Energy Efficient Indoor Air Quality Analysis
Preliminary Findings Report – Month 1

520 MADISON AVENUE, NEW YORK, NY 10022

Work Plan Number: *WP-VID02*
Date: 7/24/2020

Customer and/or Site Name: *520 Madison Avenue, Tishman Speyer*

Building Square Footage:
1,000,000 square feet

Building Description:

520 Madison Avenue, New York City, is a 43-story high-rise office building located on Madison Avenue between 53rd and 54th Streets in the Plaza District of Midtown Manhattan. The property was built in 1982 with a total rentable area of approximately 1,000,000 sq. ft. intended for both corporate and retail purposes. The lower levels include two restaurants and other retail tenants.

FACILITY DESCRIPTION

1st Floor Lower Level houses the refrigerant plant, incoming high-pressure steam service, steam pressure reducing stations and heating equipment for the lower level to 13th floor. The refrigerant plant consists of three (3) centrifugal chillers, condenser water pumps and chilled water pumps. Con Edison delivers high pressure steam to a pressure reducing station at 125 PSI. There are two rigs of pressure reducing valves, one rated for 2/3 of the load and one for 1/3 of the load operating in parallel. The pressure reducing station delivers low pressure steam at 15 PSI to the building systems. The heating system for the lower building zone consists of a steam to hot water heat exchanger, circulating pumps, perimeter radiators, and hot water piping distribution.

The tenant floors are occupied by office space. The air conditioning system consists of a medium and low-pressure air distribution system, variable air volume boxes and ceiling diffusers. The conditioned air is delivered to the floor area using a medium pressure ductwork distribution system via duct risers running through the main building shafts. Variable volume boxes control the amount of conditioned air delivered to each zone. Ductwork distribution downstream of the variable air volume boxes is low pressure type. The conditioned air is returned from the office space to the main return air shafts via a ceiling return air plenum. The office spaces are typically heated by perimeter radiators fed from the main hot water supply and return risers.

The building has remained open during the COVID-19 pandemic, but the tenant occupancy load is approximately 5%.

- **Study findings to date**
  1. <u>Resources and guidance documents used to formulate study approach</u>
     a. Vidaris requested drawings and documents (plans, elevations, HVAC information) for developing the baseline energy model which will be used to study the impact of various IAQ EEMs. The client is in the process of compiling these.
     b. Kickoff meeting on 7/15/2020 identified opportunities and issues with various strategies for addressing Covid-19 in the building. Client (Tishman Speyer) shared a document they have prepared for addressing Covid-19 in the building - “520 Madision Client Covid IAQ Supplement 07142020.pdf” - and suggested that this be used in guiding the selection of IAQ EEMs to be studied. Specific interest is to include bipolar ionization in addition to UVC
     c. Vidaris requested and received utility bill data for the 12 months of year 2019.

2. Building-specific opportunities relative to the study focus areas
    a. In-duct UVGI.
    b. Bi-Polar Ionization and Dry Hydrogen Peroxide in AHUs – we have requested permission from NYSERDA. New testing results exist for bi-polar ionization, indicating effectiveness against viruses.
    c. Portable UVGI devices in large meeting rooms.
    d. Reduce infiltration by better air sealing at doors so untreated air doesn't go to other spaces.
    e. IAQ sensors to monitor particulates in addition to CO2
    f. Air flushing before and after occupancy.
    g. Heat recovery for OA.
    h. Static pressure monitoring to make sure filters are replaced at the right time.
    i. Rotation of filters.
    j. Oversize fan motors for better part-load operation.
3. Findings to date of the building-specific opportunities
    a. Access to ducts is an issue for UVGI. OA for entire building is brought in at one location and one common chamber on 14th floor for return air. Each AHU has very little straight run and there is not much room for external devices. Access to lobby AHU is via tenant space and is difficult. This requires further study.
    b. Client believes other disinfecting technologies like Bi-Polar Ionization and Dry Hydrogen Peroxide could prove practical is addition to UVGI.
    c. Client is open to using portable UVGI devices to disinfect large meeting rooms before and after occupancy.
    d. Client is open to reduce infiltration by better air sealing at doors so untreated air doesn't go to other spaces. Vestibules around the elevators to minimize the stack effect is one option.
    e. Client is open to IAQ sensors to monitor particulates in addition to CO2
    f. Building is capable of providing 100% OA and air flushing before and after occupancy is done when the weather allows it. HVAC is not designed to operate on 100% OA on a design day.
    g. No scope for adding heat recovery for OA due to space limitations.
    h. Static pressure at filters is monitored regularly as 75% of the building is DDC, to make sure filters are replaced at the right time.
    i. Rotation of filters is impractical as there are too many filters (444+ filters) and the labor would be too time consuming.
    j. Fan motors are too big to make it bigger

- **Proposed work plan adjustments**
  1. EEMs to be added
      a. Bi-polar ionization or hydrogen peroxide in ducts, if NYSERDA allows to include in study.
  2. EEMs that are considered potentially impractical
      a. Heat recovery (insufficient space), to be studied further
      b. Replacing certain fan motors with larger ones to operate at lower part load (Fans are very big already. Likely we will need to replace this EEM with another)
      c. Static pressure reduction for advanced filtering (Building has DDC controls and advanced filters. Likely we will need to replace this EEM with another)
      d. Rotation of filters on a scheduled basis (Over 400 filters – impractical in terms of labor. We will need to replace this EEM with another)
- **Next steps**
  1. Finalize list of EEMs
      a. Discuss EEM options with NYSERDA and client to finalize list of EEMs.
  2. Energy Model
      a. Create Baseline Model after receiving drawings and HVAC information. Match utility bills.
      b. Code IAQ EEMs to investigate energy savings

