Mechanical, Plumbing, and Fire Protection Conditions

Mechanical Conditions

The mechanical systems within the building consist of a combination of the original 1926 systems and renovations that occurred in 1979. The majority of the existing mechanical systems are nearing the end of their useful life, and are in need of replacement. For the purpose of this report, the mechanical system reviewed were heating, ventilating and air conditioning (HVAC), plumbing, and fire protection. The major issues with the existing building are the lack of code required ventilation air and a fire protection system that is well below the current code requirement for this type of building. The following is a detailed review of each system and the current deficiencies within the building.

Heating, Ventilation and Air Conditioning

The heating system for the building consists of two gas-fired steam boilers located in the lower level mechanical room. One, ___MBH, boiler is original to the building and the other boiler, ___MBH, was installed during the 1979 renovation. Both boilers are currently operating, however, are nearing the end of their usable life.

The chilled water system consist of one, ___ton, water-cooled chiller (CH-1) located in the mechanical room. There is also a heat reclaim chiller (CH-2), which rejects heat from the chilled water system to a hot water storage tank located in the same lower level mechanical room. Both chillers were installed during the 1979 renovation, and are nearing the end of their usable life. Figure * below shows significant rust and age degradation to the header of each chiller.

Figure 1 - Rust on Heat Reclaim Chiller

A draw through cooling tower is located on the single story roof and serves both chillers located in the lower level mechanical room. The cooling tower was installed during the 1979 renovation, and is nearing the end of its usable life. Both Figure * and Figure * below show the current condition of the cooling tower. In the last five years there have been multiple leaks in the condenser water piping that have been temporarily patched. The cooling tower does not operate the majority of the year, due to the heat reclaim chiller.

In the lower level mechanical room, there are a heating water primary and secondary pumps, chilled water primary and secondary pumps, and condensing water pumps. All pumps were installed during

the 1979 renovation and are nearing the end of their usable life. Figure * below is an example of the typical rust and water damage that is present on many of the pumps. The pumps require additional regular maintenance including seal replacement, bearing replacement, etc. due to their age.

Figure 2 - Rust on Pump Header

Many of the valves located in the lower level mechanical room are rusting and show signs of water damage to insulation as shown in Figure * below.

Figure 3 - Leaking Valve and Damaged Insulation

The zone heating strategy for the building is split into two separate systems. Heating water is provided by a shell and tube heat exchange located in the lower level mechanical room, which converts steam into hot water. The lower level and first floor are heated by a combination of overhead recirculating fan coil units with hot water heating and chilled water-cooling coils and fin-tube radiation installed along the exterior wall. Both were installed during the 1979 renovation. It was reported that the system occasionally has leaks at fittings, valves, etc.; however, overall the system is functioning as intended. The second and third floor heating is still served by the original cast iron radiators located in each room, see Figure *. The only temperature controls during heating season is through manually opening or closing the control valve located at each radiator, see Figure *. These radiators and associated steam and condensate piping are approximately eighty-seven years old and are at the end of their expected life. Moisture damage was noted in multiple locations due to radiator leaks, and the radiators have been painted multiple times.

Figure 4 - Steam Radiator

The zone level cooling system is split into two separate systems similar to the heating system. The lower level and first floor are cooled by overhead recirculating fan coil units with chilled water cooling coils and hot water heating coils. The fan coil units were installed curing the 1979 renovation, and are nearing the end of their expected life. The facilities staff noted maintenance issues such as fan replacement and leaking valves for the overhead fan coil units, which reflects expected maintenance for units thirty-four years old. The second and third floor is cooled using window air conditions units. The chilled water piping does not serve anything above first floor. Window air conditioners have been

added to areas requiring additional cooling over the last forty years. Figure * below shows one example of a window air conditioning unit installation.

Ventilation air is provided to lower level and first flower through a 100% outside air unit located in a crawl space on first floor. The ventilation unit is currently very difficult to provide maintenance because of the limit dimensions of the crawl space, see Figure * below. There is also significant water damage to pipe insulation within the crawl space. The outside air is pretreated by a fixed plate energy recovery unit located in the same crawl space. The energy recovery unit uses exhaust air from bathrooms, janitor closets, and other miscellaneous exhaust to pretreat the outside air. The ventilation air is then supplied to the plenum space above the ceiling in multiple locations. This outside air is then delivered to the occupiable spaces through the return plenums on the inlet to each fan coil unit above the ceiling. This method of outside air delivery is not considered the standard of car e, and would need to be modified during a renovation to bring the current system up to code. Current ventilation code requires that outside air be directly ducted to each individual fan coil unit return to ensure the correct amount of ventilation air is delivered to each space.

Ventilation for second and third floor is provided through operable windows in each room, except for Meeting Room 260. Many of the "operable" windows have become stuck shut due to old age, and limit occupant ventilation. Current ventilation code does not allow natural ventilation for office buildings, and mechanical ventilation would need to be added if the spaces were renovated. Meeting Room 260 is supplied with ventilation air through a combination of three rooftop air-handling units. All three rooftop units were installed in different years as the heating and cooling load changed in the space. The units are currently sequenced on manually by the facilities staff as more heating and cooling is needed in the space. The newest Carrier rooftop unit was installed within the last five years and appears to be in good working condition; however, the other two units appear to be approximately twenty years old.

