



Office of Audits
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Audit of GSA's Response to COVID-19: PBS Faces Challenges to Meet the Ventilation and Acceptable Indoor Air Quality Standard in GSA-Owned Buildings

Report Number A201018/P/4/R23008
June 5, 2023

Executive Summary

Audit of GSA’s Response to COVID-19: PBS Faces Challenges to Meet the Ventilation and Acceptable Indoor Air Quality Standard in GSA-Owned Buildings

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Why We Performed This Audit

In April 2020, we began monitoring GSA’s activities in response to the nationwide public health emergency resulting from Coronavirus Disease 2019 (COVID-19) and GSA’s implementation of the Coronavirus Aid, Relief, and Economic Security Act. During our monitoring efforts, we became aware of concerns with ventilation system capabilities in GSA-owned buildings. As a result, we initiated this audit to determine whether GSA’s Public Buildings Service (PBS) has: (1) adhered to federally adopted industry standards for acceptable indoor air quality and (2) implemented Centers for Disease Control and Prevention (CDC) and Occupational Safety and Health Administration (OSHA) guidance to mitigate and prevent the spread of COVID-19 in GSA-owned buildings.

What We Found

Ventilation in GSA-owned buildings is subject to industry standards as well as federal guidance. Federal regulations require that GSA-owned buildings meet the ventilation standard issued by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE ventilation standard).¹ This standard establishes minimum ventilation and testing requirements necessary to minimize adverse health effects for building occupants. GSA is also subject to guidance issued by CDC and OSHA. In response to the COVID-19 pandemic, both agencies issued guidance recommending additional measures to improve building ventilation and minimize exposure to viral particles.

PBS is struggling to meet the ASHRAE ventilation standard and to comply with CDC and OSHA guidance. We found that PBS is not meeting—or does not have complete information to determine if it is meeting—the ASHRAE ventilation standard for the majority of GSA-owned buildings. We also found that PBS has not consistently implemented CDC and OSHA recommendations to improve ventilation in GSA-owned buildings. Taken together, these deficiencies increase the risk that building occupants will be exposed to airborne viruses, including the virus that causes COVID-19.

¹ ASHRAE Standard 62.1, *Ventilation for Acceptable Indoor Air Quality*.

What We Recommend

We recommend that the PBS Commissioner:

1. Complete a comprehensive assessment to determine whether GSA-owned building air handlers meet the ASHRAE ventilation standard's minimum outdoor air requirements and develop a comprehensive plan to address deficiencies identified.
2. Create and implement a plan to notify building occupants whenever deficiencies and hazards associated with outdoor air requirements are identified.
3. Ensure that all PBS staff with ventilation system responsibilities, including contracting officer's representatives, contracting officers, project managers, and building managers, are trained on the requirements of the ASHRAE ventilation standard.
4. Ensure operations and maintenance contracts define requirements for regular testing, adjusting, and balancing of air handlers.
5. Ensure that GSA's *Guidance for COVID-19 HVAC Operations* adheres to CDC COVID-19 guidance for improved building ventilation.

The PBS Commissioner agreed with our recommendations. GSA's written comments are included in their entirety in **Appendix D**.

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Introduction

We performed an audit of GSA’s response to the nationwide public health emergency resulting from Coronavirus Disease 2019 (COVID-19); specifically, the audit was related to ventilation in GSA-owned buildings.

Purpose

In April 2020, we began monitoring GSA’s activities in response to COVID-19 and GSA’s implementation of the Coronavirus Aid, Relief, and Economic Security Act (CARES Act). During our monitoring efforts, we became aware of concerns with ventilation system capabilities in GSA-owned buildings. As a result, we initiated this audit on December 2, 2021.

Objectives

Our objectives were to determine whether GSA’s Public Buildings Service (PBS) has: (1) adhered to federally adopted industry standards for acceptable indoor air quality and (2) implemented Centers for Disease Control and Prevention (CDC) and Occupational Safety and Health Administration (OSHA) guidance to mitigate and prevent the spread of COVID-19 in GSA-owned buildings.

See **Appendix A** – Objectives, Scope, and Methodology for additional details.

Background

COVID-19 is an infectious viral disease first discovered in December 2019. On March 13, 2020, the president of the United States issued an emergency declaration for COVID-19 response efforts in the United States. Congress passed the CARES Act on March 25, 2020, which authorized the transfer of funds to federal agencies—including \$275 million to GSA’s Federal Buildings Fund—to prevent, prepare for, and respond to COVID-19.² PBS budgeted \$80 million of these funds for COVID-19-related ventilation or air quality issues.

According to the CDC, the viral particles that cause COVID-19 spread between people more readily indoors than outdoors. The CDC further provides that:

Indoors, the concentration of viral particles is often higher than outdoors, where even a light wind can rapidly reduce concentrations. When indoors, ventilation mitigation strategies can help reduce viral particle concentration. The lower the concentration, the less likely viral particles can be inhaled into the lungs

² The Federal Buildings Fund operates as a revolving fund and is used to finance GSA’s property management activities.

(potentially lowering the inhaled dose); contact eyes, nose, and mouth; or fall out of the air to accumulate on surfaces.

Ventilation strategies, including introducing outdoor air, can help reduce airborne concentrations and reduce overall viral doses to building occupants.

Ventilation is the process of supplying air to or removing air from a space for the purpose of controlling air contaminant levels, humidity, or temperature within the space. The American Society of Heating, Refrigerating, and Air-Conditioning Engineers Standard 62.1, *Ventilation for Acceptable Indoor Air Quality* (ASHRAE ventilation standard), specifies minimum ventilation rates and other measures intended to provide indoor air quality that is acceptable to human occupants and minimize adverse health effects.

41 CFR 102-74.195, *What ventilation policy must Federal agencies follow?*, requires PBS to provide ventilation “during working hours in periods of heating and cooling” in accordance with the ASHRAE ventilation standard where physically practical. The regulation further provides that, where not physically practical, PBS must provide the maximum allowable amount of ventilation during periods of heating and cooling and pursue opportunities to increase ventilation up to current standards.³

Building ventilation systems move air either naturally, by opening doors and windows, or mechanically. Air handling units (air handlers) are the components of a mechanical ventilation system that regulate and circulate air throughout a building. Outside air enters a ventilation system through intakes and is delivered to an air handler. Air handlers condition both the outside air and recirculated return air before distributing the conditioned air throughout designated areas of the building. Finally, the recirculated air is returned to the unit to be reconditioned or exhausted.

The ASHRAE ventilation standard specifies that ventilation systems must be designed to bring in a minimum amount of outdoor air. For systems in GSA-owned buildings, this amount is determined using the ASHRAE ventilation rate procedure. Using this procedure, minimum outdoor air intake rates are calculated based on space type, space application, occupancy level, and floor area. Results of these calculations must be included in the design documentation and maintained within the system’s operations and maintenance (O&M) manual for the life of the system.

