licensed PE and in accordance with recommendations provided by the American Society of Heating and Air-Conditioning Engineers (ASHRAE). A school-specific plan to meet the goals outlined by the assessments has been developed by the PE, Raj Setty—a nationally recognized expert and team member of Epidemic Task Force School Team at ASHRAE—and is being implemented by the HVAC contractors.

DESIGN APPROACH

The District sought the input of the American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE) Epidemic Task Force School Team. The team consolidated recommendations into solutions that maximize the air quality across all facility types and associated HVAC systems throughout the DCPS portfolio. The portfolio is classified in three types:

- Type A Facilities with 100% outside air capability
- Type B Facilities with partial outside air capability
- Type C Facilities with no outside air capability

Once the building types were identified, Setty & Associates was hired to do the mechanical electrical and plumbing (MEP) designs for each school. Setty & Associates based their analysis & design of each school on the following principles.

- The air change rates throughout a building. Filter levels and appropriate technology were selected based on the individual School's HVAC unit's ability to handle the changes. In most schools with the larger units, acceptable changes can be accomplished from the system itself. In schools that do not have larger units and rely on smaller classroom level

units, the recommended approach is to install portable units with **filtration levels that exceed MERV 13** through HEPA and **ultraviolet light** to disinfect the air. (This methodology using HEPA filters and UV Light is used in hospital settings and provides a high level of particulate filtration). The design improves indoor air quality, hereby mitigating the probability of infection.

- The second principle is to ensure the indoor air quality is monitored by the building control systems and by a secondary sensor system that runs in parallel with the existing Building Automation System (BAS). This sensing system will take samples across the school and monitor for particulate level (PM 2.5), CO2 levels, Temperature, Humidity, VOC's. As people occupy the space and the time element increases, efficiency of the filtration and dilution via fresh air must be monitored. After various solutions were vetted, the best solution was Senseware. This platform will allow us to answer the most basic question— is it working and what we can do to continue to improve the indoor air quality.
- The design strategy for individual classrooms used the Wells-Riley model for transmission rates.

SPECIFICS ON HVAC ENHANCEMENTS UNDERWAY

One of two paths will be taken for HVAC enhancements determined by each school's current infrastructure.

1. For schools receiving outside air from central HVAC systems—Type A Facilities and components of Type B Facilities—, the followings steps occur:
    - Perform visual inspection of air distribution mechanisms in walls and ceilings.
    - Confirm registers and diffusers are not blocked or closed.
    - Evaluation of air handling equipment for proper operation.
    - Energize all HVAC systems and confirm proper indoor air temperature and humidity.
    - Disinfection and cleaning of air handling equipment.
    - Review equipment control sequences to verify systems are operating in accordance with issued guidance and maintaining required ventilation, temperature, and humidity conditions to occupied areas.
    - Integrate new sequences into existing controls to run systems before and after occupancy helping to flush zones, increasing filtration and dilution.
    - Expansion of central HVAC equipment monitoring for real-time system health checks and critical alarming.
    - For HVAC equipment compatible with higher rated air filters, install one to two weeks prior to re-opening.
    - Placement of a mobile HEPA filter in learning spaces (see below for more details).
2. Schools without central air systems—Type C Facilities and components of Type B Facilities—will receive portable medical grade true **HEPA filters** to cover all instructional spaces and additional 10 units for other centralized and shared spaces such as

lobbies and welcome centers, nurse suites, and the health isolation rooms. These are mobile units that will be placed in classrooms and run continuously to increase air changes in rooms and filter the air. True HEPA filters are proven to filter particulates down to .3 microns at a 99.99% efficiency. All of the HEPA filter units are equipped with a UVC light kit to provide an additional level of protection.

As shown in the image below, the HEPA filters are designed to bring in air from the room and put it through a 3-step filtration process. First, the air goes through a preliminary filter to catch particulates, then through a UV light to treat and deactivate microorganisms and pathogens, then finally through the HEPA filter, which captures small particulates at a 99.99% efficiency. After the air has gone through those steps, it exits the unit as clean air.

In addition to HVAC enhancements, domestic hot and cold-water systems will be fully flushed before a building reopens per DC Health guidelines. This will remove any metals (e.g. lead) that may have leached into the water and minimize the risk of Legionnaires' disease and other diseases associated with water. Water closets, lavatories, faucets, and soap dispensers will be surveyed for proper operations.

The following steps are being taken prior to re-opening:

- Flush domestic hot and cold-water systems after confirming all valves are operational.
- Open all fixtures on branch of piping simultaneously for a period of not less than 5 minutes. Perform this flush for both hot and cold-water systems.
- Turn hot water heaters to a target of 150˚ F or higher for at least one hour. Return to normal temperature prior to flushing systems.

- If water discoloration is found after the flush, remove, clean, and sanitize faucet aerators

- Check all lavatories and sinks for proper operations, document substandard conditions. Ensure soap dispensers are functional and supplied.
- Remove and sanitize all drinking fountain bubblers.
- Complete all work in accordance with ASHRAE Guideline 188.

