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inside out—since 1968

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VIA EMAIL: lindsey.june@nyserda.ny.gov

August 26, 2020

Ms. Lindsey June
NYSERDA
Senior Project Manager
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RE: Energy Efficient Indoor Air Quality (IAQ) Analysis
Preliminary Findings Report – August Update

Dear Lindsey:

Per our contract with NYSERDA, Goldman Copeland has partnered with three real estate trusts within the New York City Class A commercial office building market to review solutions to effectively improve indoor air quality while minimizing the impact on energy consumption within the building. During the initial stage of this project, Goldman Copeland has reviewed project scope with clients, conducted initial site visits, gathered utility data, continued ongoing research, and begun preparation of a standardized draft report for the buildings. Specific progress updates for the individual buildings are delineated below.

Large Midtown Manhattan Commercial Office Building #1

Large Midtown Manhattan Commercial Office Building #1 was constructed in 1987. The building is typically fully occupied. The building has approximately 1,500 occupants during normal business hours of 8am to 6pm Monday through Friday. However, during the Covid-19 pandemic the building saw a reduced occupancy of about 5% (the building never closed). The current occupancy remains at about 5%. Each floor has one air handling unit that supplies ventilation to the space.

The building is unique amongst those included in this project as outdoor air distribution to the tenant spaces is deeply limited by the existing dedicated outdoor air system (DOAS). Because of this, a number of building specific measures are in development to control and monitor outdoor air flow. Implementation of these measures should benefit the building beyond just providing solutions for the current Covid pandemic.

This building is being used to develop the template study, which has been made available to NYSERDA for review. Portions of the study are included in the initial draft to date, with other portions still under review by specific team members.

- Utility Analysis
 - Utility data has been collected and tabulated
 - Detailed analysis is underway

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- Site Information Analysis
 - Building information collected including
 - Base building equipment and controls
 - Ventilation system description and current operation
 - AHU equipment information including coil size, capacity, and air flow
 - Basic tenant information
- Site Visits
 - Detailed site visit conducted reviewing general building information
 - Follow up site visit planned to review tenant spaces to determine optimal location for local IAQ equipment
 - Follow up site visit will review additional questions on building exhaust that arose during initial walk-through
- Energy Analysis and Calculations
 - Energy analysis to follow further research and development
- Rough Draft
 - Draft report in development
 - Measures identified, and writing tasks distributed
 - Portion of measures have been completed and added to draft report
- Final Draft
 - Not yet begun

Large Midtown Manhattan Commercial Office Building #2

Large Midtown Manhattan Commercial Office Building #2 is a 46 story (46 floors at or above grade and 3 floors below) commercial office building in the Midtown neighborhood of Manhattan. The building was constructed in 1970. The building is typically fully occupied. The building has approximately 2,600 occupants during normal business hours of 8am to 8pm Monday through Friday. However, during the Covid-19 pandemic the building saw a reduced occupancy of about 5% (the building never closed). The current occupancy remains at about 5%. A total of four (4) interior air handling units and two (2) perimeter air handling units supply ventilation to the building. Additional units serve the lobby and first floor retail and restaurant tenants.

As part of this study, Goldman Copeland is reviewing actual current air distribution to the floors, as buildings of this vintage typically provide far more than current outdoor air requirements. For this reason, even without increasing outside air, the building could be achieving many of the benefits of added air distribution.

- Utility Analysis
 - Utility data has been collected and tabulated
 - Detailed analysis is underway
- Site Information Analysis
 - Building information collected including
 - Base building equipment and controls
 - Ventilation system description and current operation
 - AHU equipment information including coil size, capacity, and air flow
 - Basic tenant information
- Site Visits

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- Detailed site visit conducted reviewing general building information
- Follow up site visit planned to review tenant spaces to determine optimal location for local IAQ equipment, in parallel to review of existing design drawings, as Goldman Copeland has been involved in the bulk of tenant fit-outs to date.
- Energy Analysis and Calculations
 - Energy analysis to follow further research and development
- Rough Draft
 - Draft report in development
 - Measures identified, and writing tasks distributed
 - Portion of measures have been completed and added to draft report
- Final Draft
 - Not yet begun