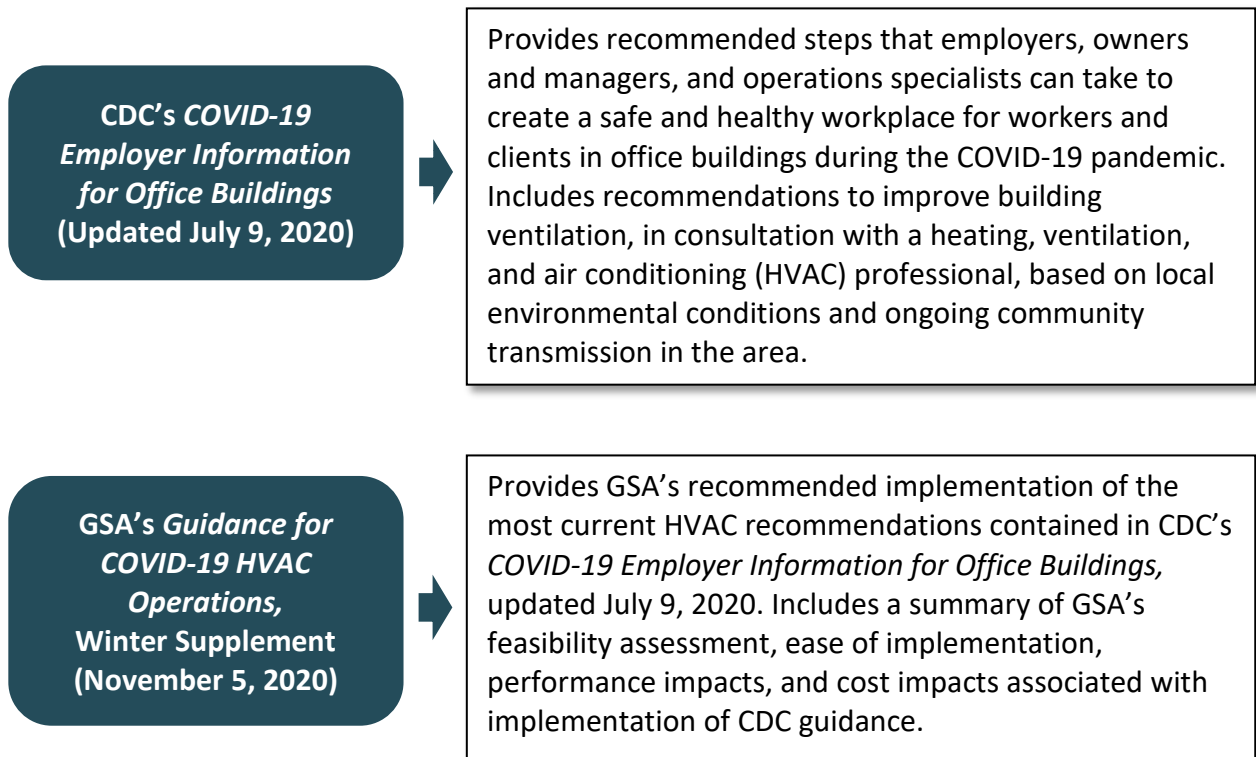
To remain in compliance with the ASHRAE ventilation standard after installation, ventilation systems must continue to bring in the minimum amount of outdoor air determined at design within a ± 10 percent tolerance. Over the life of a ventilation system, many factors can affect its ability to provide the required amount of outdoor air. These include the age and associated

³ ASHRAE Standard 62.1 requirements for the introduction of outdoor air may not be physically practical when outdoor air is contaminated or during extreme weather conditions.

degradation of air handlers and other system components, alterations to building spaces, changes in space use, and changes in space occupancy. Accordingly, the ASHRAE ventilation standard requires minimum maintenance tasks and frequencies to ensure systems remain in compliance.⁴ For example, air handlers must be tested every 5 years to verify that they continue to deliver required minimum amounts of outdoor air.⁵ Tested ventilation systems that do not provide sufficient outdoor air must be adjusted or balanced to ensure compliance.

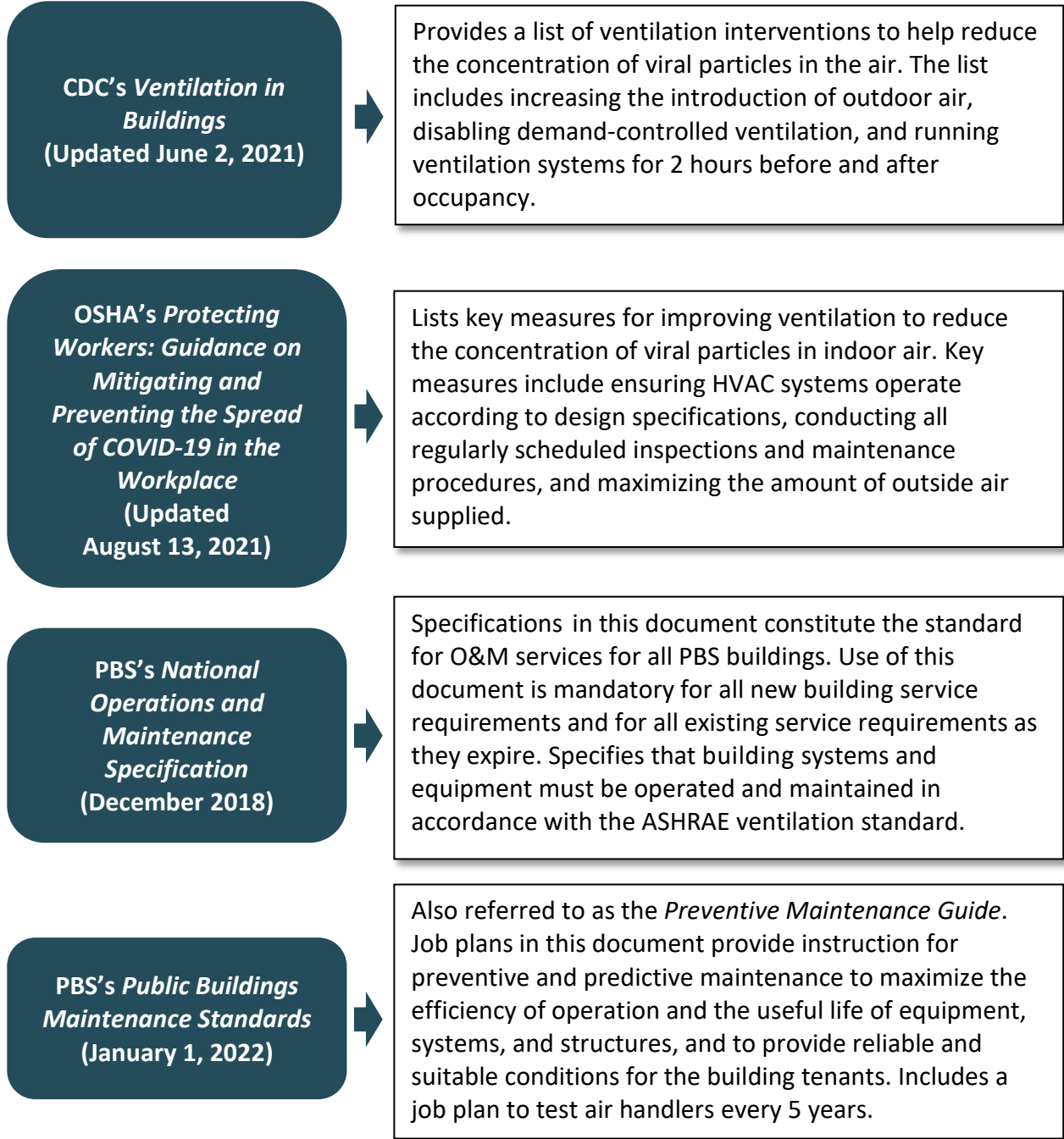
In response to the COVID-19 pandemic, CDC and OSHA issued recommendations for improved building ventilation to help reduce the concentration of viral particles in the air. GSA developed its *Guidance for COVID-19 HVAC Operations* based on the guidance issued by CDC and OSHA. This and other applicable guidance are further described in *Figure 1* below.