CONTRACTOR SCOPE OF WORK:

Once the initial design strategy was complete, the final HVAC scope of work was developed; see outline below.

Phase 1: Assessment and System Modification.

- Delivery by Early October.
    - Fill in HVAC unit sheets.
    - Note any deferred maintenance or broken equipment/non-functioning equipment.
    - Document central spreadsheet with Building Management System (BMS) work station and native BMS software usernames and passwords, screen shots of system.
- Delivery by November 7, 2020.
    - Gather and upload HVAC plans, including any recent renovations, into the Setty online portal.
    - Generate HVAC site visit field assessments from the Setty online portal.
    - Provide and complete HVAC start-up and diagnostic of each school.
        - Review air distribution conditions of existing spaces (look for covered diffusers, blocked return grilles, overly close supply diffusers/registers and return/exhaust grilles.
        - Perform initial air flush of all spaces prior to occupants re-entering building: Energize HVAC systems 5 days before occupancy and maintain proper indoor air temperature and humidity to maintain human comfort, reduce potential for spread of airborne pathogens and limit potential for mold growth in building structure and finishes (refer to ASHRAE Standard 55, recommended temperature ranges of 68-78 degrees F dry bulb depending on operating condition and other factors, recommend limiting maximum RH to 60%).
        - Clean HVAC intakes.
        - Verify proper separation between outdoor air intakes and exhaust discharge outlets to prevent/limit re-entrainment of potentially contaminated exhaust air (generally minimum of 10-foot separation - comply with local code requirements).
        - Change all filters 1 week before occupancy – MERV 13 upgrades to facilities with full or partial outside air HVAC capability.
        - Disinfect with bleach/cleaning solution that cleaners are using inside of the air handlers and mechanical rooms. Maintain cleaning logs with products.

        - Conduct any Testing and Balancing reports and submit to Setty for review.
        - Review pre-existing Indoor Air Quality abnormalities provided through the work order system, Enteliweb, or other documents available.
        - General inspection of HVAC systems and surrounding spaces to identify any potential concerns for water leaks or mold growth that could negatively impact occupant health.
        - Review control sequences to verify systems are operating according to this guidance to maintain required ventilation, temperature and humidity conditions to occupied areas.
        - Test sequence of operation to run 2 hours before and 2 hours after occupancy. This will help increase filtration and dilution of specific zones.
    - Procure and install portable air filtration units to be placed in nurse's suite, administrative areas, and assembly areas (exact locations to be determined by DGS and directed by the contracting officer's technical representative).
        - General Unit Specifications:
            - UV-C light – minimum of 1200 microwatts/cm^2
            - HEPA filter
            - CFM adjustable from 200 cfm to 400 cfm
            - Noise sound level under NC 35
            - Power 110 volt plug in
            - Portable unit
- Provide and complete plumbing start-up and diagnostic for each school as follows:
    - Flush Building Main – In coordination with the local water supplier, flush the service line that runs from the water main to the building.
    - Flush Building Domestic Water System – following one of the options below, fully flush the building's hot & cold-water lines. Prior to flushing it is important to exercise all system valves (close and open all valves, repeating the exercise at least twice for each valve).
    - Domestic water systems shall be prepared for use before school occupancy: Domestic cold-water systems should be flushed with all fixtures on a branch of piping opened simultaneously for a minimum period of five minutes – preferred approach is to have all building fixtures open at same time if possible – if not, care should be taken to ensure adequate flow rate to flush piping mains and branch lines.
    - Domestic hot water systems should be flushed with all fixtures on a branch of piping opened simultaneously for a minimum period of fifteen minutes – preferred approach is to have all building fixtures open at same time if possible – if not, care should be taken to ensure adequate flow rate to flush piping mains and branch lines.
    - Turn hot water heater to maximum temperature, target 150 F plus for 1 hour. Then turn system down to normal operating temperatures and flush hot water tank.

- Flush all water closets.
- Turn on all faucets for a minimum of 5 minutes – if there is any water discoloration then being water quality sampling. Remove, clean, sanitize all faucet aerators and reinstall.
- Check all lavatories and sinks for correct operation and ensure soap dispensers are functional and adequate supply of soap is available to allow for proper handwashing and notify onsite DCPS janitorial staff of the deficiency.
- Start and turn on all gas appliances for at least 5 minutes.
- Drinking fountain bubblers should be removed sanitized and reinstalled.
- Remove and sanitize all aerators and shower heads and reinstall.
- Any questions and concerns refer to ASHRAE Guideline 188.

PROJECT MANAGEMENT & QUALITY CONTROL TEAM

The project management & quality control team is a partnership of two local firms and a nationally recognized engineering firm. The Project management team oversees the daily operation at each school as well as provides inspectors to ensure that the contractor's work complies with designs and specifications and ensure any deficiencies in work are corrected.