Large Midtown Manhattan Commercial Office Building #3

Large Midtown Manhattan Commercial Office Building #3 is a 26 story commercial office building with retail tenants on the ground floor. The building is located in the Midtown neighborhood of Manhattan. The building was constructed in 1954. The building is typically fully occupied. The building has approximately 2,000 occupants during normal business hours of 8am to 6pm Monday through Friday. However, during the Covid-19 pandemic the building saw a reduced occupancy of about 5% (the building never closed). The current occupancy remains at about 5%. Each floor has at least one air handling unit serving the interior space. The building has separate perimeter air handling units that supply ventilation to north, south, east, and west zones. The building is controlled by a New York Temperature Control Building Management System.

Further review of the base building air distribution system is necessary to better understand potential for integration with the various options, as the system is hybrid. Main air handling units distribute air to a portion of the building's floors, while other floors have dedicated AHUs. Solutions will likely vary depending on the air distribution system.

- Utility Analysis
 - Utility data has been collected and tabulated
 - Detailed analysis is underway
- Site Information Analysis
 - Building information collected including
 - Base building equipment and controls
 - Ventilation system description and current operation
 - AHU equipment information including coil size, capacity, and air flow
 - Basic tenant information
- Site Visits
 - Detailed site visit conducted reviewing general building information
 - Follow up site visit planned to further review current air distribution system, accounting for variance between the floors.
- Energy Analysis and Calculations
 - Energy analysis to follow further research and development
- Rough Draft
 - Draft report in development
 - Measures identified, and writing tasks distributed

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- Portion of measures have been completed and added to draft report
- Final Draft
 - Not yet begun

Measures under review

- Upper Room UVGI
 - Three technologies for this option are under review
 - More detailed assessment will be available at next update
- UVGI at coils in AHUs
 - Solution was in place on two floors at a Large Midtown Manhattan Commercial Office Building #1
 - Most studies suggest limited efficacy because of lack of transmission through AHU systems
- Increased outside air rates
 - Highly costly alternative from energy perspective
 - Measure discussions options to provide some limited OA increase rather than 100% OA or 24/7 OA
- Improved filtration at AHUs
 - Although transmission through AHU systems appears to be limited, this option is low cost both from an energy and a maintenance perspective, and provides other benefits
- Improved controls, including IAQ monitoring, and adjustment of DCV set-points
 - Detailed analysis of alternatives underway
 - Measure is recommended for restoring occupant confidence, and providing a pathway to future energy savings
- Increased tenant visibility of ongoing IAQ
 - Detailed analysis of alternatives underway
 - Measure is recommended for restoring occupant confidence, and providing a pathway to future energy savings
- Local filtration options within tenant space
 - Local HEPA filters in common spaces and bathrooms
 - Appears that this measure would be presented as information to tenants, with action to be implemented by them if interested
- Retro-commission HVAC systems, with a focus on air-side testing and balancing
 - Low cost measure with significant ancillary benefits
 - Applicable at Large Midtown Manhattan Commercial Office Building #1 to determine current OA levels to better inform decision making
 - Applicable at Large Midtown Manhattan Commercial Office Building #2 to assess level of action already taken
- Confirm air flow through toilet exhaust system (possibly operate 24/7)
 - Large Midtown Manhattan Commercial Office Building #1 has limited efficacy at current toilet exhaust system, suggesting significant benefit

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- Add humidification, with set-points varied based on OA temperature
 - Further review required before comment on this option – very costly from both an implementation and an energy intensity perspective

Resource and guidance documents

The following documents have been used in support of the preparation of these studies to date. Note that a proper bibliography has been prepared with additional resources listed. The bibliography is included in this PDF as a Appendix.