Figure 1 – COVID-19 Ventilation Guidance



⁴ ASHRAE Standard 62.1, Table 8-1. *Minimum Maintenance Activity and Frequency for Ventilation System Equipment and Associated Components.*

⁵ Air handlers under 2,000 cubic feet per minute of supply air are exempt from the ASHRAE ventilation standard's testing requirement. The standard also allows an exception for increases or decreases to frequency in testing if documented in a ventilation system's O&M manual.



GSA's Roles and Responsibilities

PBS's portfolio includes 1,477 owned buildings. As the landlord of the federal government, PBS is statutorily required to operate, maintain, and protect these buildings. Within PBS, the Office of Facilities Management is responsible for ensuring that building systems function, identified problems are addressed, and problems and corrective actions are communicated to tenants. Office of Facilities Management personnel are also responsible for developing and issuing the

National Operations and Maintenance Specification, the Public Buildings Maintenance Standards, and the Guidance for COVID-19 HVAC Operations.

PBS contracting officers are responsible for effectively administering contracts and for ensuring compliance with contract terms. Contracting officers must designate and authorize, in writing and in accordance with Agency procedures, a contracting officer's representative (COR) unless the contracting officer retains and executes the COR duties. CORs are responsible for assisting in the technical monitoring or administration of a contract. Office of Facilities Management building managers and building management specialists can be designated as CORs for PBS's O&M contracts.

O&M contractors are responsible for operating and maintaining GSA-owned buildings in accordance with the terms of the *National Operations and Maintenance Specification*. Prior to the start of contract performance, O&M contractors must acknowledge the use of the *Public Buildings Maintenance Standards* as is or submit any proposed revisions to job plans or alternate maintenance plans to the COR for review.

Previous Office of Inspector General COVID-19 Reports

Since we began monitoring GSA's response to the COVID-19 pandemic in April 2020, the GSA Office of Inspector General has issued the following reports alerting GSA management to air quality issues:

- ***Management Alert: Inadequate Ventilation in GSA Headquarters Child Care Center (Report Number JE22-001)***. On March 10, 2022, the Office of Inspections alerted GSA management to deficiencies in GSA's compliance with the ASHRAE ventilation standard in the child care center at the GSA Headquarters Building in Washington, D.C. Although GSA took steps to mitigate inadequate ventilation in the child care center, the Office of Inspections reported that GSA would not be able to meet the ASHRAE ventilation standard without replacing the air handler serving the area. The PBS National Capital Region installed a new air handler in May 2022.
- ***COVID-19: PBS Faces Challenges in Its Efforts to Improve Air Filtration in GSA-Controlled Facilities (Report Number A201018/P/4/R22008)***. On September 30, 2022, we reported that PBS cannot install CDC-recommended air filters in some of its buildings because aging HVAC systems cannot handle these filters. In addition, PBS is not consistently: (1) verifying that O&M contractors change air filters or meet preventive maintenance requirements for air handlers in GSA-owned buildings and (2) inspecting GSA-leased space to ensure that air filters meet lease requirements. As a result, PBS is using air filters in some of its buildings that are less efficient at capturing airborne viruses, including the virus that causes COVID-19.

- ***Ventilation Issues Persist in Unrenovated Wings of GSA Headquarters Building (Report Number JE23-001)***. On November 28, 2022, the Office of Inspections reported that outdated and deteriorating ventilation systems and equipment in the non-renovated Wings 0 and 3 at the GSA Headquarters Building significantly impaired indoor air quality in these wings. Despite knowing of these issues, GSA management did not address or communicate the severity of the ventilation systems' deficiencies before or during the COVID-19 pandemic to the occupants of Wings 0 and 3. Mitigation steps taken by GSA to reduce the risk of COVID-19 exposure did not improve or address the larger and more significant ventilation issues in Wings 0 and 3. As a result, GSA cannot achieve adequate ventilation and acceptable indoor air quality for occupants in Wings 0 and 3 in accordance with the ASHRAE ventilation standard.

Results

Ventilation in GSA-owned buildings is subject to industry standards as well as federal guidance. Federal regulations require that GSA-owned buildings meet the ASHRAE ventilation standard. This standard establishes minimum ventilation and testing requirements necessary to minimize adverse health effects for building occupants. GSA is also subject to guidance issued by CDC and OSHA. In response to the COVID-19 pandemic, both agencies issued guidance recommending additional measures to improve building ventilation and minimize exposure to viral particles.

PBS is struggling to meet the ASHRAE ventilation standard and to comply with CDC and OSHA guidance. We found that PBS is not meeting—or does not have complete information to determine if it is meeting—the ASHRAE ventilation standard for the majority of GSA-owned buildings. We also found that PBS has not consistently implemented CDC and OSHA recommendations to improve ventilation in GSA-owned buildings. Taken together, these deficiencies increase the risk that building occupants will be exposed to airborne viruses, including the virus that causes COVID-19.

Finding 1 – PBS is not meeting—or does not have complete information to determine if it is meeting—the ASHRAE ventilation standard in GSA-owned buildings.

In accordance with 41 CFR 102-74.195, PBS is required to ensure that GSA-owned buildings meet the ASHRAE ventilation standard. However, PBS is not meeting—or does not have complete information to determine if it is meeting—the standard in GSA-owned buildings. We found that PBS is not performing required testing to determine whether ventilation systems in GSA-owned buildings meet the standard. In addition, a ventilation study initiated by PBS after the onset of the COVID-19 pandemic and our own testing found that the majority of GSA-owned buildings either do not meet the standard or cannot be assessed due to incomplete data. As a result, occupants in these buildings may be at increased risk of exposure to airborne viruses, including the virus that causes COVID-19.