FREQUENTLY ASKED QUESTIONS: HVAC ENHANCEMENTS

Do HEPA filters work and how do they compare to MERV filters?

- Yes, HEPA filters are proven method of cleaning the air and are consistently used in hospital settings. HEPA filters filter small particulates at a higher efficiency than a MERV filter and both are included in the ASHRAE guidance.

What happens if the building's system cannot accept a MERV 13 filter?

- Prior to November 9, if the building's HVAC evaluation determines the current HVAC system is not able to accommodate a MERV 13 filter, additional work will be completed to retrofit the system to accommodate the increased filtration. Portable HEPA filters will be provided while the work is ongoing. If it is determined that retrofits are not possible, the system will be upgraded to the highest-level filter possible and portable HEPA filters will be put in place throughout the building to achieve improved air quality. Portable HEPA filters will stay in place throughout the school year with routine filter maintenance.

Can we open windows as well? Windows don't open, so can those work orders be expedited?

- HVAC updates are based on a closed-window model to ensure safe air quality regardless of weather impacts. School by school guidance will be provided on when and if windows should be opened in each facility. For buildings where opening windows is recommended, DCPS and DGS will evaluate work orders to address known issues.

How will you monitor the air in the building?

- Prior to November 2, all schools will receive indoor air quality (IAQ) sensors to monitor, in real time, particulate matter, temperature, carbon dioxide, volatile organic compounds,

ozone, and carbon dioxide levels for measurement and verification purposes. While there is no air quality check for COVID-19, monitors will ensure systems are working properly and give important information to help identify solutions if modifications are required.

How will schools be notified if a system stops working, and there isn't proper air filtration in the school?

- In addition to the indoor air quality sensors, which will provide a significant amount of data to measure effectiveness, DCPS and DGS are building in the capability to monitor and adjust the HVAC systems remotely. Additions in elementary schools will be complete by November 6; remaining schools in the DCPS portfolio are slated for completion by December 31, 2020.

Will this HVAC work ensure that people in the building remain safe?

- The HVAC work is part of a comprehensive plan to keep children and adults safe in school buildings, but it is not the only solution. Other health and safety measures, like social distancing, mask wearing, cohorting, and hygiene measures all contribute to a healthy environment.

How do I know what system my building has and how will I know what work has been done?

- A school level summary will be posted and shared with school communities in the coming weeks after all HVAC evaluations have been reviewed by the professional engineer.

By when should I expect these updates to be made?

- Work will be continuing through October and into early November at some elementary schools. If there are system challenges that cannot be addressed by November 9th, additional portable HEPA filters will installed.

DESIGNER BACKGROUND

Mr. Raj Setty is President & Principal of SETTY, a full-service Mechanical, Electrical, and Plumbing Consulting Engineering Firm headquartered in Washington, DC, with 8 additional offices nationwide. He has over 25 years of experience in the Architecture/Engineering field and is a registered Professional Engineer, Certified Commissioning Agent and LEED Accredited Professional. He is on three American Society of Heating Refrigerating and Air Conditioning Engineers (ASHRAE) technical and research committees. ASHRAE is an American professional non-profit organization that seeks to advance heating, ventilation, air conditioning and refrigeration systems design and construction. He is currently on the ASHRAE Epidemic Task Force on the Schools team. The Task Force was established to respond to the current global pandemic and provide guidance on how to ensure that buildings are prepared for future epidemics. He is a leader in the HVAC industry and on re-opening schools safely, an ASHRAE Instructor and has presented on various national stages for the built environment. He has recently appeared in NPR advising schools and businesses on how to reopen safely as well as in the Washington Post on how KIPP DC is implementing SETTY's reopening and long term solutions to mitigate infections in their schools. His focus on education has always been a priority starting from his Peace Corp days as a volunteer as a High School teacher in Namibia. The safety and education of today's youth is paramount. His children currently attend DCPS schools.

In response to COVID-19 and based on Raj's work with the ASHRAE epidemic task force, Raj has presented to 1000's of practitioners across the country as an instructor for commissioning agents, EPA, Dept of Energy, GSA, dozens of schools systems, ASHRAE engineers, commercial building owners, DDOE, several universities and dozens of building managers on planning how to adapt their current buildings to safeguard against future disruptions to occupancy.

Is a "Deep Clean" enough? Do "Six Feet Spaces" makes sense? What's in the Air? A critical part of the conversation needs to be the Indoor Air Quality and reducing transmissions through the air. Implementing a strategic risk-based blueprint for the building systems will help your recovery readiness team define its priorities, establish the right safeguards, and ensure occupant confidence.

Furthermore, the team at Setty has developed a risk infection calculator that is basis for helping to improve indoor air quality in rooms. This document is used by many practitioners to reduce the risk of infection in rooms. This calculator is based on the Wells Riley Equation for infection probability. The approach is to look at the building's HVAC system holistically and ensuring the three main tools to improve indoor air quality are used.