Energy Efficient Indoor Air Quality Analysis
Preliminary Findings Report

THE MARK HOTEL, NEW YORK, NY 10075

Work Plan Number: *WP-VID01*

Customer and/or Site Name: *Mark Hotel LLC*

Building Square Footage:
185,000 square feet

Building Description:

Built in 1927 and upgraded during 2006 -2009 with new restaurants and penthouse, the 118-room boutique hotel is approximately 185,000 SF and has short- and long-term guest rooms and suites, guest amenities such as meeting rooms, salon, restaurant, full-service kitchen and fitness areas. Laundering process is outsourced except in house emergency guest services.

The building is heated and cooled by two absorption chiller heaters. AHUs with heating and cooling coils provide comfort cooling and ventilation in lower level common areas. Two natural gas fired DX roof top units provide conditioned ventilation air in corridors. Dedicated kitchen make-up air units, toilet and other exhaust fans provide the air pressurization balance. A Building Management System controls schedules and setpoints and setbacks for the HVAC System. Domestic HW heaters are dedicated for Guestrooms, Low Zone/Salon, and Kitchen/Restaurant.

The hotel was closed due to COVID-19 from March 28, 2020 through June 15, 2020. After reopening, the occupancy is currently at 20%. The hotel restaurant opened on July 6, 2020.

Summary of Progress to Date:

- **Data Collection:** Vidaris has collected and analyzed 5 years of historic energy consumption at the facility starting from May 2016 through May 2020.
    1. Bills were gathered for electric as well as gas consumption.
    2. Data included 6 electric meters and 4 gas meters which include retail areas, office, hotel, as well as restaurant.
    3. Absorption chillers' gas usage was obtained and analyzed for the past several cooling seasons.
    4. Energy consumption was plotted against heating degree days and cooling degree days to study weather-dependent energy use at the facility.

- **Energy Use Baseline:** Vidaris has developed an energy use baseline consisting of several years of building utility use prior to any recent building shutdowns or adjustments due to COVID-19.

i. This energy use will be used as a baseline to determine the energy impact from COVID-safe energy efficient IAQ package of improvements in a manner that aligns with published guidance from reputable sources and code minimums.

- **Site Visits:** Vidaris consultant has completed a site visit to the hotel for data collection in regard to the HVAC equipment operation, air flow measurements, motors specifications, as well as for measurement of equipment performance.
    i. The site visits will continue as appropriate for data collection and monitoring.
    ii. Field surveys to be scheduled to identify spaces within the occupied areas as well AHUs where portable UV devices can be installed.

Lessons Learned:

- **Outdoor Air Intake**
    i. The Lobby AHU is a 100% OA system with no heat recovery or demand controlled ventilation currently.
    ii. Typically the system operates at 50% OA spring, fall and summer; However currently due to the COVID-19 it is operating at 100% OA. This will affect the energy use negatively but is a necessity, for now, to maintain safe indoor environment.
    iii. Minimum OA quantity will be based on maintaining negative air pressure in the common areas so as to prevent cross contamination to other areas of the facility.

- **Costs**
    i. Cost of installation of any UVGI devices would be much higher since the access to majority of the AHUs is from guest rooms. Some systems may not have a direct access at all and would need to have to cut a hole in the ceiling to gain access to the AHUs.
    ii. Unavailability of access to some areas means some installation work may have to be conducted during nighttime or other periods of low occupancy.
    iii. The above issues will add to the measure costs significantly.

Next Steps:

- Complete airflow and power measurements of the air handling units via the consultant.
- Assemble a comprehensive AHU schedule including dimensions, flow rates, and capacities to study applicability of the following energy measures accounting for COVID safe operations:
    i. Optimum air-side economizer operation
    ii. Demand controlled ventilation
    iii. UV feasibility in AHUs and Ductwork for guestrooms.
    iv. UVGI Portable Room Decontamination as Maintenance Protocol.
    v. Calculate energy impact of the above measures.
    vi. Determine installation costs and payback periods.
- Applicability of a MERV 14 or more efficient filters in common areas:

i. Field measurements are being conducted to check whether high pressure drop filters will be compatible or if they exceed the service factor of the motors.

- Applicability of a MERV 14 or more efficient filters in guestrooms:
  ii. Field measurements are being conducted to check whether high pressure drop filters will be compatible with guestroom fan coil units or if they exceed the service factor of the motors.
- Review of above data as well as peer review articles to devise appropriate strategy for safe operation.
- Draft report detailing the energy analysis as well as recommended industry standard best practices.

Proposed Adjustments:

- During the initial proposal stage to NYSERDA an energy measure was considered – ASH-3: Add heat recovery to lobby system to increase outside air. Analysis of air distribution and pressurization in lobby and opportunity for heat recovery.
  i. After field investigation it was determined that this measure may not be feasible due to the lack of the room in the ceiling ductwork and return air plenum for installation of the heat recovery wheel.
  ii. In-lieu of this measure we propose to redirect the investigative and analysis effort towards the gymnasium AHU unit, which is a standalone unit and to which access could be provided without much trouble.