PBS Is Not Performing Required Testing to Determine Whether Ventilation Systems in GSA-Owned Buildings Meet the ASHRAE Ventilation Standard

The ASHRAE ventilation standard stresses that ventilation systems must allow for a sufficient flow of outdoor air to maintain acceptable indoor air quality. Because of the importance of outdoor airflow, the standard prescribes a 5-year frequency for testing air handlers to verify that they supply sufficient levels of outdoor air. Tested systems that do not meet the standard must be adjusted or balanced accordingly.⁶

⁶ Adjusting refers to changes and alterations to system components so that the heating or cooling unit is operating properly and according to design requirements and indoor comfort demands. Balancing ensures that proportional airflow, heat transfer, and other characteristics are equalized among all terminals, branches, and subsystems.

We found that PBS is not meeting the ASHRAE ventilation standard because it did not conduct required testing of any of the 39 air handlers in our sample. PBS building management specialists, building managers, and O&M contractors (PBS building support personnel) told us that testing is typically completed only at the time of air handler installation or during renovation projects. They added that full buildings do not undergo testing, adjusting, and balancing on a regular basis.

PBS officials cited budget concerns as a barrier to meeting the testing requirement and added that the requirement was not clearly defined in PBS's *National Operations and Maintenance Specification*. However, PBS subject matter experts in both its Office of Facilities Management and Office of Design Construction confirmed the applicability of the testing requirement.

In sum, PBS is not meeting the ASHRAE ventilation standard's requirement to conduct air handler testing every 5 years. PBS does not routinely test, adjust, and balance air handlers in GSA-owned buildings. As a result, PBS does not know whether a sufficient flow of outdoor air is circulating through ventilation systems in these buildings to minimize exposure to airborne viruses.

Air Handlers in GSA-Owned Buildings Either Do Not Meet the ASHRAE Ventilation Standard or Cannot Be Assessed Due to Incomplete Data

The ASHRAE ventilation standard requires that ventilation systems supply minimum levels of outdoor air. However, a PBS ventilation study and our testing found that air handlers in the selected GSA-owned buildings either did not meet minimum outdoor air requirements or could not be assessed due to incomplete data. These results are discussed below.

PBS's National Outdoor Air Verification project. In July 2021, PBS allocated \$29 million in CARES Act funding for the National Outdoor Air Verification (NOVA) project. The purpose of this project was to determine whether air handlers in selected GSA-owned buildings met the ASHRAE ventilation standard's outdoor airflow requirement. The contractors performing the assessments were also responsible for recommending corrective actions for air handlers that did not meet the outdoor airflow requirement. The NOVA project's planned sample consisted of 272 of the 1,477 GSA-owned buildings (18 percent). Collectively, the sampled buildings represented approximately 60 percent of rentable square footage in PBS's portfolio of GSA-owned buildings. PBS structured the NOVA project contract to include a base contract to complete 62 buildings under the project's first phase and a contract option to complete the remaining 210 buildings under the project's second phase. The contract required the air handlers to be tested by certified testing and balancing contractors.

During the first phase of the project, contractors tested 1,808 air handlers in the 62 buildings selected. The contractors recommended corrective actions totaling over \$20 million for 1,262

of the 1,808 air handlers (70 percent). Corrective actions were identified in all 62 buildings.⁷ Many of these recommendations included actions necessary to ensure that the sampled GSA-owned buildings meet the ASHRAE ventilation standard, including the following examples:

- **Elbert P. Tuttle U.S. Court of Appeals Building, Atlanta, Georgia.** The contractor found that the building automation system is not operating properly and lacks minimum outside air control sequence programming. The contractor recommended that a qualified mechanical engineer recommission the air handler to meet the ASHRAE ventilation standard. The contractor estimated that these actions would cost \$4,000.
- **U.S. Department of Veterans Affairs Headquarters Building, Washington, D.C.** The contractor found issues with the building automation system, outside air dampers, and demand-controlled ventilation.⁸ The contractor recommended that a qualified mechanical engineer recommission the air handler to meet the ASHRAE ventilation standard. The contractor estimated that these actions would cost \$3,000.

Additionally, the contractors were unable to determine whether 109 of the 1,808 air handlers tested (6 percent) in 17 of the 62 buildings (27 percent) met the ASHRAE ventilation standard because PBS did not provide square footage and occupancy data. Without this data, the contractors could not determine if corrective actions were required.

Further, in two instances where PBS did provide design, square footage, and occupancy data, we question the accuracy of the data. Occupancy data varies for each tenant agency based on the number of employees assigned to the office space; however, PBS provided duplicate square footage and occupancy figures for the following two PBS Southeast Sunbelt Region buildings:

- **Peachtree Summit Federal Building, Atlanta, Georgia.** PBS staff provided the contractor with the same occupant population (67) and square footage of serviced area (12,918) for 48 air handlers in the building.
- **Sam Nunn Atlanta Federal Center, Atlanta, Georgia.** For one air handler in the building, PBS staff provided the contractor with the same occupant population (67) and square footage of serviced area (12,918) as the 48 air handlers in the Peachtree Summit Federal Building. Additionally, PBS staff provided the same occupant population (129) and square footage of serviced area (19,400) for over 50 air handlers in the building.

This practice is problematic because the use of questionable data provided by PBS may result in invalid recommended corrective actions.

⁷ PBS is currently in the process of addressing NOVA project corrective actions using CARES Act funding.

⁸ As discussed further on page 13 of the report, demand-controlled ventilation uses sensors to monitor space occupancy levels and reduce the rate at which outdoor air is delivered to a zone during periods of limited occupancy.

Finally, PBS did not exercise the contract option to test the remaining 210 buildings.⁹ In April 2022, PBS officials told us that in place of the contract option, they would develop a plan to continue testing and implement corrective actions across the GSA-owned building inventory using available resources.

In May 2022, GSA and the White House Office of Science and Technology Policy agreed to develop a partnership to improve indoor air quality in all federal buildings. As a result, GSA awarded a contract for an independent study to perform analysis and recommend a methodology to improve ventilation performance in federal buildings. This study requires the contractor to review and seek feedback on the corrective action list from the first phase of the NOVA project.¹⁰ Additionally, the contractor must provide support to improve the NOVA project and identify gaps in training building management teams. However, there is no requirement to test air handlers in the remaining 1,415 GSA-owned buildings. Without a strategy to regularly test its inventory of GSA-owned buildings, PBS cannot ensure that ventilation systems meet the ASHRAE ventilation standard's requirement to minimize exposure to airborne viruses.