Plumbing

A 3" combination domestic water and fire protection service provides water to the building for the plumbing system. The #" fire service splits off upstream of the water meter and feeds the remainder of the building; see fire protection system description below for details. Within the water entry room the

domestic water system is metered, see figure * below. Figure * below also shows significant rust and water damage within the water entry room.

Figure 5 - Incoming Combined Plumbing and Fire Protection Service

One gas fired water heater, (see Figure * below) located in the lower level mechanical room, provides hot water to the building. All hot water is softened by a water softener located in the same mechanical room. The domestic hot water system is currently stored and circulated at approximately 115°F. Both the water heater and softener appear to be a newer vintage and are said to be in good working condition.

The existing plumbing distribution system consist ___ piping for domestic water and ____ piping for sanitary and vent. Most of the piping is original to the building, and with the exception of some leaking shutoff valves, the system is reported to be in good working condition. There are various vintages of plumbing fixtures installed throughout the building, see Figure * below. Many of the plumbing fixtures are antiquated, and some have been abandoned in place due to infrequent use.

Fire Protection

The existing fire protection system is served by a 3" water main located in the basement. This water main serves as a combination domestic water and fire protection service. The fire service is routed through a reduced pressure backflow preventer located in the lower level mechanical room. The fire service is then boosted by an existing fire pump (see figure * below) installed during the 1979 renovation of basement and first floor. The building is currently not sprinkled and the only means for fire protection are 1-1/2" hose valves located in multiple locations on each floor. The current fire protection system does not meet the minimum code requirements for a building of this type. Current code would require the building to be fully sprinkled per NFPA 13 and Class III standpipes in stairwells per NFPA 14. The existing system is not currently monitored by the fire alarm system, and does not provide constant monitoring of water flow as required by the latest version of NFPA 13. The existing incoming water service will likely be undersized for the code required fire protection system.

Figure 6 - Fire Pump

Electrical Conditions

Electrical Conditions

The existing electrical system is a 4000 Amp, 120/208V 3-phase, 4-wire service, which is adequate for the facilities current functions and use. This electrical system is most likely more than capable of handling modifications and minor expansions to the existing building, as the majority of new systems are very efficient compared to what is currently installed. The existing lighting is largely outdated, and very inefficient to modern fluorescent and LED fixtures. Fire alarm is dated and may require updates in the near future. All three electrical systems have a fair amount of exposed conduit and junction boxes, especially on second and third floor due to the original block walls and additional system items being added over the years.

Power

As mentioned before, the existing service is 4000 Amp, 120/208V 3-phase, 4-wire service, GE Service Entrance switchgear, in good condition. See picture 1. The incoming utility service is served from exterior transformers on the northwest side of the building. The existing main electrical service equipment is in good condition, and large portions of the branch panels are undergoing an upgrade. Most of the second and third floor panels are being completely overhauled with new branch panels and splice boxes replacing the original 1920s panels in the corridors. In addition, the distribution has been upgraded to include an individual feeder for each panel located on the upper floors, greatly expanding the available capacity. Although the second and third floor panels are being upgraded, the other areas of the building have already seen one or two renovations, and branch panels vary in type, quality, and condition throughout. Some of the existing to remain panels are Westinghouse; these can be difficult to find parts for and even though they are in good operating condition now, they eventually will need replacement. See picture 2.

Picture 1

Picture 2

Devices are a bit more varied throughout the facility. The second and third floors appear to be the most dated, with portions of the building looking completely original, or very dated. There is potential that receptacle circuits in the un-renovated areas are fed with ungrounded cloth wiring, which presents a very dangerous fire hazard. Need to revisit site for Picture 3. Third floor also has exposed disconnect located in an office for roof mounted equipment. This is a potential safety issue, and it presents a problem each time it needs maintenance, as the office could be shut down for a period of time while conducting the maintenance. Need to revisit site for Picture 4.

Picture 3

Picture 4

The building also has an elevator, which has undergone some changes since the original building. It appears to still be served from the original exposed motor located in the penthouse equipment room. The inspection dates looked current and the elevator appears to be in good working condition. The elevator cab itself has had at least one recent upgrade, and so have the button interfaces on each floor. See Picture 5 and 6

Picture 5

Picture 6

The last area of concern for general power is the fact that the building does not currently have a generator or means of back-up power. This could be a problem in the future, as there is not much of a fire protection system in place, and a building of this size and height will require a fire pump to serve a new fire protection system. The fire pump will in turn require a means of dependable back-up power, which will need to be supplied from an emergency generator.

Lighting

Lighting is the electrical system most in need of upgrades. The majority of the existing lighting is a mixture of fluorescent and incandescent. Of those two types, the more efficient fixtures are the fluorescent, but even those are outdated compared to modern offerings of fluorescent fixtures. Much

of the 2x2 fixtures are 2x2 T12 U-tube lighting. This is very outdated and inefficient. In addition, the remaining fluorescent fixtures are 4-foot T12 or 4-foot T8 fixtures. Although T8 fixtures are still the widely accepted universal fluorescent lamp type, there have been improvements to the lamps and ballasts that have increased efficiency of 4-foot T8s to 30% energy savings.