- Steven Taylor – Covid transmission white paper
- ASHRAE white paper
- July ASHRAE – Infectious airborne transmission article
- Mosto Tech – humidification white paper
- Steril Aire – equipment information and specifications

Lessons Learned

A detailed analysis of air changes per hour (ACH) was conducted for Building #2, which demonstrated that design ACH for the building was approximately 2. With current operating protocols, this level was reduced to 1.5 ACH. Design standards for commercial office buildings are for higher ACH. But, this reflects specific fully occupied spaces rather than the building as a whole. These lower levels can be anticipated to be standard throughout, and should be considered in the OA related measures reviewed in the project.

Additional research regarding bi-polar ionization options continues to be pushed on clients, who are expressing increased interest in the technology. While it remains outside of the scope of work of the NYSERDA study, we will continue to keep an eye on the technologies, and will present information on it to our clients with the clear caveat that it is not within the general project scope.

Proposed Work Plan Adjustments

Based on current progress, and delays corresponding to coordinating NYSERDA protocols with building staff, the schedule for development of these projects will need to be extended. While additional review of technologies has been completed, the path to development of the full reports will likely be on a longer than originally intended timeline. We anticipate further review of technologies, particularly those related to Upper Room UVGI to extend further out, as we have not been satisfied with the data we have obtained to this point. We anticipate the following schedule moving forward:

- Additional research – 3-4 weeks (complete 9/23)
- Adjust draft report and associated calculations accordingly – 3-4 weeks (complete 10/21)
- Review with clients and finalize – 2-3 weeks (complete 11/11)

Next Steps

As expressed above, progress over the month of August was somewhat delayed, and the technology review process will be further extended. We have installed a prototype IAQ analysis monitoring system

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in our office space (installation was not within scope of this project). We will use this to monitor air conditions, and to add further detail into potential uses of this system both for energy optimization, and for improved air quality. We will schedule continued meetings with product vendors to better our understanding of all technologies.

Based on the above, the template report will be further flushed out. Goldman Copeland's initial white paper, dated from April of this year, will be updated to the current state of the art and incorporated into the introduction to the report. Initial detail on specific technologies, in particular upper room UVGI will be reviewed and incorporated. Further study will be completed on site to review specific requirements for installation of various measures. It is anticipated that this further review will require 3-4 weeks.

Based on this review, Goldman Copeland will develop basic scopes of work required for implementation of each measure, which will in turn provide the basis for estimating implementation costs. Simultaneous to this work, we will begin developing energy calculations to assess the energy impact of each of the measures.

Sincerely,

Tristan Schwartzman

Appendix A: UCGI Study References

Statement of Condition & Plan for Improvement, Sacramento Hospital, Sacramento, CA 95823, AHU-2 & AHU-3. Steril-Aire, 2015.

Proof Source Test (Statement of Conditions), Microbial Analysis and Airflow Uniformity Report. Steril-Aire, June 2013.

An Energy Saving, Indoor Air Quality & Sustainability Initiative, EFP Headquarters, Edmund Barton Building. Steril-Aire, October 2017.

An Energy Saving, Indoor Air Quality & Sustainability Initiative, Woolworth Paradise Centre. Steril-Aire, June 2017.

An Energy Saving, Indoor Air Quality & Sustainability Initiative, Brisbane Entertainment Centre. Steril-Aire, 2016.

An Energy Saving, Indoor Air Quality & Sustainability Initiative, Redacted Report. Steril-Aire, March 2016.

Ultraviolet C (UVC) Light System Installation. TBL Building Sciences.

Understanding the Touchless World. TBL Building Sciences.

Data-Driven Communication for a Healthier World. TBL Building Sciences.

ASHRAE Position Document on Infectious Aerosols. ASHRAE, April 2020.

P.E. David, HUMIDIFICATION helps to protect your respiratory system and HUMIDIFICATION fights against bioaerosol infectivity. Armstrong International.

Noti, J.D. et. al, Steam Humidification Plays an Essential Role in Minimizing the Transmission of the Corona virus. Mosto Technologies.

Healthway Indoor Air Quality Solutions. Gil-Bar Industries.

Example Project Statement. Healthway.

Healthy indoor air, For the public good. Healthway.

Healthway Intellipure Portable Air Purifiers, Brochure. Healthway, 2020.