Audit testing of air handlers. Using data provided by PBS, we compared the actual outdoor airflow levels measured by independent third parties to the ASHRAE ventilation standard's outdoor airflow requirement using two methodologies—breathing zone and design.¹¹ Similar to the NOVA project, we found that most air handlers in GSA-owned buildings did not meet minimum outdoor air requirements or could not be assessed due to incomplete data. The results of our analysis are described below and detailed in **Appendix B**.

Breathing Zone Method. Using the breathing zone method, we found that 28 of the 39 air handlers we tested (72 percent) did not meet the ASHRAE ventilation standard or could not be assessed due to incomplete data. This method calculates the minimum outdoor air required using:

- **Zone floor area** – This input is unique to each building. It is the square footage of the area serviced by an air handler;
- **Zone population** – This input is unique to each occupied zone of each building. It is the number of people that occupy the zone floor area;
- **Outdoor airflow rate required per person** – This input is a defined value in the ASHRAE ventilation standard; and

⁹ The NOVA project's total sample was 272 buildings; the remaining 210 buildings mentioned here reflects a subtraction of the 62 included in the first phase of the NOVA project.

¹⁰ PBS now refers to the NOVA project and subsequent follow-on actions as the Ventilation Verification Program.

¹¹ Federal Occupational Health and the NOVA project contractors measured actual outdoor air coming into the building at each air handler with direct-reading instruments.

- **Outdoor airflow rate required per unit** – This input is a defined value in the ASHRAE ventilation standard.¹²

The results of this calculation are then compared to the actual measurement of outdoor air at the air handler to determine compliance with the ASHRAE ventilation standard.

The results for our sample are discussed below:

- We found that 6 of the 39 air handlers did not meet the minimum outdoor air requirements established under the ASHRAE ventilation standard.
- PBS did not provide the actual outdoor air measurement, zone floor area, or zone population data necessary to determine compliance for 22 of 39 air handlers in our sample. Without complete data, we could not determine if these buildings met the ASHRAE ventilation standard using the breathing zone testing methodology.

Design Method. Using the design method, we found that 33 of the 39 air handlers we tested (85 percent) did not meet the ASHRAE ventilation standard or could not be assessed due to incomplete data. This method compares the designed level of minimum outdoor air required to the actual measurement of outdoor air at the air handler.

The results for our sample are discussed below:

- PBS provided the required data for 13 of the 39 air handlers in our sample. Using the data, we found that 7 of the 13 air handlers did not provide the designed level of minimum outdoor air. For these air handlers, NOVA project contractors reported that noncompliance with the ASHRAE ventilation standard was related to deficient system components or inadequate preventative maintenance.
- For the other 26 air handlers in our sample, PBS did not provide the designed level of minimum outdoor air or the actual outdoor air data that is required to determine compliance. PBS staff told us that record retention has been a systemic issue and design data was not available in most cases. Without complete data, we could not determine if air handlers in these buildings met the ASHRAE ventilation standard using the design testing methodology.

In summary, PBS is not performing the required testing and balancing of its air handlers to ensure that its equipment is providing a sufficient flow of outdoor air. Further, as demonstrated above, air handlers in GSA-owned buildings did not meet minimum outdoor air requirements or could not be assessed due to incomplete data. Taken together, these deficiencies increase the risk that building occupants will be exposed to airborne viruses, including the virus that causes COVID-19.

¹² ASHRAE Standard 62.1, Table 6-1. *Minimum Ventilation Rates in Breathing Zone.*

Finding 2 – PBS has not consistently implemented CDC and OSHA recommendations to improve ventilation in GSA-owned buildings.

COVID-19 guidance issued by CDC and OSHA included recommendations for improved building ventilation. These recommendations were designed to help reduce the concentration of viral particles in building spaces. We found that PBS did not consistently implement CDC and OSHA recommendations to:

- Increase the introduction of outdoor air when conditions allow,
- Turn off demand-controlled ventilation controls to ensure all building spaces remained ventilated during occupied hours, and
- Run ventilation systems for 2 hours before and after occupancy to maintain clean air supply.

These deficiencies are described below and detailed in ***Appendix C***.

PBS Did Not Always Increase the Introduction of Outdoor Air

CDC's *COVID-19: Ventilation in Buildings* recommends increasing the introduction of outdoor air, when conditions allow, to reduce or eliminate air recirculation.¹³ Similarly, OSHA's *Protecting Workers: Guidance on Mitigating and Preventing the Spread of COVID-19 in the Workplace* recommends that building owners maximize the amount of outdoor air supplied.

However, we found that PBS did not take actions to increase outdoor air in 10 of 20 sampled buildings (50 percent). For example, we found the following:

- For 4 of the 10 sampled buildings where actions were not taken to increase outdoor air, PBS building support personnel cited issues with ventilation system capabilities as a concern. For example, at the GSA Regional Office Building in Washington, D.C., the building's O&M contractor told us that outside air could not be increased because most of the building's outside air fans were not operational. The O&M contractor added that most air handlers in the building are over 30 years old and do not have functioning outdoor air systems due to failed equipment and controls.
- For 3 of the 10 sampled buildings where actions were not taken to increase outdoor air, PBS building support personnel cited weather conditions as a concern. For example, at the Robert N. C. Nix, Sr. Federal Building in Philadelphia, Pennsylvania, the building's O&M contractor told us that ventilation system adjustments to increase outdoor air during the winter months were not made due to cold temperatures.

¹³ CDC's guidance specifies that pollution and weather conditions should be considered prior to implementing this recommendation.

CDC's guidance specifies that weather conditions should be considered before taking actions to increase outdoor air; however, we found that PBS's guidance lacks the necessary detail for its staff to make informed decisions. For example, in November 2020, PBS issued a winter supplement to GSA's *Guidance for COVID-19 HVAC Operations*. The winter supplement detailed GSA's strategy for increasing outdoor air during the heating season; however, it did not provide similar instruction for other seasons. Instead of addressing this deficiency, PBS removed the heating season strategy altogether in a December 28, 2022, revision to its *Guidance for COVID-19 HVAC Operations*.

PBS Did Not Always Turn Off Demand-Controlled Ventilation Controls to Ensure All Building Spaces Remained Ventilated During Occupied Hours

Demand-controlled ventilation (DCV) is a ventilation system capability that uses sensors to monitor space occupancy levels and automatically reduce the rate at which outdoor air is delivered to a zone during periods of limited occupancy. CDC's *COVID-19: Ventilation in Buildings* recommends turning off DCV controls that reduce air supply based on occupancy or temperature during occupied hours.

However, we found that PBS building support personnel did not disable DCV controls in 7 of 13 applicable buildings in our sample (54 percent).¹⁴ In discussing the DCV controls, PBS building support personnel at two sampled buildings told us DCV could not be disabled because of energy savings performance contract requirements. Energy savings performance contracts often include DCV controls as an energy conservation measure—turning them off would reduce the related energy savings.¹⁵ For example, PBS building support personnel at the U.S. Department of Veterans Affairs Headquarters Building in Washington, D.C., told us that DCV system control settings could not be adjusted based on the building's energy savings performance contract.