Where incandescent fixtures are remaining, it appeared that many are utilizing Edison-base screw in fluorescent lamps. Some of the incandescent fixtures may have historical significance, and could be maintained with the use of Edison base LED lamps that have the look of incandescent bulbs.

There did not appear to be much for automated lighting controls. Most of the corridors have switches at either end. Some of the renovated areas do have local occupancy sensor control. Efficiencies can still be realized through the use of more occupancy/vacancy sensors, daylight sensors near windows, and timer switches or a lighting control panel with a building time schedule.

As far as emergency and life safety lighting is concerned, the building is lacking. Any existing emergency lighting is battery backup only. There appears to be three different generations or more of exit signage. Some appear to be broken or disconnected. See Picture 7. Existing renovation drawings from 1979 indicated night lights/emergency lighting in the basement and first floor areas. It is unclear if second and third floor have any of these types of lights. Where emergency lighting is located, it is mostly battery wall-packs, affectionately referred to as "bug-eyes".

Picture 7

Fire Alarm

The existing fire alarm system is in need of an upgrade. There are multiple styles of devices throughout the building, and there are two fire alarm control panels. The older fire alarm control panel, AutoCall, appears to still be functional. It is unclear what all this system serves, but it is still operational. It is outdated though, and service and parts will become increasingly difficult to find. The newer fire alarm control panel is a Simplex 4010. This is a common system widely used today. Its existing capacity and ability to be expanded is unknown, but the Simplex system is easily expandable and service and components for this system are readily in supply. The existing devices serving the building appear to be at a minimum, three different generations. There is a mixture of strobe/horn devices, mechanical bell alarms, pull stations, and strobe only devices. See Picture 8. Over time the older devices, and even the newest devices, will be tough to maintain.

Picture 8

Conclusion

The existing electrical conditions are far from terrible. There are obvious areas that could use significant upgrades to gain efficiencies, but over the years, the building has been maintained very well, even during portions of renovations. New mechanical systems, new lighting, and even new office equipment will all be more efficient and therefore electrical power can be more efficiently used. However, current codes are much different from when this building was built, and there are stricter requirements for amounts of air to a space, exhaust, fire alarm, lighting, etc. These code requirements may require larger pieces of equipment, additional fixtures and/or devices, so future expansions will require power analysis to verify that the new additions and renovations can be accommodated with the current power provisions.

Recommendations

Priority 1: Possible life safety hazard – Conduct emergency lighting egress calculations and provide emergency lighting to meet current code requirements. Most of the building emergency lighting is either non-existent or is outdated battery backup lighting and outdated exit signage. New exit signs can be provided with self-diagnostic circuiting, battery backup and even additional "bug-eyes" to provide egress lighting as needed. Additional bug-eyes fixtures or battery back-up fluorescent fixtures can be provided as needed to meet egress light level requirements.

Priority 2: Possible fire hazard/shock hazard – Remove cloth wiring and ungrounded receptacles from the building. At a minimum, all circuits utilizing cloth wiring should be disconnected and removed from service. Our recommendation would be to pull all cloth wiring and 2-wire circuits from the building and remove all ungrounded receptacles. Then replace cloth wiring and ungrounded wiring with new 3-wire circuiting wiring (minimum #12) in conduit. Replace all removed receptacles with new devices and coverplates, and provide blank coverplates over abandoned in place backboxes.

Priority 3: Owner's best interest – Replace existing fire alarm systems with one single fire alarm system for the entire building. There are a few options for this depending on when this item is addressed. One option would be to keep the existing Simplex 4010 system in service, and expand it to encompass the entire building. The other option would be to remove both systems and replace with a single new addressable fire alarm system. If the system were to be upgraded within the next five years, it would be our recommendation to remove the AutoCall system entirely, and remove all non-simplex devices. Remove old signal devices, including bells and outdated non-Simplex strobe devices. Replace all removed devices with new Simplex devices capable of interfacing with existing Simplex 4010 system and provide new addressable signal line devices where needed and new notification devices where needed to meet current code requirements.

Priority 3: Owner's best interest – Replace outdated electrical panels. The Westinghouse panels will grow continually more difficult to maintain, as they are nearing the end of their useful life and service and repair parts will become more challenging to get. Some of this may be addressed as part of the current power panel upgrade, so further evaluation will be needed after the electrical panel upgrade project is complete.

Priority 3: Owner's best interest – Replace all lighting, provide and updated control scheme throughout the facility. The building lighting can gain a lot of efficiency just by replacing the lighting with modern day LED and fluorescent fixtures. Fixtures with historical significance can remain, as long as LED lamping can be retrofit. Controls can also help efficiency, starting with occupancy sensors, daylight sensors, timer switches, and multi-level switching or dimmers. We would also recommend a lighting control panel for corridor lighting, to be timer switched based on the building schedule, which could be provided and managed by the building automation system, or independently with the lighting control panel itself.