PBS Did Not Always Run Ventilation Systems 2 Hours Before and After Occupancy to Maintain Clean Air Supply

CDC's *COVID-19: Ventilation in Buildings* recommends running ventilation systems for 2 hours before and after occupancy. The intent of this recommendation is to ensure air is flushed throughout the building before occupant arrival and to ensure indoor air is sufficiently circulated at the end of the day.

¹⁴ The CDC's recommendation to turn off DCV controls was not applicable to 7 of the 20 buildings in our sample.

¹⁵ Energy savings performance contracts are partnerships between federal agencies and energy service companies. These contracts allow federal agencies to implement cost-saving facility energy improvements with minimal upfront capital costs, using projected energy savings to pay for the improvements.

We found that PBS did not run ventilation systems 2 hours before and after occupancy in 6 of 19 applicable buildings in our sample (32 percent).¹⁶ PBS building support personnel often referred to energy savings goals as a hurdle to implementing CDC recommendations. For example, PBS building support personnel at two buildings in Philadelphia stated that the regional energy subject matter expert told them that running the ventilation system after occupancy was not worth the extra energy in the afternoon.

Since the completion of our testing, PBS issued a revision to its *Guidance for COVID-19 HVAC Operations*, which will further impair compliance with CDC recommendations. On December 28, 2022, PBS revised this guidance by providing that ventilation systems will only be run 2 hours before and after occupancy when the COVID-19 community level is high in the county where the GSA-owned building is located. However, PBS's revised guidance is inconsistent with CDC guidance, which recommends running ventilation systems 2 hours before and after occupancy regardless of community transmission levels.

As discussed above, PBS has not consistently implemented CDC and OSHA recommendations to improve ventilation in GSA-owned buildings. PBS faces challenges with implementation due to deficiencies in existing ventilation systems, limited instructional guidance, contractual requirements, and increased energy costs and consumption associated with implementation. PBS should take steps to address existing system deficiencies and, where possible, identify alternate methods to implement CDC and OSHA COVID-19 ventilation recommendations. Additionally, GSA's *Guidance for COVID-19 HVAC Operations* should be updated to ensure adherence with CDC recommendations.

¹⁶ CDC's recommendation to run the ventilation systems for 2 hours before and after occupancy was not applicable to 1 of the 20 sampled buildings because it was occupied 24 hours per day.

Conclusion

Ventilation in GSA-owned buildings is subject to industry standards as well as federal guidance. Federal regulations require that GSA-owned buildings meet the ASHRAE ventilation standard. This standard establishes minimum ventilation and testing requirements necessary to minimize adverse health effects for building occupants. GSA is also subject to guidance issued by CDC and OSHA. In response to the COVID-19 pandemic, both agencies issued guidance recommending additional measures to improve building ventilation and minimize exposure to viral particles.

PBS is struggling to meet the ASHRAE ventilation standard and to comply with CDC and OSHA guidance. We found that PBS is not meeting—or does not have complete information to determine if it is meeting—the ASHRAE ventilation standard for the majority of GSA-owned buildings. We also found that PBS has not consistently implemented CDC and OSHA recommendations to improve ventilation in GSA-owned buildings.

Taken together, these deficiencies increase the risk that building occupants will be exposed to airborne viruses, including the virus that causes COVID-19. Accordingly, PBS should develop a plan to assess whether air handlers in GSA-owned buildings meet the ASHRAE ventilation standard and take appropriate corrective action where problems are identified. PBS should also ensure that building occupants are notified of problems with air quality in GSA-owned buildings. Additionally, PBS should ensure that staff understand their responsibilities related to the ASHRAE ventilation standard and O&M contracts and define requirements necessary to ensure compliance with the standard. Lastly, PBS should update its guidance to ensure adherence with CDC recommendations.

Recommendations

We recommend that the PBS Commissioner:

1. Complete a comprehensive assessment to determine whether GSA-owned building air handlers meet the ASHRAE ventilation standard's minimum outdoor air requirements and develop a comprehensive plan to address deficiencies identified.
2. Create and implement a plan to notify building occupants whenever deficiencies and hazards associated with outdoor air requirements are identified.
3. Ensure that all PBS staff with ventilation system responsibilities, including CORs, contracting officers, project managers, and building managers, are trained on the requirements of the ASHRAE ventilation standard.
4. Ensure O&M contracts define requirements for regular testing, adjusting, and balancing of air handlers.

5. Ensure that GSA's *Guidance for COVID-19 HVAC Operations* adheres to CDC COVID-19 guidance for improved building ventilation.

GSA Comments

The PBS Commissioner agreed with our recommendations. GSA's written comments are included in their entirety in **Appendix D**.

Audit Team

This audit was managed out of the Southeast Sunbelt Region Audit Office and conducted by the individuals listed below:

Nicholas V. Painter	Regional Inspector General for Auditing
Arthur Edgar	Audit Manager
Alenda Blackwell	Auditor-In-Charge
Lucas Mann	Management Analyst

Appendix A – Objectives, Scope, and Methodology

Objectives

In April 2020, we began monitoring GSA’s activities in response to the nationwide public health emergency resulting from COVID-19 and GSA’s implementation of the CARES Act. During our monitoring efforts, we became aware of concerns with ventilation system capabilities in GSA-owned buildings. As a result, we initiated this audit to determine whether PBS has: (1) adhered to federally adopted industry standards for acceptable indoor air quality and (2) implemented CDC and OSHA guidance to mitigate and prevent the spread of COVID-19 in GSA-owned buildings.

Scope and Methodology

We assessed PBS’s compliance with ASHRAE Standard 62.1 (ASHRAE ventilation standard) and its implementation of CDC and OSHA COVID-19 guidance. Specifically, we selected a judgmental sample of 20 GSA-owned buildings from four metropolitan areas—Philadelphia, Pennsylvania; Atlanta, Georgia; Washington, D.C.; and Chicago, Illinois.¹⁷ We also randomly selected 39 air handlers, 2 from each building, except for one building that only had 1 air handler.

Using data provided by PBS, we compared the actual outdoor air supplied by each air handler to the minimum outdoor air required using two methodologies prescribed in ASHRAE Standard 62.1—breathing zone and design. We also interviewed PBS building support personnel to determine actions taken to implement CDC and OSHA COVID-19 guidance in each building.

To accomplish our objectives, we:

- Reviewed 41 CFR 102-74.195, *What ventilation policy must Federal agencies follow?* and ASHRAE Standard 62.1, *Ventilation for Acceptable Indoor Air Quality*;
- Reviewed ASHRAE, CDC, OSHA, and PBS guidance related to indoor air quality, ventilation standards, and COVID-19;
- Conducted site visits at 20 GSA-owned buildings to interview PBS building support personnel and tour mechanical rooms;
- Interviewed CDC and PBS subject matter experts;
- Reviewed PBS’s *National Operations and Maintenance Specification, Public Buildings Maintenance Standards*, and O&M contracts; and
- Reviewed air handler design records, air quality test reports, and building reports from PBS’s NOVA project.

¹⁷ One of the 20 buildings in our sample is currently leased by GSA. However, GSA retains all O&M responsibilities for this location. Further, GSA will take ownership of the building on October 21, 2023.

Data Reliability

We assessed the reliability of outdoor air measurement data provided by PBS. We question the accuracy of some data PBS provided to independent third parties responsible for determining compliance with ASHRAE Standard 62.1. As mentioned in the body of the report, we found that PBS provided one contractor with duplicated square footage and occupancy figures for two buildings in our sample. Additionally, PBS did not always provide design, square footage, and occupancy data required to determine compliance with ASHRAE Standard 62.1. We relied on the technical competence of the independent third parties for outdoor air actual measurements. We also reviewed air handler design documents, when available, to determine the required minimum outdoor air for each air handler. Except as noted in the report, data were sufficiently reliable for the purposes of this audit.

Sampling

We derived our judgmental sample from GSA's inventory of owned and leased properties, as of December 17, 2021, maintained on the data.gov website. Our nationwide sample included 20 of GSA's 1,477 owned buildings from four metropolitan areas—Philadelphia, Pennsylvania; Atlanta, Georgia; Washington, D.C.; and Chicago, Illinois.

We considered the following when selecting the sample buildings:

- Cities with dense populations of GSA-owned buildings,
- Proximity to and between building locations to limit travel, and
- Building age and size.

We also randomly selected 39 air handlers, 2 from each building, except for one building that only had 1 air handler.

Internal Controls

We assessed internal controls significant within the context of our audit objectives against GAO-14-704G, *Standards for Internal Control in the Federal Government*. The methodology above describes the scope of our assessment and the report findings include any internal control deficiencies we identified. Our assessment is not intended to provide assurance on GSA's internal control structure as a whole. GSA management is responsible for establishing and maintaining internal controls.

Compliance Statement

We conducted the audit between November 2021 and November 2022 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for

our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Appendix B – Compliance with ASHRAE Standard 62.1 Minimum Outdoor Air Requirements

GSA-Owned Building	Location #	Unit #	Breathing Zone		Design	
			Below Standard	Unknown Condition	Below Standard	Unknown Condition
Note 1		Note 2	Note 3	Note 4	Note 5	Note 6
U.S. Department of Veterans Affairs Headquarters Building	DC0007ZZ	1		X	X	
		49		X	X	
William Jefferson Clinton Federal Building	DC0028ZZ	5A		X		
		2B		X		X
GSA Regional Office Building	DC0031ZZ	1-14		X		X
		3-6		X		X
Wilbur J. Cohen Federal Building	DC0034ZZ	32		X		X
		54		X		X
Robert N. C. Nix, Sr. Federal Building	PA0143ZZ	3SE	X			X
		2CH1				
U.S. Custom House	PA0144ZZ	I-2				X
		E-1				X
William J. Green Jr. Federal Building	PA0277BG	84		X		X
		103		X		X
James A. Byrne U.S. Courthouse	PA0278BG	15		X		X
		32		X		X
Martin Luther King, Jr. Federal Building	GA0007ZZ	1-1				
		1-2				
Elbert P. Tuttle U.S. Court of Appeals Building	GA0008ZZ	1-1		X		X
		5-1	X		X	
Internal Revenue Service Annex	GA0010AE	1-1		X		X
		2-1		X		X
John C. Godbold Federal Building	GA0030ZZ	4		X		X
		7		X		X
Peachtree Summit Federal Building	GA0087AD	24S	X			X
		18S	X			X
Richard B. Russell Federal Building and U.S. Courthouse	GA0121ZZ	13	X			X
		11				X
Sam Nunn Atlanta Federal Center	GA1007ZZ	LR-1			X	
		LR-2	X		X	

GSA-Owned Building	Location #	Unit #	Breathing Zone		Design	
			Below Standard	Unknown Condition	Below Standard	Unknown Condition
Note 1		Note 2	Note 3	Note 4	Note 5	Note 6
U.S. Custom House	IL0032ZZ	3				X
		5				X
Federal Building – 536 S. Clark St.	IL0054ZZ	10-1			X	
		5-3				
Everett M. Dirksen U.S. Courthouse	IL0205ZZ	S-48		X		X
		S-49		X		X
John C. Kluczynski Federal Building	IL0236FC	12		X	X	
		26		X		
Federal Building – 11 W. Quincy Court	IL2125ZZ	1		X		X

Notes:

1. This column presents our nationwide sample of 20 buildings.
2. This column presents the 39 air handlers sampled in the 20 buildings.
3. This column indicates the six air handlers where the actual outdoor air measured was below the minimum outdoor air required by ASHRAE Standard 62.1 using the breathing zone calculation.
4. This column indicates the 22 air handlers where PBS did not provide the actual outdoor air measurement, zone floor area, or zone population data necessary to complete the breathing zone calculation and determine compliance with ASHRAE Standard 62.1.
5. This column indicates the seven air handlers where the actual outdoor air measured was below the minimum outdoor air required by the air handler design.
6. This column indicates the 26 air handlers where PBS did not provide the actual outdoor air measurement or design data necessary to determine compliance with ASHRAE Standard 62.1.

Appendix C – Implementation of CDC and OSHA COVID-19 Guidance

GSA-Owned Building	Location #	Outdoor Air Not Increased Beyond Minimum Requirements	DCV Controls Not Disabled	Air Handlers Not Run 2 Hours Before and After Occupancy
Note 1		Note 2	Note 3	Note 4
U.S. Department of Veterans Affairs Headquarters Building	DC0007ZZ		X	
William Jefferson Clinton Federal Building	DC0028ZZ		X	X
GSA Regional Office Building	DC0031ZZ	X		X
Wilbur J. Cohen Federal Building	DC0034ZZ		X	
Robert N. C. Nix, Sr. Federal Building	PA0143ZZ	X	X	X
U.S. Custom House	PA0144ZZ	X		X
William J. Green Jr. Federal Building	PA0277BG			X
James A. Byrne U.S. Courthouse	PA0278BG			X
Martin Luther King, Jr. Federal Building	GA0007ZZ	X		
Elbert P. Tuttle U.S. Court of Appeals Building	GA0008ZZ	X		
Internal Revenue Service Annex	GA0010AE	X		
John C. Godbold Federal Building	GA0030ZZ	X		
Peachtree Summit Federal Building	GA0087AD	X		
Richard B. Russell Federal Building and U.S. Courthouse	GA0121ZZ	X		
Sam Nunn Atlanta Federal Center	GA1007ZZ	X		
U.S. Custom House	IL0032ZZ		X	
Federal Building – 536 S. Clark St.	IL0054ZZ		X	
Everett M. Dirksen U.S. Courthouse	IL0205ZZ		X	
John C. Kluczynski Federal Building	IL0236FC			
Federal Building – 11 W. Quincy Court	IL2125ZZ			

Notes:

1. This column presents our nationwide sample of 20 buildings.
2. This column indicates the 10 buildings where PBS did not implement CDC and OSHA recommendations to increase outdoor air beyond minimum requirements.
3. This column indicates the seven buildings where PBS did not implement CDC’s recommendation to disable DCV controls.
4. This column indicates the six buildings where PBS did not implement CDC’s recommendation to run air handlers 2 hours before and after building occupancy.

Appendix D – GSA Comments


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Public Buildings Service

April 27, 2023

MEMORANDUM FOR: NICHOLAS V. PAINTER
REGIONAL INSPECTOR GENERAL FOR AUDITING
SOUTHEAST SUNBELT REGION AUDIT OFFICE (JA-4)
OFFICE OF INSPECTOR GENERAL

FROM: NINA M. ALBERT 
COMMISSIONER (P)
PUBLIC BUILDINGS SERVICE

SUBJECT: Response to the GSA Office of Inspector General's Draft
Report, *Audit of GSA's Response to COVID-19: PBS Faces
Challenges to Meet the Ventilation and Acceptable Indoor
Air Quality Standard in GSA-Owned Buildings (Report
A201018-6)*

Thank you for the opportunity to comment on the subject draft report. The Public Buildings Service (PBS) appreciates the U.S. General Services Administration (GSA) Office of Inspector General (OIG) sharing the draft version of the report and providing an opportunity for feedback. PBS considers indoor air quality to be vitally important for our occupant agencies, especially during this COVID-19 pandemic. PBS has reviewed the draft audit report and agrees with the recommendations. The following information is provided in response.

Responses to OIG Recommendations

1. **Complete a comprehensive assessment to determine whether GSA-owned building air handlers meet the ASHRAE ventilation standard's minimum outdoor air requirements and develop a comprehensive plan to address deficiencies identified.**

PBS agrees with this recommendation. The requirement in 41 C.F.R. § 102-74.195 is to provide the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Standard 62.1 levels of ventilation during working hours in periods of heating and cooling where physically practical, and where not physically practical, to provide the maximum allowable amount of ventilation during periods of heating and cooling and pursue opportunities to increase non-compliant ventilation levels up to the current standards. The

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Centers for Disease Control and Prevention (CDC) and the U.S. Environmental Protection Agency guidelines recommend, rather than require, actions to increase ventilation as part of a layered approach to reduce the spread of disease and lower the risk of exposure to the virus that causes COVID-19. PBS will develop an assessment plan using a consistent, multi-year maintenance effort and a forward-looking policy to verify results of actions to maintain proper ventilation. PBS notes that a complete assessment of its inventory and development of a comprehensive plan to address deficiencies, as OIG recommends, may require additional PBS resources and take a significant number of years. This ventilation assessment must be performed in coordination with a filtration assessment because any alteration in filtration affects the building air handlers total air flows, including ventilation air. PBS will determine how best to prioritize the assessments in terms of sampling and scheduling.

- 2. Create and implement a plan to notify building occupants whenever deficiencies and hazards associated with outdoor air requirements are identified.**

PBS agrees with this recommendation. [Risk Management Notification \(PBS 2400.1, January 8, 2021\)](#) establishes requirements for timely notification to affected building occupants, relevant GSA offices and personnel, and applicable regulatory agencies of all environmental, health, safety, and fire protection (EHSF) risks.

PBS will review the scope of the above-referenced GSA order as it relates to compliance with ASHRAE Standard 62.1 for levels of ventilation, and, if necessary, will revise the order to define the conditions under which non-compliance with ASHRAE 62.1 qualifies as an EHSF risk. PBS will implement occupant notifications in accordance with the order.

- 3. Ensure that all PBS staff with ventilation system responsibilities, including contracting officer's representatives, contracting officers, project managers, and building managers, are trained on the requirements of the ASHRAE ventilation standard.**

PBS agrees with this recommendation. PBS is currently developing a curriculum designed for facility managers, Contracting Officer's Representatives, Contracting Officers, project managers, and others to understand air handling systems, their required maintenance and means of assessing the sufficiency of operation and maintenance of these systems.

- 4. Ensure operations and maintenance contracts define requirements for regular testing, adjusting, and balancing of air handlers.**

PBS agrees with this recommendation. PBS will develop a plan to address ASHRAE Standard 62.1 in the [National Performance Work Statement](#) for

operation and maintenance contracts and the requirements for periodic air handler testing and adjusting.

5. Ensure that GSA's *Guidance for COVID-19 HVAC Operations* adheres to CDC COVID-19 guidance for improved building ventilation.

PBS agrees with this recommendation. Since its creation in January 2021, GSA has consistently followed the guidance issued by the Safer Federal Workforce Task Force (SFWTF) and CDC. Any change to GSA's guidance has been coordinated with SFWTF. GSA heating, ventilation and air conditioning (HVAC) COVID-19 guidance, which was developed in accordance with SFWTF and CDC guidance, recommends actions, to the extent they are possible, to achieve standards to improve air ventilation with existing HVAC equipment. Although GSA agrees with this recommendation, in some of the cases reviewed by OIG, the potential to modify existing HVAC equipment operations relative to the guidance is limited due to the original design of the HVAC equipment.

Thank you again for the opportunity to review and comment on the draft report. If you have any questions, please contact Patrick Fee, Director of Facilities Operations, Office of Facilities Management, at (202) 501-0038.

Attachment:

[A201018-6 Draft Report 04-06-2023](#)

Appendix E – Report Distribution

GSA Administrator (A)

GSA Deputy Administrator (AD)

PBS Commissioner (P)

PBS Deputy Commissioner (PD)

Chief of Staff (PB)

Deputy Chief of Staff (PB)

Assistant Commissioner for Strategy & Engagement (PS)

Acting Assistant Commissioner, Office of Facilities Management (PM)

Director, Facility Technology & Innovation Division (PMB)

Director, Facilities Operations Division (PME)

Director, Facilities Risk Management Division (PMG)

Chief Financial Officer (B)

Deputy Chief Financial Officer (B)

Office of Audit Management and Accountability (BA)

Assistant Inspector General for Auditing (JA)

Deputy Assistant Inspector General for Acquisition Program Audits (JA)

Deputy Assistant Inspector General for Real Property Audits (JA)

Director, Audit Planning, Policy, and Operations Staff (JAO)